

Tuakau and Pokeno Water Supply

Water Safety Plan

Organisation and Supply Details:

Community Name	Tuakau (TUA002), Pokeno (POK001)
Supply owner/organisation name:	Waikato District Council
Prepared by:	CH2M Beca Ltd consultants and Waikato District Council staff
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Signed off by Karl Pavlovich - Waters Manager

<i>Version Date:</i>	February 2018	<i>File ref:</i>	xxxx
<i>Version:</i>	Final	Tuakau and Pokeno Water Safety Plan	
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		<i>Authority:</i>	Waters Manager

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1 Revision Details

This plan will be revised and submitted for approval before 31 January 2023.

Assessment of the Performance of the Plan

Assessment of the performance of the plan will be undertaken annually. The assessment will consider any events, non-compliances, near misses and unexpected situations that have occurred, progress against the improvement schedule and any changes to any of the supply elements. Any matters requiring attention will be included into the Annual Plan, the Asset Management Plan for Water Supplies and if requiring significant capital funding, the Council Long Term Plan.

Reporting of the Plan

A brief report on the performance of the plan, including information from the assessment of the plan will be provided by the Compliance and Income Team Leader to the Treatment and Services Team Leader annually on the anniversary of finalisation of the plan. The report will cover the items listed in the assessment of the performance of the plan, listed above. The Treatment and Services Team Leader will be responsible for ensuring that any matters requiring attention will be appropriately included into the Annual Plan or the Asset Management Plan for Water Supplies. If significant capital funding is required the Treatment and Services Team Leader will include the matter into the Council approval process and the Council Long Term Plan.

Links to other Quality Systems

This Water Safety Plan (WSP) will be linked to the Annual Plan, the Activity Management Plan for Water Supplies and the Long Term Plan.

2 Introduction

This Water Safety Plan (WSP) has been prepared for the Pokeno and Tuakau Communities to identify potential events that present public health risks to the consumers of the drinking water supply. Waikato District Council (WDC) is committed to the WSP and to the future improvements identified in this WSP.

A PHRMP was first prepared for the Tuakau Community (TUA002) in 2012. This WSP has been prepared using the original PHRMP as a starting point but includes more up to date information following inclusion of the Pokeno Community (POK001) in March 2016 (through having a common supply), and further consultation.

Tuakau is a networked supply providing water to a population of approximately 3,942 people in the zones of Tuakau North and Tuakau South. Pokeno is a networked supply providing water to a population of approximately 519 people in the town of Pokeno. These combined networks comprise of reticulation serving a population of approximately 4,461 people on metered supplies.

The water for the zones is supplied from the Watercare Services Ltd (Watercare) Waikato water treatment plant (TP02337). There are two bulk supply points, each with individual bulk water meters. Bulk meters are located at:

- 296a Whangarata Road, Tuakau
- 118F Barnaby Road, Tuakau

This WSP covers the Pokeno and Tuakau Zones (PTZs) only. The WSP for the abstraction and treatment of water used in the PTZs is the responsibility of Watercare.

Because the PTZs consist of distribution systems only, WDC will demonstrate compliance against Section 4.4 of the Drinking-Water Standards for New Zealand (DWSNZ).

The scheme is administered at the main WDC offices in Galileo Street, Ngaruawahia and managed by the Waters Manager.

The management, maintenance and operation of the Pokeno and Tuakau water supply is the responsibility of:

- Waters Manager – Karl Pavlovich
- Treatment & Services Team Leader – Mark Curtis
- Treatment Supervisor – David Kennington
- Compliance and Income Team Leader – Jaime Wara
- Water Planning Team Leader – Richard Pullar

3 Supply Details

Table 1. Summary of Pokeno and Tuakau Water Supply Details

Supply Details	
Supply Name	Tuakau and Pokeno
WINZ Community Code	TUA002 and POK001
Supply Owner	Waikato District Council
Population Served by Supply	Tuakau 3942 Pokeno 519 <u>Total 4,461</u> (WINZ register April 2017)
Source Details	
Source Name	Waikato River, Auckland
Source WINZ Code	S00865
Type of Source	River
Consent Expires	2032
Maximum Consented water take:	1 July 2015 to 30 June 2021 – 150,000m ³ /day 1 July 2021 to 30 June 2042 – 200,000m ³ /day
Grid Reference of Source (NZMG)	
Easting : 1745947	Northing : 3716538
Treatment	
Location	Waikato
Plant WINZ Code	TP02337
Treatment Processes	Clarification; membrane ultrafiltration; biological activated carbon (BAC) filtration; chlorination;
Net Daily Volume	150,000m ³ /day (Dec 2013), of which approximately 1,438m ³ is supplied to Tuakau/Pokeno
Peak Daily Volume	175,000m ³ /day, of which approximately 7,353m ³ is supplied to Tuakau/Pokeno
Distribution – Zone 1	
Distribution Zone Name	Tuakau North
Distribution Zone WINZ Code	TUA002TN
Distribution Zone Population	823 (WINZ database, extracted Sept 2016)

Distribution – Zone 2	
Distribution Zone Name	Tuakau South
Distribution Zone WINZ Code	TUA002TS
Distribution Zone Population	3119 (WINZ database, extracted Sept 2016)
Distribution – Zone 3	
Distribution Zone Name	Pokeno
Distribution Zone WINZ Code	POK001PO
Distribution Zone Population	519 (WINZ database, extracted Sept 2016)

4 Description of the Tuakau and Pokeno Water Supply

Water is supplied to the Tuakau and Pokeno supplies from the Watercare water treatment plant off Trig Road at Tuakau. A written agreement between Watercare and WDC is in place for the supply and acceptance of potable water. This agreement does not place limits on volume or duration of the agreement. Water is supplied from the Watercare trunk main via two separate metered bulk mains, one at 296a Whangarata Road for the Tuakau supply, and one at 118F Barnaby Road for the Pokeno supply.

