

# Southern Districts Drinking Water Supply

## Water Safety Plan

### Organisation and Supply Details:

Community Name	Southern Districts (SOU009)
Supply owner/organisation name:	Waikato District Council
Prepared by:	CH2M Beca Ltd and Waikato District Council staff
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Signed off by Karl Pavlovich - Waters Manager

## Contents

1	Revision Details.....	4
2	Introduction .....	5
3	Supply Details .....	6
4	Description of Southern Districts Distribution Zone.....	7
5	Photographs of Southern Districts Distribution Zone .....	9
6	Flow Chart / Schematic of the Supply.....	12
7	Barriers to Contamination .....	13
8	Benefits of Proposed Improvements .....	15
9	Methodology.....	15
10	Risk Ranking Procedure .....	16
11	Improvement Schedule.....	18
12	Drinking Water Standards and Grading.....	22
13	Consultation .....	23
14	Contingency Plan .....	24
15	Risk Tables .....	27

## List of Figures

Figure 1.	Location Plan of Southern Districts Distribution Zone Reticulation Network.....	8
Figure 2.	Newstead Reservoir.....	9
Figure 3.	Newstead Reservoir Pumps.....	9
Figure 4.	Matangi Road Reservoir .....	10
Figure 5.	Matangi Road Pumps .....	10
Figure 6.	Matangi Road Reservoir Pump Chamber.....	11

## List of Tables

Table 1	Summary of Southern Districts Water Supply Details .....	6
Table 2.	Critical Points.....	13
Table 3	Likelihood Scale.....	16
Table 4	Consequence Scale.....	16
Table 5	Risk Level Allocation Table .....	17
Table 6	Capital and Significant Projects.....	18
Table 7	Operational Improvements and Minor Projects.....	20
Table 8	Summary of Compliance with DWSNZ.....	22
Table 9.	Risk Table: Supply of Water.....	27
Table 10.	Risk Table: Delivery Pumps .....	31
Table 11.	Risk Table: Reticulation .....	35
Table 12.	Risk Table: Reservoirs.....	41
Table 13.	Risk Table: Other .....	46

## 1 Revision Details

This plan will be revised and submitted for approval before 1 October 2021.

### Assessment of the Performance of the Plan

Assessment of the performance of the Water Safety Plan (WSP) 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 Water Supply Activity Management Plan and if requiring significant capital funding, the Council Long Term Plan.

### Reporting of the Plan

A brief report on the performance of the WSP, 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 in February of each year. 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 Water Supply Activity Management Plan. 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 WSP will be linked to the Annual Plan, the Water Supply Activity Management Plan and the Long Term Plan.

## 2 Introduction

This Water Safety Plan (WSP) has been prepared for the Southern Districts Distribution Zone 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 to the supply identified in this WSP.

The Southern Districts Distribution Zone (SDDZ) is a zone formed from the amalgamation of the Tamahere, Matangi, Gordonton, Newstead and Eureka zones. This zone is comprised of reticulation serving a population of approximately 5,466 people on metered supplies.

The water for the zone is supplied from the Hamilton City Council (HCC) water treatment plant located at Waiora Terrace (TP00066). There are multiple supply points, each with individual bulk water meters. Bulk meters are located at:

- Matangi Road / Silverdale Road, Matangi
- Newells Road / State Highway 1, Tamahere
- Nevada Road, Newstead
- Ruakura Road, Newstead
- Powells Road, Powells
- Crosby Road, Gordonton / Puketaha

This WSP covers the SDDZ only. The WSP for the abstraction and treatment of water used in the SDDZ is the responsibility of HCC.

Because the SDDZ 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 Southern Districts 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 Southern Districts Water Supply Details**

<b>Supply Details</b>	
Supply Name	Southern Districts
WINZ Community Code	SOU009
Supply Owner	Waikato District Council
Population Served by Supply	5,466 (WINZ register March 2016)
<b>Source Details</b>	
Source Name	Waikato River, Hamilton
Source WINZ Code	S00041
Type of Source	River
Depth of Bore	NA
Consent No.	113941
Grid Reference of Source (NZMG)	
<b>Easting</b> : 2713006	<b>Northing</b> : 6374633
<b>Treatment</b>	
Location	Waiora Terrace, Hamilton
Treatment Processes	Clarification; Filtration; Activated Carbon; Chlorination; UV
Average Daily Volume	55 MI/day
Average Daily Volume to Southern Districts Zone (6 monthly average)	1,020 – 2,220 m <sup>3</sup> /day
<b>Distribution</b>	
Distribution Zone Name	Southern Districts Zone
Distribution Zone WINZ Code	SOU009SO
Distribution Zone Population	5,466 (WINZ register March 2016)

## 4 Description of Southern Districts Distribution Zone

The town of Matangi was the first in the southern districts area to be connected to a reticulated supply. This supply was established in 1989 and sourced water from the HCC treatment plant at Waiora Terrace. This supply was later extended in stages to include the communities at Eureka, Gordonton, Newstead, Tamahere and the rural and lifestyle areas around those communities. Figure 1 below shows the extent of the SDDZ distribution network.

WDC provides a restricted supply to a majority of the customers relying on the pressure provided by the HCC reticulation system to properties in the Southern Districts Supply. The exception being properties in rural areas (Tauwhare Pa, Gordonton Village, Matangi Village) that are grandparented full pressure. Each restricted property is required to have an onsite storage tank.

Between 1999 and 2002, the distribution network was upgraded to help alleviate problems with low pressure in the system, particularly around Eureka, Tamahere and Gordonton / Puketaha. This upgrade included the installation of a booster pump station at Newell Road, construction of storage reservoirs at Newstead on State Highway 1B and Matangi Rd, construction of a booster pump station on Puketaha Road and the duplication of some delivery mains.

