Ashburton
DISTRICT COUNCIL

Rakaia Water Supply

Water Safety Plan

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Water Safety Plan

Version 2.1: August 2018

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Document Control

Version No	Description	Authorised	Approval Date
V 1.1	For submission to DWA for approval	AG	May 2007
V 2.0	5 yearly revision to DWA for approval	AG	August 2014
V2.1	Revision to include CCPs	CS	August 2018

Contents

1 Background

Ashburton District Council (ADC) own and manage the Rakaia drinking water supply. Under the Health (Drinking Water) Amendment Act 2007 (the Act) water suppliers have a duty to prepare and implement Water Safety Plans (WSP), formerly Public Health Risk Management Plans (PHRMP) [Section 69Z].

Under the Act Council has a responsibility to take all practicable steps to comply with the drinking water standards [Section 69V]. This requirement can be met in part by implementing the provisions of an approved Water Safety Plan that relate to the drinking water standards.

The purpose of a Water Safety Plan is to identify the public health risks associated with a drinking water supply. A Water Safety Plan identifies what could go wrong with a water supply and what measures can be put in place to prevent or eliminate the risk to public health.

Rakaia is classified as a minor supply under the legislation and is therefore required to be compliant with the Act by 01 July 2014. In 2007 the Ministry of Health (MoH) approved a PHRMP for Rakaia. As this PHRMP has now expired this WSP has been prepared to meet the requirements of section 69Z of the Act.

2 Implementation, Review and Reporting

2.1 Implementation of the Plan

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

2.2 Reviewing Plan Performance

The WSP will be fully reviewed and updated at least every five years by the ADC Assets Manager in conjunction with Council Assets staff and Maintenance Contractor staff. If significant changes are made to the water supply during this time, the WSP will be reviewed and updated as appropriate.

The review will include an assessment of 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. Adjustments will be made to the plan as a result of information provided by this assessment.

2.3 Reporting of the Plan

A brief report on performance against the plan will be prepared by the Assets Manager, for incorporation in three yearly updates of the Activity Management Plan (AMP) and Long Term Plan (LTP).

2.4 Duration of the Plan

This plan shall remain in force for a period of up to five years following approval. During the five year period, the document will be kept current through the following steps:

- Collating comments from those regularly using the WSP and making any required changes;
- Monitoring customer complaints and making any required changes;
- Incorporating any minor changes that have been made to the water supply;
- Updating the risk tables as required;
- Updating the improvement schedule.

2.5 Revision and Re-approval of the Plan

It is a requirement that the Plan be reviewed, revised and submitted for re-approval within five years of approval. Revision processes are detailed above.

2.6 Links to other Quality Systems

This Plan will contribute improvement measures to the AMP for prioritisation and funding via the LTP.

3 Supply Details

Supply	
Supply Name	*Rakaia*
WINZ Community Code	*RAK001*
Supply Owner	*Ashburton District Council*
Supply Manager	*Andrew Guthrie*
Supply Operator	*Ashburton Contracting Ltd – Robin Jenkinson (NZCE Civil, R.E.A.)*
Population Served by Supply	*957 (WINZ, accessed 24 April 2014)*
Supply Grading	*Ud (current)*
Source	
Source Name	*Rakaia Deep Bore 1*
Source WINZ Code	*G01873*
Location	*West Town Belt*
Map Reference of Source	*NZMS 260 L36:310-171* *NZMG 2431007 easting, 5717063 northing* *NZTM 1521025 easting, 5155455 northing*
Type of Source	*Groundwater*
Depth of Bore	*117.5m*
Consent Number	*CRC073787*
Consent Expires	*29 April 2044*
Maximum Consented water take:	*30L/s, 2,562m^3 per day, 374,000m^3 per year*
Treatment Plant	
Treatment Plant Name	*Rakaia*
Treatment Plant WINZ Code	*TP00341*
Location	*West Town Belt*
Map Reference	*NZMS 260 L36:310-171* *NZMG 2431007 easting, 5717063 northing* *NZTM 1521025 easting, 5155455 northing*
Treatment Processes	*Chlorination*
Average Daily Volume	*750 m^3/day*
Peak Daily Volume	*1,606 m^3/day*
Distribution	
Distribution Zone Name	*Rakaia Township*
Distribution Zone WINZ Code	*RAK001RA*
Distribution Zone Population	*957*