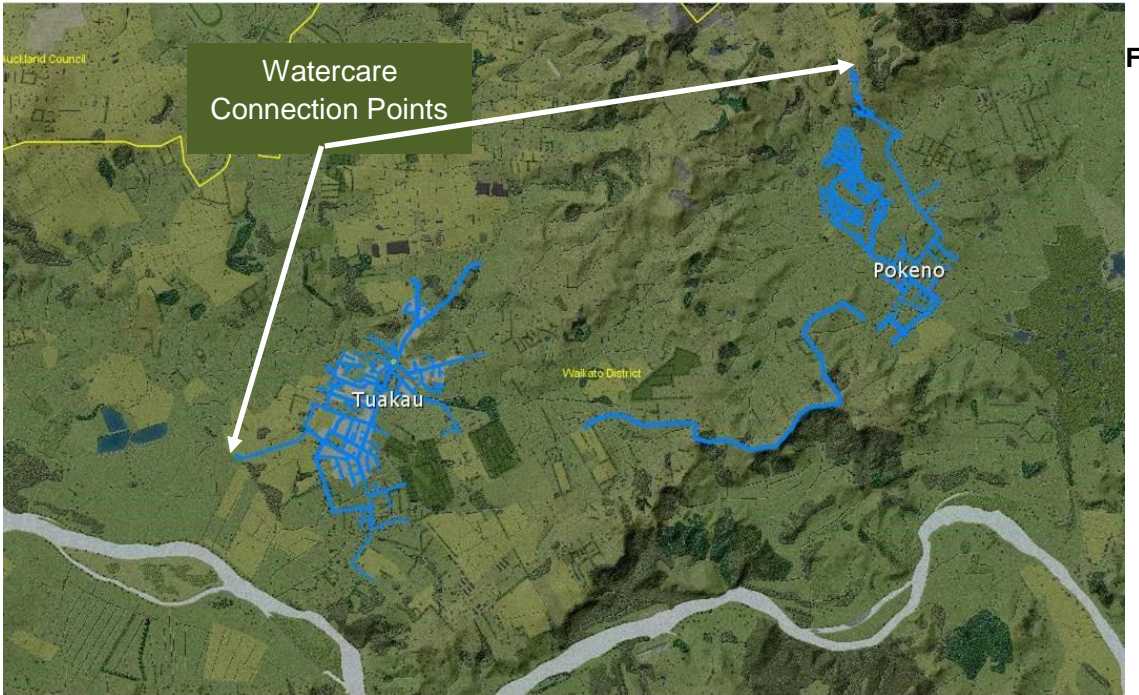


Figure 1 Location Plan of the Tuakau and Pokeno Water Supply

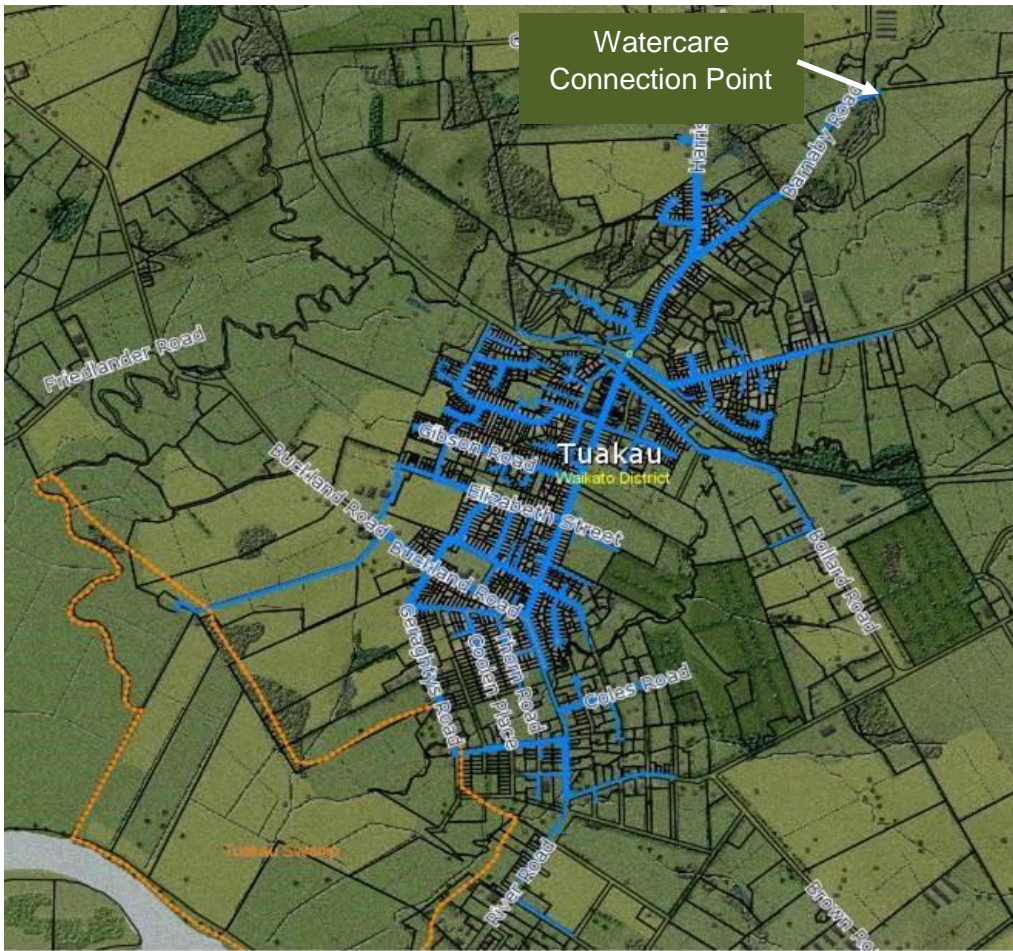


Figure 2 Location Plan of the Tuakau Water Supply Network

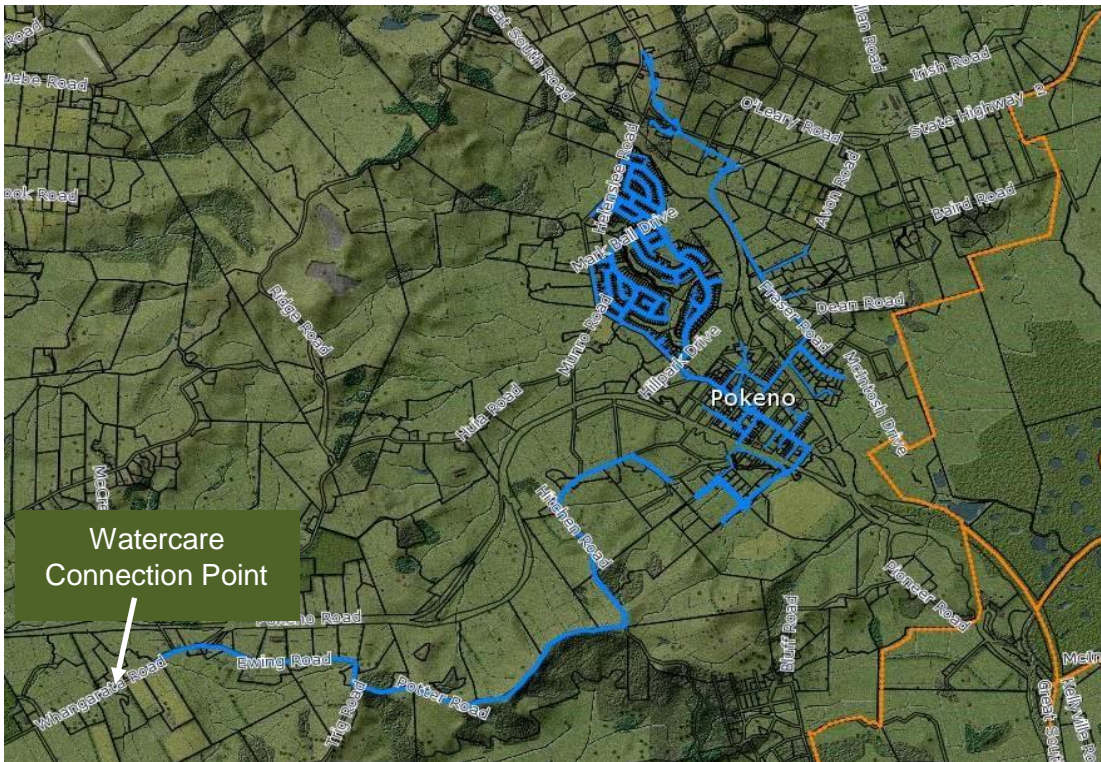


Figure 3 Location Plan of the Pokeno Water Supply Network

The water treatment plant at Trig Road sources water from the Waikato River before treating it prior to distribution. The primary raw water quality concerns are microbiological - protozoa, bacteria, viruses and cyanobacteria. The Waikato River water is low in turbidity but reasonably high in colour. Quality is also relatively constant compared to most surface waters, being heavily influenced by Lake Taupo and hydro-electric impoundments upstream of the treatment plant along the river.

The treatment process has the capacity to treat 175,000 m³/day in a four-stage process: coagulation and clarification, membrane filtration, biological activated carbon filtration, and chlorine treatment. An upgrade is currently underway to increase peak capacity to 200,000m³/day.

4.1 Tuakau Supply

The Tuakau drinking-water supply was passed from the now disestablished Franklin District Council to WDC as part of the local authority reform and setting up of the Auckland Council. The operation of the supply by WDC used to be run using in-house staff but is has been contracted to CityCare since 2016.

Prior to treated water supply from Watercare starting in 2016, raw water was abstracted from two bores located at a spring referred to as Peters Spring, at the rear of 2380 Buckland Road, Tuakau. Following abstraction the raw water was dosed with chlorine gas prior to distribution and the Harrisville Road reservoirs. This system now sits redundant.

The Watercare supply point details are undefined but likely to be of similar configuration to the Pokeno supply point. Management of the supply point is the responsibility of Watercare.

Coordinates of the connection are N 3714407m and E 1745735m.

The supply has two distribution zones, the South Zone and the North Zone. The distribution network for the North and South zones contains 54km of pipe, consisting predominantly of PE, AC and PVC pipework. Water from the Watercare supply point is fed direct to the Harrisville Road reservoirs from where it gravitates to the South zone. The treated water storage includes two reservoirs, a 2,145m³ above ground circular steel reservoir and a 260m³ above ground circular timber reservoir (total capacity of 2,405m³). Continuation of supply in the event of Watercare treatment plant failure is reliant upon Watercare's Redoubt Road reservoirs, and the Harrisville Road reservoirs. The extent to which this supply can continue to provide supply during plant outage is yet to be defined. The Railway Road booster pump station, supplied from the Harrisville Road reservoirs, boosts pressure to the North Zone.

The Railway booster pump station, located at the intersection of Ryders and Harrisville Roads, includes two booster pumps. The pumps are controlled by pressure transducers to maintain pressure at a set point. The pumps operate in response to demand identified by the pressure transducer set point. When the booster pumps are not in operation the North Zone is still supplied with water, but at a reduced pressure. The booster pumps ensure that the minimum performance requirements for pressure within the higher parts of the zone are met.

The system includes several alarms including reservoir high and low, and loss of communications. The Railway Booster Pump Station has a low pressure alarm and a pump failure alarm. The alarms alert the operation and maintenance CityCare staff to attend. WDC staff respond to network queries, or if input is required into issues which cannot be managed by CityCare.