A written agreement between the HCC and the WDC is in place for the supply and acceptance of potable water. This agreement states that HCC will supply a maximum of 5,000m<sup>3</sup>/day for distribution to the District (District includes North Western, Western and Southern Districts). The HCC water treatment plant at Waiora Terrace sources water from the Waikato River before treating it prior to distribution. Treatment consists of clarification and filtration followed by chlorine and UV disinfection. Granulated activated carbon is also available for removal of cyanotoxins.

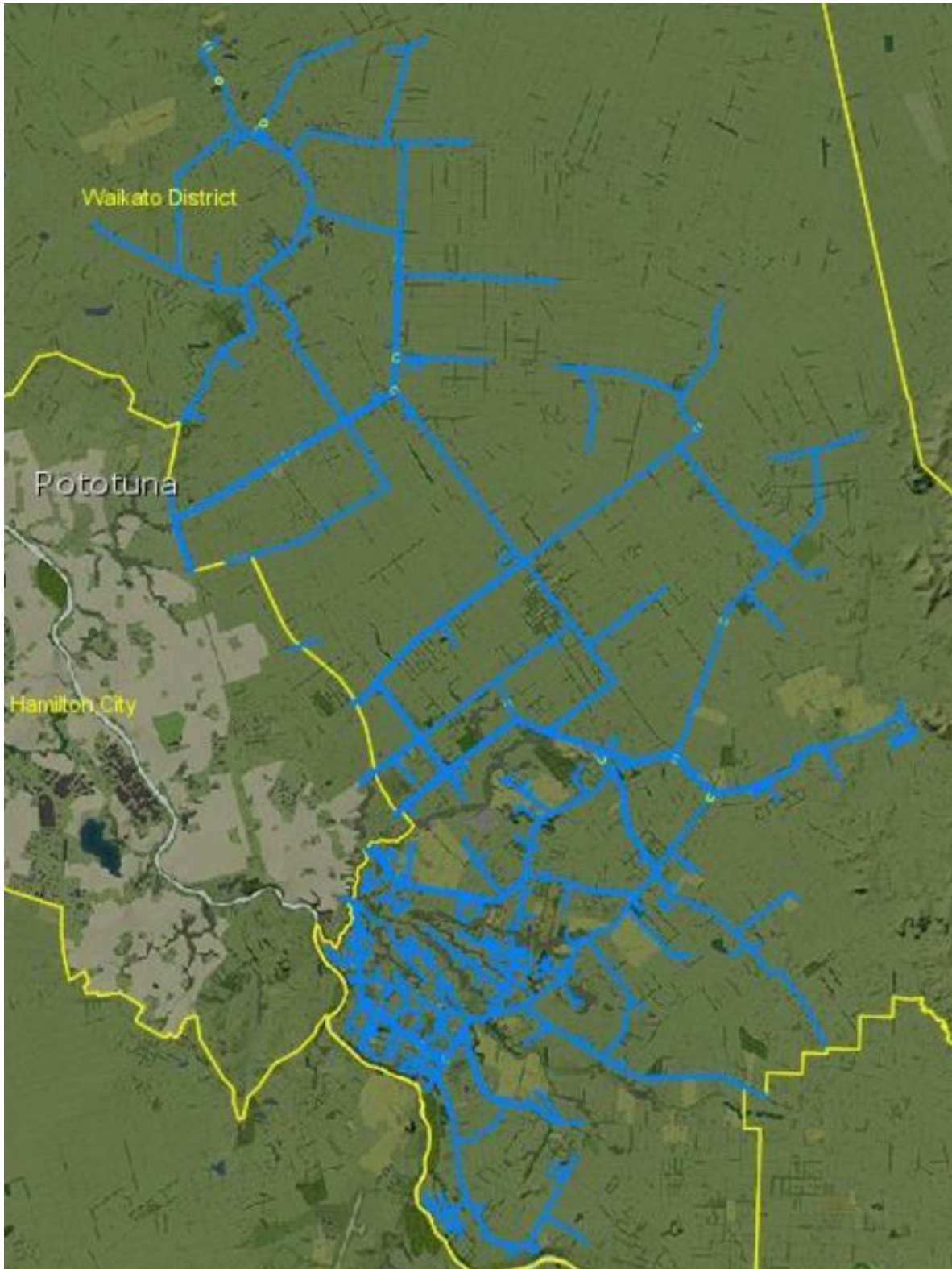


Figure 1. Location Plan of Southern Districts Distribution Zone Reticulation Network