Regulatory Compliance	
Standards compliance assessed against	*DWSNZ 2005 (rev 2008)*
Laboratory undertaking analyses	*Ashburton District Council*
Secure bore water	*Yes, Granted April 2013*
Bacterial compliance criteria used for water leaving the treatment plant	*Criterion 1*
Bacterial compliance for water leaving the treatment plant has been achieved for the last 4 quarters.	*Yes*
Protozoa log removal requirement required for the supply	*0*
Protozoa treatment process	*NA – secure bore water*
Protozoa compliance for water leaving the treatment plant has been achieved for the last 4 quarters.	*NA*
Compliance criteria used for water in the distribution zone.	*Criterion 6A*
Bacteria compliance for water in the distribution zone has been achieved for the last 4 quarters.	*Yes*
P2 determinands allocated to supply	*Nil*
Chemical compliance achieved for the last 4 quarters.	*Yes*
Cyanobacteria identified in the supply	*No*
Cyanobacterial compliance has been achieved for the last 4 quarters.	*NA*
Identify any transgressions that have occurred in the last 4 quarters *Nil*	

3.1 Contact Information

Water Supply Owner:

Ashburton District Council
PO Box 94, Ashburton
Contact: Andrew Guthrie, Assets Manager
Phone: 03 307-7741

Water Supply Operator:

Ashburton Contracting Ltd
PO Box 264, Ashburton
Contact: Robin Jenkinson
Phone 03: 308-4039

4 Methodology

This WSP has been prepared generally in accordance with "Small Drinking-water Supplies: Preparing a Water Safety Plan", Ministry of Health (2014). This section of the WSP describes the approach taken to develop the plan and a brief overview of what is included.

4.1 System Description

Within this WSP the water supply is described and a schematic diagram prepared to illustrate the key elements of the supply (Section 5). Critical points and barriers to contamination are also illustrated (Sections 7 and 8).

4.2 Consultation

Version 1 of this plan was prepared in 2007 in consultation with Ashburton District Council water supply management and operational staff and in accordance with existing documentation. Documentation included the Rakaia Asset Management Plan (AMP) and the Assessment of Water and Sanitary Services (WSSA).

In June 2014, this plan was comprehensively revised to take into account improvements made to the water supply system by means of capital works, and management, operation and maintenance modifications since 2007.

Discussions were held with management and operational staff during May/June 2014. The intent was to discuss the specific health risks associated with this supply, confirm changes to the system since the WSP (PHRMP) was originally produced in 2007, and provide further inputs to this plan which was subsequently completed and finalised.

In particular, the draft WSP was reviewed and discussed with Andrew Guthrie, Asset Manager, Ashburton District Council, and Robin Jenkinson, Ashburton Contracting Ltd, prior to completion.

4.3 Risk Assessment

A qualitative risk assessment approach has been taken following the guidance notes in Appendix 2 of "A Framework on How to Prepare and Develop Water Safety Plans for Drinking-water Supplies", Ministry of Health (2014) allowing the prioritisation of improvement needs and development of the Improvement Schedule.

The scales used have been adapted from those suggested in Appendix 2 of "A Framework on How to Prepare and Develop Water Safety Plans for Drinking-water Supplies", Ministry of Health (2014). Changes have been made to achieve a better spread of risk level outcomes, and to ensure relativity between the risks assessed for supplies of varying sizes.

Potential public health risks have been evaluated using the Likelihood and Consequence scales tabulated below (tables 1-3) to determine a risk level from low to extreme.

Table 1: Likelihood Scale

Likelihood	Frequency	Description
Likely	More than once per year	The threat can be expected to occur
Quite Common	Once per 1-5 years	The threat will quite commonly occur
Unlikely	Once per 5-10 years	The threat may occur occasionally
Unusual	Once per 10-50 years	The threat could infrequently occur
Rare	Less than once per 50 years	The threat may occur in exceptional circumstances