4.2 Pokeno Supply

The Pokeno drinking-water supply was passed from the now disestablished Franklin District Council to WDC as part of the local authority reform and setting up of the Auckland Council. The operation of the supply by WDC used to be run using in-house staff but is has been contracted to CityCare since 2016.

Prior to treated water supply from Watercare starting in 2016, raw water was abstracted from a bore at 421a Razorback Road, and pumped from springs behind a property on Helenslee Road Pokeno. Following abstraction the raw water was dosed with chlorine gas prior to entering the Razorback Road reservoirs. Treated water was then distributed via gravity to Pokeno. This system now sits redundant.

The Watercare supply point consists of a primary Pressure Regulating Valve (PRV), a secondary PRV for primary PRV bypass, and a manually operated bypass for both PRVs. Management of the supply point is the responsibility of Watercare. Coordinates of the connection are N 5874086 m and E 1775168 m.

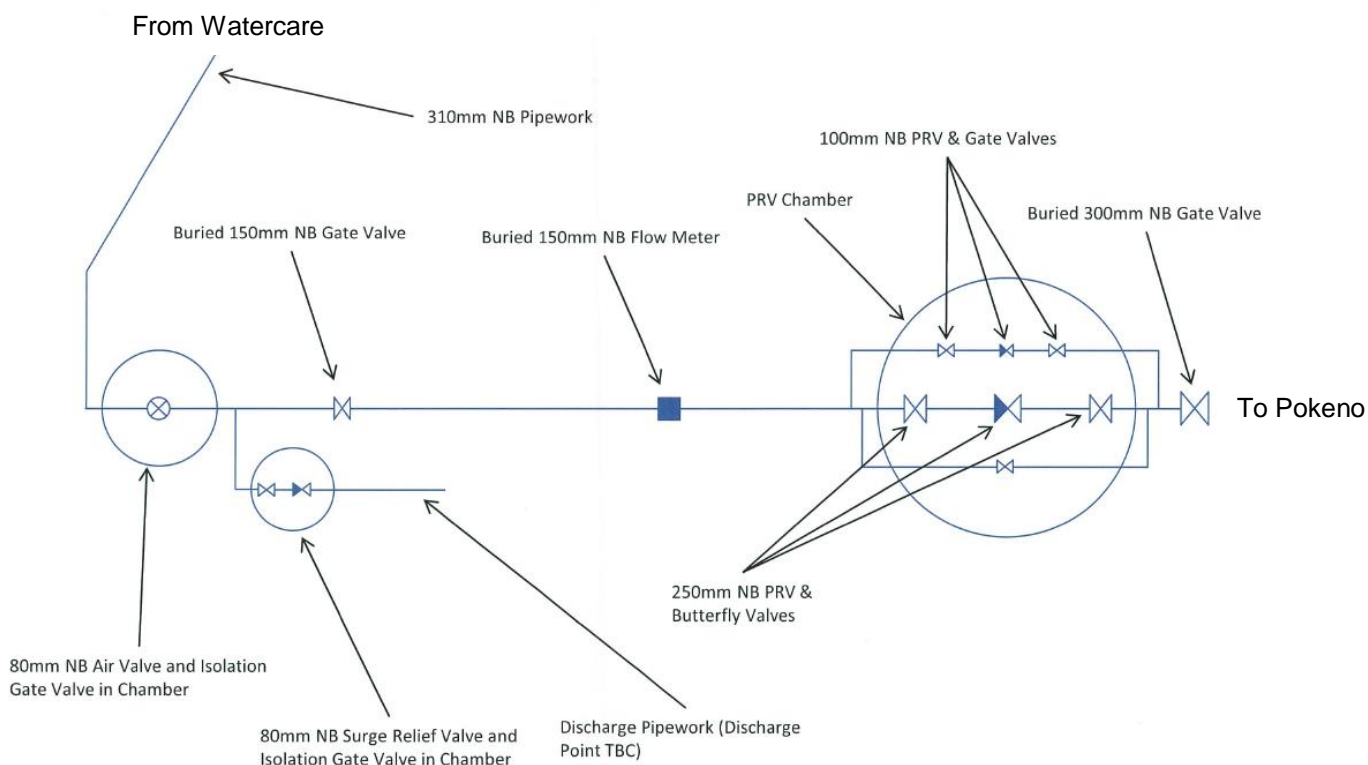


Figure 4 Watercare’s Pokeno Water Supply Point Configuration

The supply has one distribution zone and at present no storage within the zone as the Razorback Road reservoirs have been isolated from the supply. Continuation of supply in the event of Watercare treatment plant failure is reliant upon Watercare’s storage systems. The extent to which this supply can continue to provide supply during plant outage is yet to be defined, however WDC has let a contract for the construction of a 2,400m³ reservoir to supply the Pokeno distribution zone. The distribution network for Pokeno contains 41km of pipe, consisting predominantly of MDPE and PVC pipework.

4.3 Management

The Tuakau and Pokeno reticulation systems are managed by WDC and operated by CityCare. The associated reticulation water supply assets are managed using the AssetFinda management system. The land on which the functioning treatment plant components are located is owned by Watercare. The land on which the redundant Tuakau and Pokeno treatment plant components are located is currently owned by WDC.