## 5 Photographs of Southern Districts Distribution Zone



Figure 2. Newstead Reservoir



Figure 3. Newstead Reservoir Pumps



Figure 4. Matangi Road Reservoir

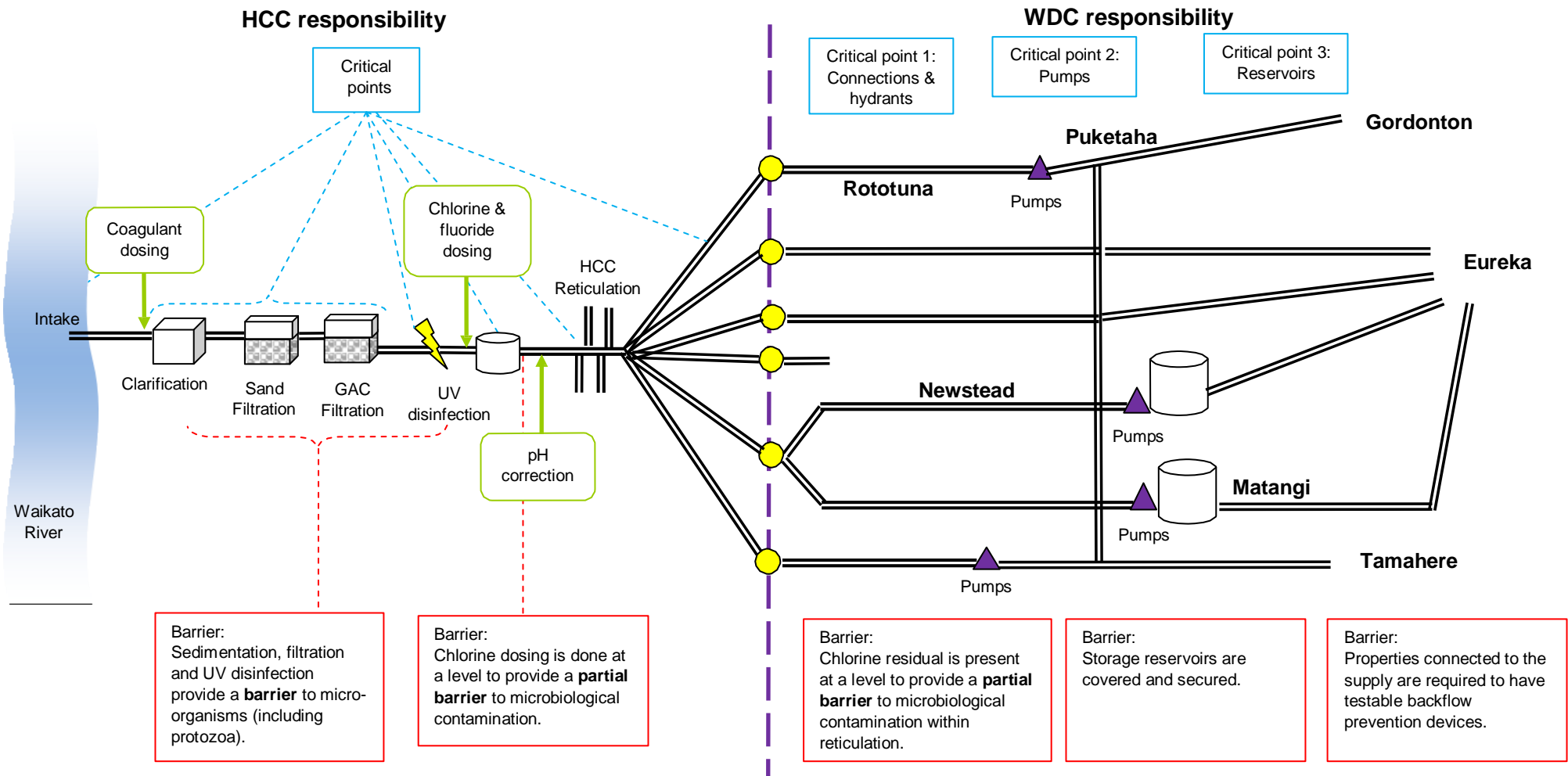


Figure 5. Matangi Road Pumps



Figure 6. Matangi Road Reservoir Pump Chamber

## 6 Flow Chart / Schematic of the Supply



## 7 Barriers to Contamination

Table 2. Critical Points

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

	Critical Point	Description	Responsibility
A.	Intake pumps	<i>Pump failure means eventual loss of supply.</i>	HCC
B.	Coagulant / flash mix	<i>Failure will result in reduced natural organic matter, particle and pathogen removal in the clarification and filtration processes.</i>	HCC
C.	Clarifiers	<i>Failure will result in reduced natural organic matter, particle and pathogen removal.</i>	HCC
D.	Sand filters	<i>Failure will result in reduced natural organic matter, particulate and pathogen removal.</i>	HCC
E.	GAC filters	<i>Failure will result in reduced cyanotoxin and organics removal.</i>	HCC
F.	UV disinfection	<i>Failure will result in reduced protozoa inactivation.</i>	HCC
G.	Chlorine dosing	<i>Failure will result in a lack of bacterial and viral inactivation. Overdosing may exceed chemical MAV.</i>	HCC
H.	HCC reticulation prior to bulk meter	<i>Contamination or failure event in reticulation will impact quality or quantity of water delivered to WDC.</i>	HCC
1.	Distribution system hydrants and connections	<i>Possible access point for contamination due to backflow.</i>	WDC
2.	Booster pumps	<i>Pump failure means loss of system pressure and potential loss of supply to some areas.</i>	WDC
3.	Reservoirs	<i>Possible point for microbiological contamination.</i>	WDC

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

**1. Coagulation, Sedimentation Filtration**

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

**2. Granular Activated Carbon Filtration**

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

**3. UV Disinfection**

The treatment plant uses UV disinfection to inactivate microbiological organisms that have not been removed by the filtration process. This provides a **barrier to microbiological 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 time before the chlorinated water is distributed to consumers, this provides a **barrier** to bacterial and viral **contamination.**

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

**5. Prevention of Contamination of Treated Water while it is in the Network Reticulation Systems**

Maintaining chlorine residual at a level to protect against microbiological contamination provides a **barrier against recontamination** of the water in the North Western District and Western District distribution zone and storage tank. Systems and SOPs for fixing breaks etc. are in place and screens at the bulk meters provide a partial barrier to contamination of water in WDC reticulation.

**6. Installation of Backflow Prevention Devices**

Backflow prevention devices and air gaps on restricted supply connections provide 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.

Occasionally sampling from the SDDZ reticulation has found that chlorine levels are low at the furthest extents and in dead ends of the network. Installing booster dosing stations will ensure that chlorine remains at a level to provide protection against contamination throughout the system.