Table 2: Consequence Scale

Consequences	Microbiologically contaminated water	Chemically contaminated water	Supply interruption	Poor aesthetic water quality
Negligible		Minor chemical contamination event	Unplanned supply interruption for up to 8 hours	Poor aesthetic water quality of nuisance value only
Minor	Microbiological contamination (<100 population)	Recurrent chemical contamination (<100 population)	Unplanned supply interruption for in excess of 8 hours (<100 population)	
Medium	Microbiological contamination (100-500 population)	Recurrent chemical contamination (100-500 population)	Unplanned supply interruption for in excess of 8 hours (100-500 population)	Ongoing poor aesthetic water quality (may lead consumers to obtain water from other sources)
Major	Microbiological contamination (500-5000 population)	Recurrent chemical contamination (500-5000 population)	Unplanned supply interruption for in excess of 8 hours (500-5000 population)	
Substantial	Microbiological contamination (>5000 population) OR high potential for loss of life or hospitalisation with life threatening or long-term consequences	Recurrent chemical contamination (>5000 population). OR high potential for loss of life or hospitalisation with life threatening or long-term consequences.	Unplanned supply interruption for in excess of 8 hours (>5000 population)	

Table 3: Risk Level Allocation Table

	Consequence				
Likelihood	**Negligible**	**Minor**	**Medium**	**Major**	**Substantial**
Likely	Low	Medium	Very High	Extreme	Extreme
Quite Common	Low	Medium	High	Very High	Extreme
Unlikely	Low	Medium	High	Very High	Very High
Unusual	Low	Low	Medium	High	Very High
Rare	Low	Low	Medium	Medium	High

In Section 10 Risk Tables have been prepared to summarise:

a) What could happen that may cause drinking water to become unsafe,
b) What measures are in place to prevent this from occurring and whether these are sufficient,
c) The assessed level of risk, and
d) What could be done to eliminate, isolate or minimise the risks.

4.4 Improvement Schedule

An Improvement Schedule (Section 11) has been derived from the Risk Tables and is prioritised according to the assessed level of public health risk associated with hazards that are not adequately controlled at present.

Indicative cost estimates and implementation timeframes have been prepared for the required improvement measures. These will be carried forward to the next Activity Management Plan (AMP) and Long Term Plan (LTP) for approval and inclusion in annual budgets following the statutory public consultation process.

Implementation of the Improvement Schedule is ultimately subject to Council funding approval.

4.5 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. In particular, risks will be reduced through the provision of water treatment systems that are appropriate to the raw water quality and catchment conditions, and that are compliant with the Drinking-water Standards for New Zealand.

The proposed improvements include preparing an Emergency Response Plan and ensuring all plant records and emergency response procedures are up to date and available onsite. Having these in place will help Council and contracting staff to prepare for, manage, and respond to unforeseen situations in a timely and appropriate manner.

The adoption and implementation of a backflow prevention policy will help to mitigate the risk of backflow contamination and provide guidance on backflow prevention device requirements within the Ashburton District.

The proposed improvement schedule includes undertaking a criticality analysis, developing a Lifecycle Management Plan, and implementing an Asset Management System. Each of these will facilitate strategic planning and assist in guiding the overall management of the scheme.

4.6 Contingency Plans

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

5 General Description

The Rakaia water supply scheme supplies drinking water to 534 connections (ADC customer records May 2014) serving a population of 957 (WINZ data April 2014). The supply includes 15 extraordinary connections that are outside the town boundary. There are 77 businesses connected to the supply of which 65 are metered.

5.1 Plant Upgrade

In 2009 the water supply was upgraded. This saw the two old shallow bores disconnected, the elevated reservoir removed, and new infrastructure installed. The two shallow wells that previously supplied the scheme have been physically isolated, but could be reconnected in an emergency situation.

5.2 Description of Source

Water is now sourced from a single 250mm diameter bore (L36/2176) located on West Town Belt. The bore is drilled to a depth of 117.5m BGL and is screened between 108.5m and117.5m BGL.

The bore was granted secure groundwater status in April 2013. The treatment processes and programmed monitoring are fully compliant with the DWSNZ requirements for a secure groundwater source.

Figure 1 below illustrates the Rakaia water supply system from source to reticulation.