5 Photographs of Network Assets

5.1 Tuakau



Figure 5 Harrisville Road Reservoirs



Figure 6 Harrisville Road Steel Reservoir



Figure 7 Harrisville Road Steel Reservoir – Ladder Detail



Figure 8 Harrisville Road Timber Reservoir



Figure 9 Harrisville Road Reservoirs – Water Sample / Bleed Point

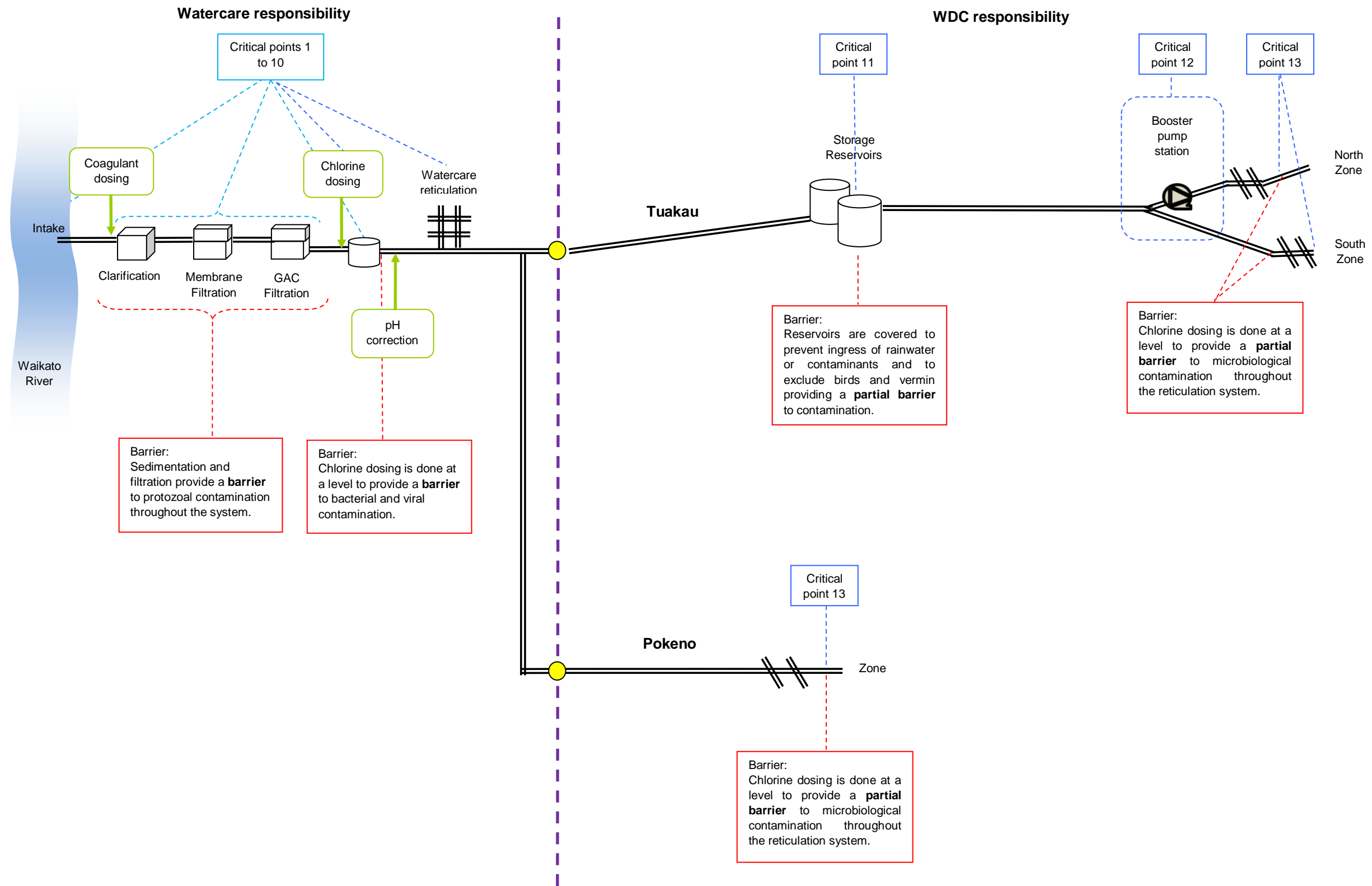


Figure 10 Railway Booster Pump Station



Figure 11 Railway Booster Pumps

6 Flow Chart / Schematic of the Supplies



7 Barriers to Contamination

Table 2. Critical points

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

	Critical Point	Description	Responsibility
1.	Catchment	<i>Possible access point for contamination.</i>	Watercare
2.	Intake	<i>Pump failure means eventual loss of supply.</i>	Watercare
3.	Coagulant / flocculation	<i>Failure will result in reduced particle and pathogen removal in the clarification and filtration processes.</i>	Watercare
4	Sedimentation	<i>Failure will result in reduced natural organic matter, particle and pathogen removal.</i>	Watercare
5.	pH adjustment	<i>Failure could result in a lack of coagulation control and a resulting failure to meet turbidity compliance values.</i>	Watercare
6.	Lift pumps	<i>Pump failure means eventual loss of supply.</i>	Watercare
7.	Membrane Filtration	<i>Failure will result in reduced pathogen removal.</i>	Watercare
8.	Biological Activated Carbon Filtration	<i>Failure will result in reduced organic, taste and odour removal</i>	Watercare
9.	Chlorine dosing	<i>Failure will result in compromised bacterial inactivation. Overdosing may exceed chemical MAV.</i>	Watercare
10.	Trunk main prior to bulk meter	<i>Contamination or failure event in trunk main will impact quality or quantity of water delivered to WDC.</i>	Watercare
11.	Reservoirs	<i>Possible point for microbiological contamination.</i>	WDC
12.	Booster pumps	<i>Pump failure means loss of system pressure and potential loss of supply to some areas.</i>	WDC
13.	Reticulation	<i>Possible access point for contamination. Possible access point for contamination due to backflow.</i>	WDC

Existing barriers to contamination that are the responsibility of Watercare include:

1. Coagulation, Flocculation, Sedimentation

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

2. Membrane Filtration

The treatment plant uses ultra-filtration membrane technology to remove pathogenic organisms. The filter membranes prevent spores of parasites, giardia, and cryptosporidium from passing through. This process provides a **barrier to protozoal and bacterial contamination**.

3. Biological Activated Carbon Filtration

The treatment plant uses biological activated carbon to remove organic chemicals, including cyanotoxins from the water. This provides a **barrier to contamination**.

4. Chlorination

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

5. Prevention of Contamination of Treated Water while it is in the Trunk Main

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

- Chlorine dosing is done at a level to ensure it is available to protect the water against microbiological contamination throughout the storage and reticulation.
- Hygiene procedures are documented and followed for all distribution system maintenance.
- Operators are trained and experienced.

Existing barriers to contamination that are the responsibility of WDC include:

6. Prevention of Contamination of Treated Water while it is in the Network Reticulation

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

- Chlorine dosing is done at a level to ensure it is available to protect the water against microbiological contamination throughout the storage and reticulation.
- Hygiene procedures are documented and followed for all distribution system maintenance.
- Operators are trained and experienced.

7. Prevention of Contamination of Treated Water in Storage

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

8. Installation of Backflow Prevention Devices

Backflow prevention devices on consumer connections a **barrier against recontamination** of the water.

The process control summaries for identified Critical Control Points (Critical Points) are stored in Council's Promapp process management online repository.

8 Benefits of Proposed Improvements

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

The Waikato water treatment plant provides good quality water that meets the Drinking Water Standards New Zealand (DWSNZ). In terms of the standards, the treatment plant needs to meet a 4-log protozoa removal for the Waikato River catchment at its abstraction point.

9 Methodology

This WSP has been prepared in accordance with the approaches recommended by the Ministry of Health. Supporting documents include the WSP Guides and *A Framework on How to Prepare and Develop Water Safety Plans for Drinking-water Supplies*, Ministry of Health (2014).

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

Indicative cost estimates have been prepared for the required improvement measures. Implementation timeframes will be discussed and agreed between the Treatment Services Team Leader and the Treatment Supervisor at the start of the financial year. Implementation of the Improvement Schedule is ultimately subject to Council funding approval.

The Treatment and Services Team Leader is responsible for implementation of improvements, subject to community and Council approvals, funding constraints and availability of resources. The Compliance and Income Team Leader is responsible for ongoing review and updating of the WSP and associated Improvement Schedule.

Contingency Plans have been prepared to provide guidance in event that control measures fail to prevent the occurrence of a risk event that may present acute risk to public health. The Treatment Supervisor is responsible for implementation of the Contingency Plans when monitoring has identified the occurrence of a risk event.

Separate risk tables have been prepared for:

- Supply of Water
- Tuakau North Zone Booster Pumps
- Tuakau Reservoirs
- Reticulation (both supplies)
- Other (both supplies)

10 Risk Ranking Procedure

The tables in this section identify the possible public health risks in each part of the supply. Each risk or possible 'event' which might occur has been evaluated based on the likelihood of the event occurring and the consequence (or outcome) if it occurs.

For the purposes of this WSP, categories for likelihood and consequence have been adapted from those in the 2014 MoH Guide, in order to make them more appropriate to this supply. These adapted ratings are given below in Table 3 and Table 4. The overall risk estimate derived from the product of likelihood and consequence is provided in Table 5.

Table 3. Likelihood Scale

Likelihood	Description
Almost certain	Is expected to occur in most circumstances.
Likely	Will probably occur (once in 1 or 2 years).
Possible	Might occur at some time (once in say 5 years).
Unlikely	Might occur (once in 10 to 20 years).
Rare	Could occur (once in 50 to 100 years).

Table 4. Consequence Scale

Consequences	Description
Insignificant	<ul style="list-style-type: none"> - Insignificant impact. - Little disruption to normal operation. - Small increase in operation costs.
Minor	<ul style="list-style-type: none"> - Short disruption of service (<1 hour) to part of a zone. - Aesthetic water quality event for some consumers. - No reported illness. - Some manageable operation disruption. - Some increase in operating costs.

Consequences	Description
Moderate	<ul style="list-style-type: none"> - Disruption of service (<4 hours) to one or more zones. - Water quality event that requires flushing to clear. - Boil water notice for up to 3 days. - No reported illness. - Significant modification to normal operation but manageable. - Operation costs increased. - Increased monitoring.
Major	<ul style="list-style-type: none"> - Disruption of service (>4 hours) to two or more zones. - Prolonged boil water notice. - Probable illnesses. - Adverse publicity and loss of trust of consumers. - Systems significantly compromised and abnormal operation if at all. - High level of monitoring required.
Catastrophic	<ul style="list-style-type: none"> - Disruption of complete supply for one or more days. - Several instances of illness in the community or instance of death. - Prolonged boil water notice. - Significant negative national press and long term loss of trust of consumers. - Complete failure of systems.

Table 5. Risk Level Allocation Table

Likelihood	Consequence				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	Moderate	High	Extreme	Extreme	Extreme
Likely	Moderate	High	High	Extreme	Extreme
Possible	Low	Moderate	High	Extreme	Extreme
Unlikely	Low	Low	Moderate	High	Extreme
Rare	Low	Low	Moderate	High	High
Estimated Risk Level		Action Plan			
Low		No action required			
Moderate		Consider action if risk can be economically mitigated			
High		Action plan required			
Extreme		Action plan required, with higher priority to complete than for a "high" risk level			

11 Improvement Schedule

The improvement schedule is derived from the risk tables that follow in Section 15. The improvement schedule outlines improvements that have been recommended for preventing, reducing or eliminating the identified public health risks in the Tuakau and Pokeno drinking water supplies. Possible improvements to the supplies have been identified in the 'Additional Measures That Could Be Put in Place' column of the risk tables. The most suitable option to improve the management of each unmanaged risk has then been included in the improvement schedule. Detail, further to that contained in Tables 6 and 7 can be found by following the number in the Reference to Risk Table column. It should be noted that costs are estimates only. Each project is ranked according to the priority to which projects should be completed. Improvement timelines will be enacted as per the improvement schedule adopted by The Waikato District Council Asset Management Plan 2017.