Reviewing of WDC processes and protocols when working on the supply will ensure they are up to date and relevant for the amalgamated zone.

## 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 WDC 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
- Delivery Pumps
- Reticulation
- Reservoirs
- Other

## 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 10 years).
Unlikely	Could occur at some time (once in 50 years).
Rare	Only in exceptional circumstances (once in 100 years).

**Table 4 Consequence Scale**

Consequences	Description
Insignificant	Insignificant public health impact.
Minor	Minor public health impact or inconvenience to supply users.
Medium	Moderate public health impact and / or short term loss of supply.
Major	Major public health impact and / or loss of supply for a long period. Small number of water-borne illnesses.
Catastrophic	Major public health impact. Significant water-borne illness.



**Table 5 Risk Level Allocation Table**

	Consequence				
Likelihood	Insignificant	Minor	Medium	Major	Catastrophic
Almost certain	Moderate	Moderate	Very High	Extreme	Extreme
Likely	Low	Moderate	High	Very High	Extreme
Possible	Low	Moderate	Moderate	Very High	Very High
Unlikely	Low	Low	Moderate	High	Very High
Rare	Low	Low	Low	Moderate	High

## 11 Improvement Schedule

The improvement schedule is derived from the risk tables that follow in Section 16. The improvement schedule outlines improvements that have been recommended for preventing, reducing or eliminating the identified public health risks in the Southern Districts drinking water supply. Possible improvements to the water supply 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
- WPTL – Water Planning 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	Reticulation	4.10	Seismic assessment of reservoirs.	TSTL	\$10,000
2	Very High	Delivery Pumps	2.6	Upgrade pump stations to ensure they are secure against ingress of stormwater, vermin, debris etc.	TSTL	\$30,000

Southern Districts Zone Water Safety Plan

Priority	Risk Level	Water Supply Area	Reference to Risk Table	Proposed Works	Person Responsible	Expected Cost
3	High	Reticulation	3.2, 3.6	Investigate and install chlorine boost dosing within the reticulation.	TSTL / CITL	\$60,000
4	Moderate	Supply of Water, Reservoirs	1.3, 1.7, 4.7, 4.9	Install additional reservoirs within the SDDZ to provide 24hours storage and meet future growth requirements: 1,000m <sup>3</sup> Tamahere.	TSTL	\$1,000,000
				1,000m <sup>3</sup> Matangi.	TSTL	\$1,000,000
				1,000m <sup>3</sup> Rototuna / Puketaha (or utilise new HCC Rototuna Reservoir once constructed).	TSTL	\$1,000,000
5	Moderate	Reticulation, Reservoirs	3.8, 4.4	Install dedicated sampling sites and taps for sampling (estimated 10 sites required).	CITL	\$15,000
6	Low	Delivery pumps	2.1	Provide a portable generator that can be brought in and connected to the pumps to continue supplying water in the event of prolonged power outage.	TS	\$50,000

**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	3.2, 3.6, 3.9	Monitor and record flushing water quality results.	CITL	Staff time
2	High	Reticulation	3.4	Review testing regime and reporting of test results for backflow protection devices. Record inspection results on asset management system.	WPTL	Staff time
3	High	Reticulation	3.1, 3.5, 3.6, 5.3	Review process for recording pipe breaks and repairs to ensure all work is captured and recorded into asset management system.	WPTL	Staff time
4	High	Reticulation	3.1, 3.5	Investigate requirement for additional on-line monitoring of pressure or reservoir levels.	TSTL	Staff time
5	High	Reticulation	3.4	Ensure trickle feed supplies are systematically inspected to ensure air gap at consumer tank. Record inspection results on asset management system.	WPTL	Staff time
6	Moderate	Other	5.1	Ensure sampling programme is reviewed by independent person. Ensure sampling collection follows sampling programme.	CITL	Staff time
7	Moderate	Reservoirs	4.2	Investigate restricting access to the Matangi reservoir site through the construction of secure fencing.	TSTL	Staff time

Priority	Risk Level	Water Supply Area	Reference to Risk Table	Proposed Works	Person Responsible	Expected Cost
8	Moderate	Delivery Pumps	2.3, 2.4	Investigate fitting Matangi booster pumps chamber with a lockable lid. Investigation to coincide with site fencing investigation above.	TSTL	Staff time
9	Moderate	Other	5.5	Undertake a formal review of the standard operating procedures, and operation and maintenance manuals.	TS	Staff time
10	Moderate	Supply of Water, Other	1.4, 5.2	Water supply agreement between WDC and HCC can include event communication protocols.	WPTL	Staff time
11	Moderate	Reservoirs	4.1, 4.3, 4.5	Inspect reservoir structures annually inside and out. Reservoir inspection and cleaning to be recorded in asset management system.	TSTL / WPTL	Staff time
12	Moderate	Other	5.4	Develop and implement treatment plants and pump stations asset criticality analysis.	WPTL	Staff time

## 12 Drinking Water Standards and Grading

All zones amalgamated into the SDDZ complied with the DWSNZ. Table 8 below shows a summary of the compliance with the DWSNZ to date.

The Hamilton City water treatment and supply has an Aa grade. The SDDZ is currently ungraded (u).

**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.	N/A. Responsibility of HCC.
Protozoa log removal requirement required for the supply.	Log 4.
Protozoa treatment process.	Coagulation, clarification, sand filtration and UV. Responsibility of HCC.
Compliance criteria 6A or 6B is used for water in the distribution zone.	Criterion 6B.
Bacterial compliance for water leaving the treatment plant has been achieved for the last 4 quarters.	Yes. Responsibility of HCC.
Protozoa compliance for water leaving the treatment plant has been achieved for the last 4 quarters.	Yes. Responsibility of HCC.
Bacteria compliance for water in the distribution zone has been achieved for the last 4 quarters.	Yes.
P2 determinands allocated to supply.	Fluoride. Responsibility of HCC.
Chemical compliance achieved for the last 4 quarters.	Yes. Responsibility of HCC.
Cyanobacteria identified in the supply.	Yes. Responsibility of HCC. Cyanobacteria management protocol in place. Source water monitoring indicates cyanobacteria present but not above the treatment capacity of the WTP.
Cyanobacterial compliance has been achieved for the last 4 quarters.	Yes. Responsibility of HCC.

## 13 Consultation

Risks to the supply, preventative measures that are in place or could be put in place, critical points and the barriers to contamination were identified in consultation with WDC staff. The WSP was then modified to take account of required updates.

Subsequent to this consultation telephone discussions and email contact with the Compliance and Income Team Leader provided 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

<b>Southern Districts Distribution Zone Water Supply Contingency Plan</b>	
<b>Type of Event</b>	<b>Required Contingency Action</b>
Pipe breaks that drain the reservoirs and network	<p>Advise customers to conserve water.</p> <p>Investigate cause.</p> <p>Take remedial action.</p> <p>Increase sampling in distribution system.</p> <p>Implement demand management strategies as required.</p> <p>Arrange emergency water supply (tankers) if necessary.</p> <p>Keep customers 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 customers 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.</p> <p>Advise Drinking Water Assessor (DWA).</p> <p>Use an enumeration test method.</p> <p>Increase sampling in distribution system.</p> <p>Investigate cause, inspect plant and source.</p> <p>Take remedial action.</p> <p>Continue to sample for E. coli until 3 consecutive samples are free of E. coli.</p> <p>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>



<b>Southern Districts Distribution Zone Water Supply Contingency Plan</b>	
<b>Type of Event</b>	<b>Required Contingency Action</b>
<p>E. coli transgression in HCC distribution zone prior to bulk meters.</p> <p>Indicators: Low FAC reported from routine monitoring.</p>	<p>Liaise with HCC 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 HCC 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>Severe microbiological contamination of source water (such that treatment is ineffective and water provided by HCC is of poor quality).</p> <p>Indicators: A contamination event may be observed by or reported to HCC or WDC staff. May also be indicated by reported illness among consumers, positive E coli monitoring results, or taste / odour etc. concerns from customers.</p>	<p>Liaise with HCC 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 customers informed and advise once regular service is restored.</p>
<p>Chemical contamination of source water such that water provided by HCC is of poor quality.</p> <p>Indicators: A contamination event may be observed by or reported to HCC 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 HCC treatment plant operators.</p> <p>Advise Drinking Water Assessor (DWA).</p> <p>Assess situation and advise customers 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 customers informed and advise once regular service is restored.</p>

<b>Southern Districts Distribution Zone Water Supply Contingency Plan</b>	
<b>Type of Event</b>	<b>Required Contingency Action</b>
<p>Cyanobacteria / Cyanotoxin contamination of source water such that GAC filtration is ineffective.</p>	<p>Liaise with HCC 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 customers informed and advise once regular service is restored.</p>
<p>Insufficient water available for abstraction and treatment or loss of ability to take water from river.                       Indicators: Observed or reported low river levels.</p>	<p>Liaise with HCC treatment plant operators.                      Advise customers to conserve water.                      Implement demand management strategies as required.                      Arrange emergency water supply (tankers) if necessary.                      Keep customers 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
- WPTL – Water Planning 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 HCC can abstract raw water from the Waikato River.	Very High (Possible x Major)	Drought conditions in region. Reduced volume of water supplied from HCC bulk delivery points Reports from public about loss of supply pressure.	The majority of existing properties have onsite storage and new properties are required by by-law to have onsite storage.  A quantity supply agreement exists between HCC and WDC.  HCC has a contingency in place to allow abstraction from the river at reduced water levels.	Yes.	Moderate (Unlikely x Medium)	None.	

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 HCC treatment plant pumps or booster pumps.	Very High (Possible x Major)	Reduced / no flow through bulk delivery points.  Power outage at treatment plant.  Reports from public about loss of supply pressure.	HCC treatment plant is recognised as a priority site for restoration of power and also has generators on site which allow 60MLD to be produced during prolonged power outage.	Yes.	Moderate  (Unlikely x Medium)	None.	
Loss of Supply	1.3	Failure in bulk main prior to SDDZ delivery point.	Very High (Possible x Major)	Reduced / no flow through bulk delivery points.  Reports from public about pipe failure or loss of supply pressure.	The majority of existing properties have onsite storage and new properties are required by by-law to have onsite storage.  SDDZ is supplied via multiple mains.  HCC reticulation has 'a' grading.	Partially	Moderate  (Possible x Medium)	Install additional reservoirs within the SDDZ to provide 24 hours storage and meet future growth requirements:  - 1,000m <sup>3</sup> Tamahere - 1,000m <sup>3</sup> Matangi - 1,000m <sup>3</sup> Rototuna / Puketaha (or utilise new HCC Rototuna Reservoir once constructed)	TSTL

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 .
Low Water Quality	1.4	Failure at treatment plant resulting in water of low quality passing through into reticulation.	Very High (Possible x Major)	Low FAC or E. coli detected in SDDZ reticulation.  HCC notifying WDC about major failure at treatment plant.  Complaints from consumers.	Treatment plant uses automated dosing / treatment control systems, continuous monitoring and alarms that are monitored by operators 24 hours a day.  Written agreement that HCC provides potable water.	Partially.	Moderate (Rare x Major)	Water supply agreement between WDC and HCC can include event communication protocols.	CITL
Low Water Quality	1.5	Contamination introduced through pipe breakage or inadequate hygiene procedures in bulk main prior to SDDZ delivery point.	High (Likely x Medium)	Low FAC or E. coli detected in the SDDZ reticulation or the HCC reticulation prior to the SDDZ.  Complaints from consumers.	Chlorination is done at a level to provide protection in the reticulation.  All breaks repaired by HCC staff.  HCC staff undertaking repairs have National Certificate in Water Reticulation (Level 3), or are under supervision of staff that have.	Yes.	Moderate (Possible x Minor)	None.	