- TSTL – Treatment and Services Team Leader
- TS – Treatment Supervisor
- CITL – Compliance and Income Team Leader

Table 6. Capital and Significant Projects

Priority	Risk Level	Water Supply Area	Reference to Risk Table	Proposed Works	Person Responsible	Expected Cost
1	Extreme	Tuakau Reservoirs	3.10	See Figures 6 and 7. Fit ladder meeting AS 1657 – 2013 standards to steel reservoir.	TSTL	\$15,000
2	Moderate	Tuakau reservoirs	3.1	Keep vegetation clear of tank.	TSTL / TS	\$2,000

Priority	Risk Level	Water Supply Area	Reference to Risk Table	Proposed Works	Person Responsible	Expected Cost
3	Moderate	Tuakau reservoirs	3.1, 3.3, 3.8	Clean reservoirs as required (identified by annual checks).	TSTL / TS	\$10,000
4	Moderate	Tuakau Reservoirs	3.9	See Figure 9. Sample or bleed point noted during site audit connected to open hose lying on ground. Disconnect hose and / or fit backflow prevention.	TSTL / CITL	\$2,000
5	High	Tuakau Reservoirs	4.2	Pipe section (Approx. 1,000m long) between WDC Tuakau WTP and Buckland Road needs to be isolated or disconnected from network, and flushing of associated sections needs to occur to ensure adequate turnover.	TSTL / CITL	\$10,000
6	High	Tuakau Reservoirs	4.2	Pipe section (Approx. 210m long) between isolated Pokeno reservoirs and O'Leary Road needs to be isolated or disconnected from network, and flushing of associated sections needs to occur to ensure adequate turnover.	TSTL / CITL	\$10,000

Table 7. Operational Improvements and Minor Projects

Priority	Risk Level	Water Supply Area	Reference to Risk Table	Proposed Works	Person Responsible	Expected Cost
1	High	Reticulation (Both Supplies)	4.4	Review testing regime and reporting of test results for backflow protection devices. Upgrade as necessary. Record inspection results on asset management system.	CITL	Staff time
2	High	Reticulation (Both Supplies), Other (Both Supplies)	4.5, 4.6, 5.3	Review process for recording pipe breaks and repairs to ensure all work is captured and recorded into asset management system. Upgrade as necessary.	CITL	Staff time
3	High	Supply of Water	1.3	Confirm that WaterCare has a contingency in place that enables supply via an alternative route, or for priority repair.	TSTL / CITL	Staff time
4	Moderate	Reticulation (Both Supplies), Other (Both Supplies)	4.1, 5.3	Review process for recording pipe breaks and repairs to ensure all work is captured and recorded into asset management system. Upgrade as necessary.	CITL	Staff time
5	High	Reticulation (Both Supplies)	4.4	Ensure trickle feed supplies are systematically inspected to ensure air gap at consumer tank. Upgrade as necessary. Record inspection results on asset management system.	CITL	Staff time
6	High	Reticulation (Both Supplies)	4.6	Ensure CityCare has a flushing programme in place to flush part of the reticulation every second month on a rotation basis. Upgrade as necessary.	TSTL / CITL	Staff time

Priority	Risk Level	Water Supply Area	Reference to Risk Table	Proposed Works	Person Responsible	Expected Cost
7	Moderate	Reticulation (Both Supplies)	4.9	Ensure CityCare has a flushing programme in place to flush part of the reticulation every second month on a rotation basis. Upgrade as necessary.	TSTL / CITL	Staff time
8	Moderate	Tuakau reservoirs	3.1, 3.8	Inspect reservoir structures annually inside and out. Reservoir inspection and cleaning to be recorded in asset management system. Repair or replace as necessary.	TSTL / TS	Staff time
9	High	Tuakau reservoirs	3.3, 3.5	Inspect reservoir structures annually inside and out. Reservoir inspection and cleaning to be recorded in asset management system. Repair or replace as necessary.	TSTL / TS	Staff time
10	High	Other	5.5	Undertake a formal review of the standard operating procedures, and operation and maintenance manuals. Upgrade as necessary.	TS	Staff time
11	Moderate	Other	5.4	Develop and implement pump stations asset criticality analysis.	TSTL	Staff time
12	Moderate	Other	5.1	Ensure sampling programme is reviewed by independent person. Ensure sampling collection follows sampling programme.	CITL	Staff time
13	Moderate	Reticulation (Both Supplies)	4.9	Monitor and record flushing water quality results.	TSTL / CITL	Staff time
14	High	Reticulation (Both Supplies)	4.2, 4.6	Monitor and record flushing water quality results.	TSTL / CITL	Staff time

Priority	Risk Level	Water Supply Area	Reference to Risk Table	Proposed Works	Person Responsible	Expected Cost
15	High	Supply of Water	1.1	Confirm that Watercare has a contingency in place to allow abstraction from the river at reduced water levels or if this is necessary as the intake may be positioned to enable abstraction at reduced river levels, or that they can back feed from other supplies.	CITL	Staff time
16	Moderate	Supply of water	1.2	Confirm that Watercare treatment plant is recognised as a priority site for restoration of power and also has generators on site which allow production during prolonged power outage.	CITL	Staff time
17	Moderate	Supply of Water	1.4, 5.2	Event communication protocols between WDC and Watercare should be developed.	TSTL / CITL	Staff time
18	Moderate	Supply of Water, Tuakau North Zone Booster Pumps, Tuakau Reservoirs, Other (Both Supplies)	1.5, 2.5	Confirm that CityCare staff undertaking repairs have National Certificate in Water Reticulation (Level 3), or are under supervision of staff that have. Upgrade CityCare qualifications as necessary.	CITL	Staff time

Priority	Risk Level	Water Supply Area	Reference to Risk Table	Proposed Works	Person Responsible	Expected Cost
19	High	Supply of Water, Tuakau North Zone Booster Pumps, Tuakau Reservoirs, Other (Both Supplies)	3.4, 4.3, 5.6	Confirm that CityCare staff undertaking repairs have National Certificate in Water Reticulation (Level 3), or are under supervision of staff that have. Upgrade CityCare qualifications as necessary.	CITL	Staff time
20	Moderate	Tuakau North Zone Booster Pumps, Tuakau Reservoirs	2.5	Confirm that CityCare have protocol for maintenance, repair work, and replacement of replacement of reticulation components. Upgrade as necessary.	CITL	Staff time
21	High	Tuakau North Zone Booster Pumps, Tuakau Reservoirs	3.4, 4.3	Confirm that CityCare have protocol for maintenance, repair work, and replacement of replacement of reticulation components. Upgrade as necessary.	CITL	Staff time
22	Moderate	Tuakau Reservoirs	3.8	Bird activity noted during site audit on steel reservoir roof overhang at ladder. Check to ensure birds cannot access reservoir, and block bird access if required.	TSTL / CITL	Staff time
23	Moderate	Other (Both Supplies)	5.7	Check that each distribution zone has 24 hours storage. Upgrade as necessary.	CITL	Staff time
24	Moderate	Other (Both Supplies)	5.3	Ensure planned and routine maintenance is undertaken including basic lubrication and greasing of pumps by CityCare.	CITL	Staff time

12 Drinking Water Standards and Grading

At the time of writing of this report the Tuakau and Pokeno water supplies do not fully comply with DWSNZ. Table 8 below shows a summary of the compliance with the drinking water standards to date.

The Waikato treatment plant is currently graded A, but the WDC distribution zones are un-graded.

Table 8. Summary of Compliance with DWSNZ

Standards compliance assessed against.	DWSNZ 2005 (revised 2008).
Secure bore water.	NA
Bacterial compliance criteria used for water leaving the treatment plant.	Criterion 2A (continuously monitored chlorination).
Protozoa log removal requirement required for the supply.	Waikato River at the abstraction point has been accepted as requiring 4-log removal.
Protozoa treatment process.	Coagulation, clarification, membrane filtration provides 6 log removal.
Compliance criteria 6A or 6B is used for water in the distribution zone.	Criterion 6A.
Bacterial compliance for water leaving the treatment plant has been achieved for the last 4 quarters.	Yes.
Protozoa compliance for water leaving the treatment plant has been achieved for the last 4 quarters.	Yes.
Bacteria compliance for water in the distribution zone has been achieved for the last 4 quarters.	No. Tuakau North and Pokeno exceeded maximum days between sampling criteria. Otherwise sample test results compliant.
P2 determinands allocated to supply.	Fluoride
Chemical compliance achieved for the last 4 quarters.	Yes.
Cyanobacteria identified in the supply.	Yes.
Cyanobacterial compliance has been achieved for the last 4 quarters.	Yes.