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 .
Low Water Quality	1.6	Contamination introduced through backflow into bulk main prior to SDDZ delivery point.	Very High (Possible x Major)	Low FAC or detected in the SDDZ reticulation or the HCC reticulation prior to the SDDZ.  Complaints from consumers.	HCC requires high risk industries to install backflow prevention devices which it tests / inspects annually.  Chlorine residual maintained in reticulation.  Written agreement that HCC provides potable water.	Yes.	Moderate (Unlikely x Medium)	None.	
Loss of Supply	1.7	Future development in SDDZ pushing demand beyond the capabilities of the HCC treatment plant.	Very High (Likely x Major)	Demand in SDDZ increases beyond the current quantity agreement with HCC.	Future quantity requirements and options for providing adequate quantities are part of the water supply planning process.  Demand projections show 5,000 m <sup>3</sup> / day is adequate for the Western and Southern Water Supplies for the next 10 years.	Partially.	Moderate (Rare x Major)	Install additional reservoirs within the SDDZ to provide 24 hours storage and meet future growth requirements:  <ul style="list-style-type: none"> <li>- 1,000m<sup>3</sup> Tamahere</li> <li>- 1,000m<sup>3</sup> Matangi</li> <li>- 1,000m<sup>3</sup> Rototuna / Puketaha (or utilise new HCC Rototuna Reservoir once constructed).</li> </ul>	TSTL

Table 10. Risk Table: Delivery Pumps

<b>2. Delivery Pumps</b>									
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.	Moderate (Likely x Medium)	Matangi and Gordonton villages are on demand supply.  Complaints from consumers about loss of pressure / supply.  No pump activity.  Reduction in storage reservoir water level.	The majority of existing properties (except Matangi and Gordonton villages) have onsite storage of greater than 24 hours and new properties are required by by-law to have onsite storage.  Telemetry transmits information about pump activity, reservoir water level and alarms back to WDC operators.	Partially.	Low (Unlikely x Minor)	Provision of portable generator that can be brought in and connected to the pumps to continue supplying water in the event of prolonged power outage.	TS

## 2. Delivery 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	2.2	Pump failure due to mechanical failure.	Moderate (Possible x Medium)	Complaints from consumers about loss of pressure / supply.  No pump activity.  Reduction in storage reservoir water level.	Two pumps used in duty / standby arrangement.  The majority of existing properties (except Matangi and Gordonton villages) have onsite storage of greater than 24 hours and new properties are required to have onsite storage.  Telemetry transmits information about pump activity, reservoir water level and alarms back to WDC operators.	Yes.	Low (Unlikely x Minor)	None.	
Loss of Supply	2.3	Pump failure due to vandalism.	Very High (Possible x Major)	Complaints from consumers about loss of pressure / supply.  No pump activity.  Reduction in storage reservoir water level.  Obvious signs of damage to pump house or pumps.	Some pumps are housed in lockable sheds.	Partially.	Moderate (Unlikely x Medium)	Pumps are fitted within lockable enclosures e.g. fit lockable lid to Matangi booster pump station chamber.	TSTL



<b>2. Delivery Pumps</b>									
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.	Very High (Possible x Major)	Low FAC or detected in reticulation.  Complaints from consumers.	Some pumps are housed in lockable sheds.	Partially.	Moderate (Unlikely x Medium)	Pumps are fitted within lockable enclosures e.g. fit lockable lid to Matangi booster pump station chamber.	TSTL
Microbiological Contamination	2.5	Microbiological contamination due to inadequate hygiene practices during pump maintenance.	Very High (Possible x Major)	Low FAC or detected in reticulation.  Complaints from consumers.	Contractors used to undertake pump maintenance are suitably qualified.  WDC staff undertaking repairs have National Certificate in Water Reticulation (Level 3), or are under the supervision of staff that have.  WDC have protocol for maintenance, repair work, and replacement of reticulation components.	Yes.	Moderate (Unlikely x Medium)	None.	

## 2. Delivery 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	2.6	Microbiological contamination due to the mounting arrangement of the pumps i.e. Matangi pumps are located at base of a stormwater manhole and Newells Rd pump shed is prone to vermin.	Very high (Possible x Major)	Low FAC or E. coli detected in reticulation.  Complaints from consumers.	None.	No.	Very High (Possible x Major)	Upgrade pump stations to ensure they are secure against ingress of stormwater, vermin, debris etc.	TSTL

Table 11. Risk Table: Reticulation

<b>3. Reticulation</b>									
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	3.1	Pipe failure.	Moderate (Possible x Medium)	Complaints from consumers about loss of supply or pressure.  Change in flow or pressure in reticulation.	Reticulation in the SDDZ is only approximately 20 years old.	Partially.	High (Likely x Medium)	Review process for recording pipe breaks and repairs to ensure all work is captured and recorded into asset management system.  Investigate requirement for additional on-line monitoring of pressure or reservoir levels.	WPTL / TSTL
Insufficient Chlorine Residual	3.2	Chlorine dosed at HCC treatment plant is insufficient to ensure sufficient residual is maintained to the furthest extents of the SDDZ reticulation.	Very High (Likely 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.	Some chlorine residual in the water.  Flushing programme in place.	No.	Very High (Likely x Major)	Investigate installing chlorine boost dosing within the reticulation.  Test results from the flushing programme to be recorded in WaterOutlook.	TSTL / CITL