13 Consultation

Site visits were undertaken at the Tuakau and Pokeno reticulation systems by those involved in the preparation of the WSP. The WDC staff provided input into identifying the systems, procedures and practices that are currently in place to prevent, reduce and mitigate risks.

The plan was then modified to take account of required updates.

Subsequent to this consultation telephone discussions and email contact has been used to provide information necessary for the preparation of this WSP. The WSP was then reviewed by all divisions of the water team and signed off by the Waters Manager.

The information provided during this consultation has been used to compile the risk tables.

14 Contingency Plan

Tuakau / Pokeno Water Supply Contingency Plan	
Type of Event	Required Contingency Action
<p>Severe microbiological contamination of source water such that treatment is ineffective and water provided by Watercare is of poor quality.</p> <p>Indicators: A contamination event may be observed by or reported to Watercare or WDC staff. May also be indicated by reported illness among consumers, positive E. coli monitoring results or taste, odour etc. concerns from consumers.</p>	<p>Liaise with Watercare treatment plant operators.</p> <p>Issue ‘Boil Water’ notice.</p> <p>Advise Drinking Water Assessor (DWA).</p> <p>Consider provision of emergency treatment or alternative water supply (e.g. tankers).</p> <p>Disinfect contaminated reservoirs and flush mains.</p> <p>Keep consumers informed and advise once regular service is restored.</p>
<p>Chemical contamination of source water such that water provided by Watercare is of poor chemical quality.</p> <p>Indicators: A contamination event may be observed by or reported to Watercare or WDC staff. May also be indicated by reported water quality concerns from consumers (taste, odour, and colour) or illness among consumers.</p>	<p>Liaise with Watercare treatment plant operators.</p> <p>Advise Drinking Water Assessor (DWA).</p> <p>Assess situation and advise consumers regarding use / treatment / disposal of contaminated water.</p> <p>Arrange emergency water supply (tankers) if necessary.</p> <p>Flush contaminated reservoirs and mains.</p> <p>Keep consumers informed and advise once regular service is restored.</p>

Tuakau / Pokeno Water Supply Contingency Plan	
Type of Event	Required Contingency Action
<p>Cyanobacterial / Cyanotoxin contamination of source water such that BAC filtration is ineffective.</p>	<p>Liaise with Watercare treatment plant operators. Advise Drinking Water Assessor (DWA). If cyanotoxins in water leaving the treatment plant exceed 50% of the MAV prepare to supply drinking water from tankers to the community. If cyanotoxins in water leaving the treatment plant exceed the MAV supply drinking water from tankers to the community. Keep consumers informed and advise once regular service is restored.</p>
<p>Insufficient water available for abstraction such that Watercare is unable to supply the full demand of Tuakau and Pokeno.</p> <p>Indicators: Observed or reported low river levels or other major event which results in an inability to supply the full demand of Tuakau and Pokeno</p>	<p>Liaise with Watercare treatment plant operators. Advise consumers to conserve water. Implement demand management strategies as required. Arrange emergency water supply (tankers) if necessary. Keep consumers informed and advise once regular service is restored.</p>
<p>E. coli transgression in water in WDC distribution zone.</p> <p>Indicators: E. coli transgression reported following routine monitoring.</p>	<p>Follow transgression response procedure in DWSNZ. Advise Drinking Water Assessor (DWA). Use an enumeration test method. Increase sampling in distribution system. Investigate cause, inspect plant and source. Take remedial action. Continue to sample for E. coli until 3 consecutive samples are free of E. coli. If E. coli is found in repeat samples consult with DWA, intensify remedial action, increase disinfection, consider 'Boil Water' notice, and consider alternative supply.</p>

Tuakau / Pokeno Water Supply Contingency Plan	
Type of Event	Required Contingency Action
<p>E. coli transgression in Watercare distribution zone prior to bulk meters.</p> <p>Indicators: Low FAC reported from routine monitoring.</p>	<p>Liaise with Watercare operators.</p> <p>Increase sampling in WDC distribution system.</p> <p>Take remedial action if required.</p> <p>Continue to sample for E. coli until 3 consecutive samples are free of E. coli in both Watercare and WDC systems.</p> <p>If E. coli is found repeat samples, consult with DWA, intensify remedial action, increase disinfection, consider 'Boil Water' notice, consider alternative water supply.</p>
<p>Inadequate chlorination.</p> <p>Indicators: Low FAC (<1mg/L) or no FAC reported from treatment plant monitoring.</p>	<p>Liaise with Watercare operators.</p> <p>Advise DWA and issue boil water notice if appropriate, i.e. if cannot reinstate adequate chlorination.</p> <p>Make arrangements for provision of emergency treatment or alternative water supply.</p> <p>Keep consumers informed and advise once regular service is restored.</p>
<p>Inadequate chlorination in reticulation.</p> <p>Indicators: Low FAC reported from routine monitoring.</p>	<p>Advise DWA and issue boil water notice if appropriate, i.e. if cannot reinstate adequate chlorination.</p> <p>Make arrangements for provision of emergency treatment or alternative water supply.</p> <p>Keep consumers informed and advise once regular service is restored.</p>

15 Risk Tables

- TSTL – Treatment and Services Team Leader
- TS – Treatment Supervisor
- CITL – Compliance and Income Team Leader

Table 9. Risk Table: Supply of Water

1. Supply of Water									
Event	No.	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Controlled	Residual Risk	Additional Measures That Could be put in Place	Resp.
Loss of Supply	1.1	Severe drought conditions limit the rate at which Watercare can abstract raw water from the Waikato River.	High (Unlikely x Major)	Drought conditions in region. Reduced volume of water supplied from Watercare bulk delivery points Reports from public about loss of supply pressure.	The Harrisville Road reservoirs will provide short term relief. A supply agreement exists between Watercare and WDC.	Partially.	High (Rare x Major)	Confirm that Watercare has a contingency in place to allow abstraction from the river at reduced water levels or if this is necessary as the intake may be positioned to enable abstraction at reduced river levels, or that they can back feed from other supplies.	CITL

1. Supply of Water

Event	No.	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Controlled	Residual Risk	Additional Measures That Could be put in Place	Resp.
Loss of Supply	1.2	Power outage affecting Watercare treatment plant pumps.	Moderate (Unlikely x Moderate)	Reduced / no flow through bulk delivery points. Power outage at treatment plant. Reports from public about loss of supply pressure.	The Harrisville Road reservoirs will provide short term relief.	Partially.	Moderate (Rare x Moderate)	Confirm that Watercare treatment plant is recognised as a priority site for restoration of power and also has generators on site which allow production during prolonged power outage.	CITL
Loss of Supply	1.3	Failure in bulk main prior to delivery point to either Tuakau or Pokeno.	High (Unlikely x Major)	Reduced / no flow through bulk delivery points. Reports from public about pipe failure or loss of supply pressure.	The Harrisville Road reservoirs will provide short term relief. Watercare reticulation has 'a' grading.	Yes.	High (Rare x Major)	Confirm that Watercare has a contingency in place that enables supply via an alternative route, or for priority repair.	TSTL / CITL
Poor Water Quality	1.4	Failure at treatment plant resulting in water of low quality passing through into reticulation.	High (Unlikely x Major)	Low FAC or <i>E. coli</i> detected in Tuakau or Pokeno reticulation. Watercare notifying WDC about major failure at treatment plant. Consumer complaints.	Treatment plant uses automated dosing / treatment control systems, continuous monitoring and alarms that are monitored by operators 24 hours a day. Written agreement that WDC provides potable water.	Partially.	High (Rare x Major)	Event communication protocols between WDC and Watercare should be developed.	TSTL / CITL

1. Supply of Water

Event	No.	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Controlled	Residual Risk	Additional Measures That Could be put in Place	Resp.
Poor Water Quality	1.5	Contamination introduced through pipe breakage or inadequate hygiene procedures in bulk main prior to Tuakau or Pokeno delivery point.	High (Possible x Moderate)	Low FAC or <i>E. coli</i> detected in the Tuakau or Pokeno reticulation or the Watercare reticulation prior to the Tuakau or Pokeno delivery point. Consumer complaints.	Chlorination is done at a level to provide protection in the reticulation. All breaks repaired by CityCare staff.	Partially.	Moderate (Unlikely x Moderate)	Confirm that CityCare staff undertaking repairs have National Certificate in Water Reticulation (Level 3), or are under supervision of staff that have. Upgrade CityCare qualifications as necessary.	CITL
Loss of Supply	1.6	Future development in Tuakau or Pokeno pushing demand beyond the capabilities of the Watercare treatment plant.	High (Unlikely x Major)	Development or subdivision of Tuakau or Pokeno.	Future quantity requirements and options for providing adequate quantities are part of the water supply planning process. Written supply agreement with Watercare does not have a supply limit.	Yes.	High (Rare x Major)	None.	

Table 10. Risk Table: Tuakau North Zone Booster Pumps

2. Tuakau North Zone Booster Pumps									
Event	No.	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Controlled	Residual Risk	Additional Measures That Could be put in Place	Resp.
Loss of Supply	2.1	Extended pump failure due to power outage.	High (Likely x Minor)	Complaints from consumers about reduced pressure / supply. No pump activity.	The Harrisville Road reservoirs will continue to provide supply at reduced level of service.	Yes.	Low (Unlikely x Minor)	None.	
Loss of Supply	2.2	Pump failure due to mechanical failure.	Moderate (Possible x Minor)	Complaints from consumers about reduced pressure / supply. No pump activity.	The Harrisville Road reservoirs will continue to provide supply at reduced level of service. Standby pump will automatically take over duty.	Yes.	Low (Unlikely x Minor)	None.	
Loss of Supply	2.3	Pump failure due to vandalism.	High (Possible x Moderate)	Complaints from consumers about reduced pressure / supply. No pump activity. Obvious signs of damage to pump house or pumps.	Pump is located in a locked shed.	Yes.	Moderate (Unlikely x Moderate)	None.	

2. Tuakau North Zone Booster Pumps

Event	No.	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Controlled	Residual Risk	Additional Measures That Could be put in Place	Resp.
Microbiological Contamination	2.4	Microbiological contamination due to vandalism of pumps.	Moderate (Unlikely x Moderate)	Low FAC or <i>E. coli</i> detected in reticulation. Complaints from consumers.	Pump is located in a locked shed.	Yes.	Moderate (Rare x Moderate)	None.	
Microbiological Contamination	2.5	Microbiological contamination due to inadequate hygiene practices during pump maintenance.	High (Possible x Moderate)	Low FAC or <i>E. coli</i> detected in reticulation. Consumer complaints.	Contractors used to undertake pump maintenance are suitably qualified.	Partially.	Moderate (Unlikely x Moderate)	Confirm that CityCare staff undertaking repairs have National Certificate in Water Reticulation (Level 3), or are supervised by staff that have. Upgrade CityCare qualifications as necessary. Confirm that CityCare have protocol for maintenance, repair work, and replacement of reticulation components. Upgrade as necessary.	CITL

Table 11. Risk Table: Tuakau Reservoirs

3. Tuakau Reservoirs									
Event	No.	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Controlled	Residual Risk	Additional Measures That Could be put in Place	Resp.
Microbiological contamination	3.1	Leakage through reservoir roofing or walls.	High (Likely x Moderate)	Holes or points of failure visible in roof. E. coli in water leaving reservoir. Decreased FAC in water leaving reservoir.	Residual chlorine in water.	Partially.	Moderate (Unlikely x Moderate)	Inspect reservoir structures annually inside and out. Repair or replace as necessary. Keep vegetation clear of tank. Clean reservoirs as required (identified by annual checks). Reservoir inspection and cleaning to be recorded in asset management system.	TSTL / TS
Microbiological contamination	3.2	Vandalism to reservoir.	High (Possible x Moderate)	Damage to reservoir. E. coli in water leaving reservoir. Decreased FAC in water leaving reservoir.	Residual chlorine in water. Reservoir partially hidden by stand of trees.	Yes.	Moderate (Unlikely x Moderate)	None.	
Microbiological contamination	3.3	Sediment / slime accumulation within reservoirs.	High (Possible x Moderate)	Suspended matter in water exiting reservoir. Consumer complaints. Decreased FAC in water leaving reservoir.	Residual chlorine in water.	Partially.	Moderate (Unlikely x Moderate)	Inspect reservoir structures annually inside and out. Clean reservoirs as required (identified by annual checks). Reservoir inspection and cleaning to be recorded in asset management system.	TSTL / TS

3. Tuakau Reservoirs

Event	No.	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Controlled	Residual Risk	Additional Measures That Could be put in Place	Resp.
Microbiological Contamination	3.4	Contamination through unsanitary maintenance or sampling procedures.	Extreme (Possible x Major)	Illness in community. E. coli present in reticulation system. Decreased FAC in water leaving reservoir.	Chlorination is done at a level to provide protection in the reticulation. All breaks repaired by CityCare staff. Dedicated sampling sites and taps used for sampling.	Partially.	High (Unlikely x Major)	Confirm that CityCare staff undertaking repairs have National Certificate in Water Reticulation (Level 3), or are supervised by staff that have. Upgrade as necessary. Confirm that CityCare have protocol for maintenance, repair work, and replacement of reticulation components. Upgrade as necessary.	CITL
Loss of Water	3.5	Deterioration of reservoir structure.	High (Possible x Moderate)	Failure of reservoir to fill. Obvious signs of spillage or deterioration of reservoir structure.	None.	No.	High (Possible x Moderate)	Inspect reservoir structures annually inside and out, and repair or replace as necessary. Reservoir inspection and cleaning to be recorded in asset management system.	TSTL / TS
Failure to Fill	3.6	Excessive demand.	High (Possible x Moderate)	Low water level in storage reservoir.	Future quantity requirements and options for providing adequate quantities are part of the water supply planning process.	Yes.	Moderate (Unlikely x Moderate)	None.	

3. Tuakau Reservoirs

Event	No.	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Controlled	Residual Risk	Additional Measures That Could be put in Place	Resp.
Stagnant Water	3.7	Inadequate circulation within the reservoir.	High (Possible x Moderate)	Complaints of taste, odour or 'stale' water. Loss of FAC. Water of lower quality exits the reservoir during peak usage when the reservoirs' storage is depleted.	Reservoir is set up so that turnover is high. On average there is 88% and 50% turnover on the large and small reservoirs respectively per day.	Yes.	Moderate (Rare x Moderate)	None.	
Microbiological Contamination	3.8	Contamination through animal ingress.	High (Possible x Moderate)	Illness in community. E. coli present in reticulation system. Decreased FAC in water leaving reservoir.	Chlorination is done at a level to provide protection in the reticulation.	Partially.	Moderate (Unlikely x Moderate)	Bird activity noted during site audit on steel reservoir roof overhang at ladder. Check to ensure birds/vermin cannot access reservoir, and block bird/vermin access if required. Inspect reservoir structures annually inside and out. Clean reservoirs as required (identified by annual checks). Reservoir inspection and cleaning to be recorded in asset management system.	TSTL / CITL

3. Tuakau Reservoirs

Event	No.	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Controlled	Residual Risk	Additional Measures That Could be put in Place	Resp.
Microbiological Contamination	3.9	Contamination through backflow	High (Possible x Moderate)	Illness in community. E. coli present in reticulation system. Decreased FAC in water leaving reservoir.	Chlorination is done at a level to provide protection in the reticulation.	Partially.	Moderate (Unlikely x Moderate)	See Figure 9. Sample or bleed point noted during site audit connected to open hose lying on ground. Disconnect hose and / or fit backflow prevention.	TSTL / CITL
Operator Safety	3.10	Fall from ladder	Extreme (Possible x Catastrophic)	Operator injury.	None.	No.	Extreme (Possible x Catastrophic)	See Figures 6 and 7. Fit ladder meeting AS 1657 – 2013 standards to steel reservoir.	TSTL

Table 12. Risk Table: Reticulation (Both Supplies)

4. Reticulation (Both Supplies)									
Event	No.	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Controlled	Residual Risk	Additional Measures That Could be put in Place	Resp.
Loss of Supply	4.1	Pipe failure.	High (Possible x Moderate)	Complaints from consumers about loss of supply or pressure. Change in flow or pressure in reticulation.	Reticulation pipework is reasonably new, or in good condition.	Partially.	Moderate (Unlikely x Moderate)	Review process for recording pipe breaks, repairs and flushing to ensure all work is captured and recorded into asset management system.	CITL