### 3. Reticulation

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	3.3	Inadequate controls on maintenance and construction work.	Very High (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 WDC staff. All WDC staff undertaking repairs have National Certificate in Water Reticulation (Level 3), or under the supervision of staff that have. WDC requires all work on reticulation to meet the specifications determined by the Hamilton City Standard Technical Specifications (Vol. 3). WDC have protocol for maintenance, repair work, and replacement of reticulation components.	Yes.	Moderate (Unlikely x Medium)	None.	

### 3. Reticulation

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	Backflow from consumer connections.	Very High (Possible x Major)	Illness in community. Contaminants present in the reticulation system. Taste or odour complaints from consumers.	Chlorine residual in water. WDC requires double check (testable) backflow devices and air gaps on all rural connections. Gordonton Village has double check valves (some testable some non-testable) on all connections. Backflow is covered in the Water Supply Policy and Bylaw. WDC currently employs a contractor to test 10% 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. Ensure trickle feed supplies are systematically inspected to ensure air gap at consumer tank. Record inspection results on asset management system.	WPTL

<b>3. Reticulation</b>									
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	3.5	Breaks or leaks in pipes.	Very high (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 in the SDDZ is only approximately 20 years old.	Partially.	High (Likely x Medium)	Review process for recording pipe breaks and repairs to ensure all work is captured and recorded into asset management system.  Investigate requirement for additional on-line monitoring of pressure or reservoir levels.	WPTL / TSTL
Microbiological Contamination	3.6	Poor circulation leading to biofilm growth.	Very High (Possible x Major)	Contaminants present in the reticulation system. Taste or odour complaints from consumers. Reduced FAC in water.	Flushing programme in place to flush part of the reticulation every second month on a rotation basis.  Flushing is undertaken if high turbidity is detected in system or if consumers complain.  Residual chlorine in water.	Partially.	High (Possible x Moderate)	Investigate installing chlorine boost dosing within the reticulation.  Review process for recording pipe breaks and repairs to ensure all work is captured and recorded into asset management system.  Test results from the flushing programme to be recorded in WaterOutlook.	TSTL / CITL

<b>3. Reticulation</b>									
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	3.7	Inappropriate materials used for reticulation pipes and fittings.	Moderate (Possible x Medium)	Illness in community. Contaminants present in the reticulation system. Taste or odour complaints from consumers. Reduced FAC in water.	Reticulation in the SDDZ is only approximately 20 years old. 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 Medium)	None.	
Microbiological Contamination	3.8	Contamination through unsanitary sampling procedures.	Moderate (Possible x Medium)	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.	Partially.	Moderate (Unlikely x Medium)	Install dedicated sampling sites and sampling taps in reticulation.	CITL

### 3. Reticulation

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	3.9	Silting up of pipes.	Moderate (Unlikely x Medium)	Reduced flows in reticulation. Complaints from consumer about quality of water.	Reticulation in the SDDZ is only approximately 20 years old. Flushing programme in place to flush part of the reticulation every second month on a rotation basis Flushing is undertaken if high turbidity is detected in system or if consumers complain.	Yes.	Low (Rare x Minor)	Test results from the flushing programme to be recorded in WaterOutlook.	CITL



Table 12. Risk Table: Reservoirs

<b>4. Reservoirs</b>									
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	4.1	Leakage through reservoir roofing or flooring.	Moderate (Possible x Medium)	E. coli in water leaving reservoir. Decreased FAC in water leaving reservoir.	Residual chlorine in water. All hatches and possible entry points for rainwater, etc. are secure against ingress. Reservoirs are relatively new structures (<15 years old).	Partially.	Moderate (Possible x Medium)	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 / WPTL
Microbiological contamination	4.2	Vandalism to reservoir.	Very High (Possible x Major)	E. coli in water leaving reservoir. Decreased FAC in water leaving reservoir.	Residual chlorine in water. Newstead Reservoir is hidden from road behind stand of trees.	Partially.	Moderate (Possible x Medium)	Investigate restricting access to the Matangi reservoir site through the construction of secure fencing.	TSTL
Microbiological contamination	4.3	Sediment / slime accumulation within reservoirs.	Moderate (Possible x Medium)	Suspended matter in water exiting reservoir. Consumer complaints. Decreased FAC in water leaving reservoir.	Residual chlorine in water.	Partially.	Moderate (Possible x Medium)	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 / WPTL

4. 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	4.4	Contamination through unsanitary maintenance or sampling procedures.	High (Likely x Medium)	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 WDC staff.  WDC staff undertaking repairs have National Certificate in Water Reticulation (Level 3), or are supervised by staff that have.  WDC have protocol for maintenance, repair work, and replacement of reticulation components.	Partially.	Moderate (Unlikely x Medium)	Install dedicated sampling sites and taps used for sampling.	CITL
Loss of Water	4.5	Deterioration of timber in timber tanks.	Very High (Possible x Major)	Failure of reservoir to fill.  Obvious signs of spillage or deterioration of timber.	Reservoirs are relatively new structures (<15 years old).	Partially.	Moderate (Possible x Medium)	Inspect reservoir structures annually inside and out.  Reservoir inspection and cleaning to be recorded in asset management system.	TSTL / WPTL

4. 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.
Loss of water / Overflow	4.6	Failure of pump control.	Moderate (Unlikely x Medium)	Service pump / s running for prolonged period.	Two pumps in duty / standby arrangement.  Telemetry transmits information about pump activity and reservoir water level back to Waikato DC office.	Yes.	Low (Rare x Medium)	None.	
Failure to Fill	4.7	Excessive demand.	Moderate (Possible x Medium)	Low water level in storage reservoir.	Supply to the SDDZ is restricted trickle feed with consumers having on site storage. Consumers are metered and invoiced for the water consumed.  Future quantity requirements and options for providing adequate quantities are part of the water supply planning process.  Current demand projections show 5,000 cubic metres per day is adequate for the Western and Southern Water Supplies for the next 10 years.	Partially.	Moderate (Unlikely x Medium)	Install additional reservoirs within the SDDZ to provide 24 hours storage and meet future growth requirements:  <ul style="list-style-type: none"> <li>- 1,000m<sup>3</sup> Tamahere</li> <li>- 1,000m<sup>3</sup> Matangi</li> <li>- 1,000m<sup>3</sup> Rototuna / Puketaha (or utilise new HCC Rototuna Reservoir once constructed).</li> </ul>	TSTL

4. 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	4.8	Inadequate circulation within the reservoir.	Low (Unlikely x Minor)	Complaints of taste, odour or 'stale' water.  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.  Drawdown is to 60% to encourage turnover.	Yes.	Low (Unlikely x Minor)	None.	
Loss of Long Term Supply	4.9	No increase in quantity of potable water supplied to SDDZ in future.	Very High (Possible x Major)	HCC reluctant to increase quantity of potable water supplied to SDDZ.	Supply to the SDDZ is restricted trickle feed with consumers having on site storage. Consumers are metered and invoiced for the water consumed.  Current demand projections show 5,000 cubic metres per day is adequate for the Western and Southern Water Supplies for the next 10 years.	Partially.	Moderate (Rare x Major)	Install additional reservoirs within the SDDZ to provide 24 hours storage and meet future growth requirements:  <ul style="list-style-type: none"> <li>- 1,000m<sup>3</sup> Tamahere</li> <li>- 1,000m<sup>3</sup> Matangi</li> <li>- 1,000m<sup>3</sup> Rototuna / Puketaha (or utilise new HCC Rototuna Reservoir once constructed).</li> </ul>	TSTL

## 4. 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.
Loss of Water	4.10	Reservoir failure due to earthquake.	Extreme (Likely x Catastrophic)	Low water level in storage reservoir. Failure of reservoir to fill. Obvious signs of spillage or deterioration of timber. Complaints from consumer about no water.	WDC staff note any visual reservoir faults when undertaking site visits.	Partially.	Very High (Possible x Catastrophic)	Seismic assessment of reservoirs.	TSTL

Table 13. Risk Table: Other

<b>5. Other</b>									
Event	No.	Cause	Risk Without Preventative Measures	Indicators	Preventative Measures in Place	Controlled	Residual Risk	Additional Measures That Could be put in Place	Resp.
<b>Sampling Failure</b>	5.1	Inadequate sampling programme, sample collection error or response to transgression.	High (Likely x Medium)	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 (Possible x Minor)	Ensure sampling programme is reviewed by independent person.  Ensure sample collection follows sampling programme.	CITL
<b>Unidentified Operational Failure of Treatment Plant</b>	5.2	Treatment plant processes are not sufficiently monitored or alarmed.	Very High (Possible x Major)	Process failure not identified before supply is contaminated.  Contamination identified in supply.  Operational near miss identified.	HCC treatment plant is fully telemetered and alarmed.	Partially.	Moderate (Rare x Major)	Water supply agreement between WDC and HCC can include event communication protocols.	CITL

<b>5. Other</b>									
<b>Event</b>	<b>No.</b>	<b>Cause</b>	<b>Risk Without Preventative Measures</b>	<b>Indicators</b>	<b>Preventative Measures in Place</b>	<b>Controlled</b>	<b>Residual Risk</b>	<b>Additional Measures That Could be put in Place</b>	<b>Resp.</b>
Failure of Supply Equipment due to Inadequate Maintenance.	5.3	Supply equipment fails due to inadequate asset information and insufficient maintenance.	Moderate (Possible x Medium)	Unexpected equipment failure.  Not having an asset register and maintenance programme.	Planned and routine maintenance undertaken including basic lubrication and greasing of pumps undertaken by operator.  Specialist maintenance is contracted out a required.	Partially.	High (Possible x Moderate)	Review process for recording breaks, repairs and maintenance to ensure all work is captured and recorded into asset management system.	WPTL
Failure of Supply due to Unavailability of Spare Parts	5.4	Inadequate spare parts held or spare parts unavailable.	Moderate (Possible x Medium)	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 Medium)	Develop and implement treatment plants and pump stations asset criticality analysis.	WPTL
Failure of Supply due to Inadequate Operating	5.5	Inadequate, out of date or incorrect standard operating procedures.	Moderate (Possible x Medium)	SOPs not used.  SOPs not up to date.  SOP copies are not the same.	SOPs prepared but not for individual sites.	Partially.	Moderate (Unlikely x Medium)	Undertake a formal review of the standard operating procedures, and operation and maintenance manuals.	TS

5. Other									
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	Very high (Likely x Major)	Poor operation of plant. Plant compliance failure. Loss of supply.  Poor score on question about level of supervision in supply grading.	WDC requires reticulation supervisors to have at least Level 3 reticulation certificate.  Treatment operators train for National Water Treatment Certificate  Ongoing training and up skilling provided for operators.	Yes	High (Unlikely x Major)	None.	