Insufficient Chlorine Residual	4.2	Chlorine dosed at Watercare treatment plant is insufficient to ensure sufficient residual is maintained to the furthest extents of the Tuakau and Pokeno reticulation.	Extreme (Possible x Major)	Low FAC detected in monitoring results in dead ends or at sampling points at the extents of reticulation. Illness in consumers. Low FAC due to stagnant pipe ends.	Sufficient chlorine residual in the water as Tuakau and Pokeno distribution zones are not extensive.	Partially.	High (Unlikely x Major)	Test results from the flushing programme to be recorded in WaterOutlook. Pipe section (Approx. 1,000m long) between WDC Tuakau WTP and Buckland Road needs to be isolated or disconnected from network, and flushing of associated sections needs to occur to ensure adequate turnover. Pipe section (Approx. 210m long) between isolated Pokeno reservoirs and O'Leary Road needs to be isolated or disconnected from network, and flushing of associated sections needs to occur to ensure adequate turnover.	TSTL / CITL
Microbiological Contamination	4.3	Inadequate controls on maintenance and construction work.	Extreme (Possible x Major)	Illness in community. Complaints from consumers about taste or odour. E. coli present in reticulation system. Inadequate FAC in reticulation.	Chlorination is done at a level to provide protection in the reticulation. All breaks repaired by CityCare staff. WDC requires all work on reticulation to meet the specifications determined by the HCC Standard Technical Specifications (Vol. 3).	Partially.	High (Unlikely x Major)	Confirm that CityCare staff undertaking repairs have National Certificate in Water Reticulation (Level 3), or under the supervision of staff that have. Upgrade CityCare qualifications as necessary. Confirm that CityCare have protocol for maintenance, repair work, and replacement of reticulation components. Upgrade as necessary.	CITL

4. Reticulation (Both Supplies)

Event	No.	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Controlled	Residual Risk	Additional Measures That Could be put in Place	Resp.
Microbiological Contamination	4.4	Backflow from consumer connections.	Extreme (Possible x Major)	Illness in community. Contaminants present in the reticulation system. Taste or odour complaints from consumers.	Chlorine residual. WDC requires testable backflow devices and air gaps on all rural connections. Backflow is covered in the Water Supply Policy and Bylaw. WDC currently employs a contractor to test a percentage of backflow devices each year. Results are recorded on property database.	Partially.	High (Unlikely x Major)	Review testing regime and reporting of test results for backflow devices. Upgrade as necessary. Ensure trickle feed supplies are systematically inspected to ensure air gap at consumer tank. Record inspection results on asset management system.	CITL

4. Reticulation (Both Supplies)

Event	No.	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Controlled	Residual Risk	Additional Measures That Could be put in Place	Resp.
Microbiological Contamination	4.5	Breaks or leaks in pipes.	Extreme (Possible x Major)	Illness in community. Contaminants present in the reticulation system. Taste or odour complaints from consumers. Reduced FAC in water.	Chlorine residual in water. Reticulation pipework is reasonably new, or in good condition.	Partially.	High (Unlikely x Major)	Review process for recording pipe breaks and repairs to ensure all work is captured and recorded into asset management system.	CITL
Microbiological Contamination	4.6	Poor circulation leading to biofilm growth.	Extreme (Possible x Major)	Contaminants present in the reticulation system. Taste or odour complaints from consumer. Reduced FAC in water.	Flushing is undertaken if high turbidity is detected in system or if consumers complain. Residual chlorine in water.	Partially.	High (Unlikely x Major)	Review process for recording pipe breaks and repairs to ensure all work is captured and recorded into asset management system. Confirm that CityCare has a flushing programme in place to flush part of the reticulation every second month on a rotation basis. Test results from the flushing programme to be recorded in WaterOutlook.	TSTL / CITL

4. Reticulation (Both Supplies)

Event	No.	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Controlled	Residual Risk	Additional Measures That Could be put in Place	Resp.
Microbiological Contamination	4.7	Inappropriate materials used for reticulation pipes and fittings.	High (Possible x Moderate)	Illness in community. Contaminants present in the reticulation system. Taste or odour complaints from consumers. Reduced FAC in water.	Reticulation pipework is reasonably new, or in good condition. WDC requires all materials used in reticulation to meet the specifications determined by the Hamilton City Standard Technical Specifications (Vol. 3).	Yes.	Moderate (Unlikely x Moderate)	None.	
Microbiological Contamination	4.8	Contamination through unsanitary sampling procedures.	High (Possible x Moderate)	Illness in community. E. coli present in reticulation system. Inadequate FAC in reticulation.	Residual chlorine in water. Sampling done by trained IANZ accredited Shared Services staff. Sampling undertaken at dedicated sampling sites and sampling taps.	Yes.	Moderate (Unlikely x Moderate)	None.	

4. Reticulation (Both Supplies)

Event	No.	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Controlled	Residual Risk	Additional Measures That Could be put in Place	Resp.
Inadequate Supply	4.9	Silting up of pipes.	High (Possible x Moderate)	Reduced flows in reticulation. Complaints from consumer about quality of water.	Reticulation pipework is reasonably new, or in good condition. Flushing is undertaken if high turbidity is detected in system or if consumers complain. WaterCare plant uses membrane filtration.	Yes.	Moderate (Rare x Moderate)	Confirm that CityCare has a flushing programme in place to flush part of the reticulation every second month on a rotation basis. Test results from the flushing programme to be recorded in WaterOutlook.	CITL

Table 13. Risk Table: Other (Both Supplies)

5. Other (Both Supplies)									
Event	No.	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Controlled	Residual Risk	Additional Measures That Could be put in Place	Resp.
Sampling Failure	5.1	Inadequate sampling programme, sample collection error or response to transgression.	High (Possible x Moderate)	DWSNZ compliance failure due to days of week, days between samples, insufficient samples, information gaps, positive results or sampling error. Gaps in records from weekly testing regime.	Sampling programme prepared checked against Standards. Relevant staff well trained and qualified. Hills Laboratory does E. coli testing and inform WDC promptly if positive result is detected. Results recorded in WaterOutlook (Council's operational and data reporting system for monitoring the quality of water).	Partially.	Moderate (Unlikely x Moderate)	Ensure sampling programme is reviewed by independent person. Ensure sample collection follows sampling programme.	CITL
Unidentified Operational Failure of Treatment Plant	5.2	Treatment plant processes are not sufficiently monitored or alarmed.	Extreme (Possible x Major)	Process failure not identified before supply is contaminated. Contamination identified in supply. Operational near miss identified	Watercare treatment plant is fully telemetered and alarmed.	Partially.	High (Rare x Major)	Event communication protocols between WDC and Watercare should be developed.	TSTL / CITL

5. Other (Both Supplies)

Event	No.	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Controlled	Residual Risk	Additional Measures That Could be put in Place	Resp.
Failure of Supply Equipment due to Inadequate Maintenance.	5.3	Supply equipment fails due to inadequate asset information and insufficient maintenance.	High (Possible x Moderate)	Unexpected plant equipment failure. Not having an asset register and maintenance programme	Specialist maintenance is contracted out as required.	Partially.	Moderate (Unlikely x Moderate)	Ensure planned and routine maintenance is undertaken including basic lubrication and greasing of pumps by CityCare. Review process for recording breaks, repairs and maintenance to ensure all work is captured and recorded into asset management system.	CITL
Failure of Supply due to Unavailability of Spare Parts	5.4	Inadequate spare parts held or spare parts unavailable.	High (Possible x Moderate)	Equipment is out of operation due to not having spare parts available.	Spare parts are held for some things. Replacement spares parts are usually available overnight.	Yes.	Moderate (Unlikely x Moderate)	Develop and implement pump stations asset criticality analysis. Check to see what spares CityCare keeps or has access to. Upgrade if necessary.	TSTL
Failure of Supply due to Inadequate Operating Procedures	5.5	Inadequate, out of date or incorrect standard operating procedures.	High (Possible x Moderate)	SOPs not used. SOPs not up to date. SOP copies are not the same.	SOPs prepared but not for individual sites.	Partially.	High (Possible x Moderate)	Undertake a formal review of the standard operating procedures, and operation and maintenance manuals. Upgrade as necessary.	TS

5. Other (Both Supplies)

Event	No.	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Controlled	Residual Risk	Additional Measures That Could be put in Place	Resp.
Operator Error or Mismanagement	5.6	Inadequate training, professional development and up-skilling of operators.	Extreme (Possible x Major)	Poor operation of plant. Plant compliance failure. Loss of supply. Poor score on question about level of supervision in supply grading.	CityCare engaged to manage operations.	Partially.	High (Unlikely x Major)	Confirm that CityCare requires reticulation supervisors to have at least level 3 reticulation certificate. Upgrade CityCare qualifications as necessary.	CITL
Loss of supply	5.7	Insufficient volume of stored water during WTP outage	High (Possible x Moderate)	Reduced flows in reticulation. Consumer complaints.	Tuakau has two reservoirs having a total volume of 2,405m ³ . Pokeno currently relies on Watercare's reservoirs for supply reserves, although WDC has let a contract for a 2,400m ³ reservoir within the Pokeno supply.	Partially.	Moderate (Unlikely x Moderate)	Confirm that each distribution zone has 24 hours storage. Upgrade as necessary.	CITL