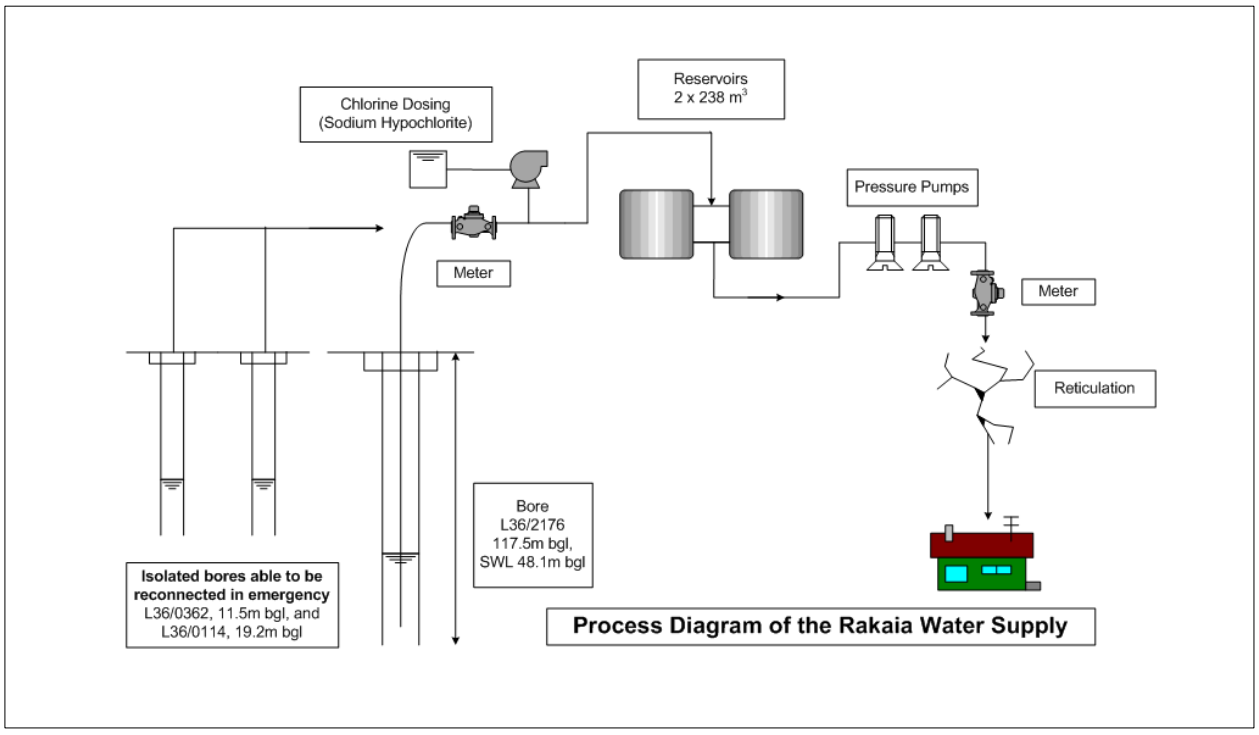

Figure 1: Rakaia Water Supply Process Diagram

5.3 Treatment and Distribution

Raw water is pumped from the bore along a DN200PVC-U trunk main to two 238m^3 reservoirs connected in parallel. The water is dosed with 1% sodium hypochlorite solution en route to the reservoirs.

As water is drawn from the reservoirs and the water level drops, the bore pump switches on to refill the reservoirs. The bore pump then switches off once the reservoirs are filled to their top water level.

The treated water then flows by gravity back to the water treatment plant along a DN300 PVC-U trunk main. Four variable speed Lowara booster pumps located inside the water treatment plant then deliver the water to the reticulation (see distribution map over page).

A standby power generator is installed onsite and is sufficient to operate the treatment equipment in the event of power supply interruption.

5.4 Monitoring and Alarms

FAC and turbidity are continuously monitored at the plant. Council Environmental Monitoring staff carry out routine pH and nitrate sampling at the plant.

Sampling bollards in the distribution zone are located at Martins Road, Rakaia Barrhill Methven Road, and Michael Street East. Thirteen E. coli samples per quarter are taken from the distribution zone.

A chlorine analyser measures chlorine residual in the water and this is reported in SCADA. SCADA is used to report power failure, bore and booster pump faults, generator fault, generator run, low bore level, high and low chlorine residual, high and low reservoir level, low sodium hypochlorite tank level, high turbidity and low system pressure to the operator by alarms.

SCADA also records booster pumps on/off, booster pump flow, bore level, bore pump on/off, bore flow, pump run hours, sodium hypochlorite tank level, system pressure, reservoir level and turbidity.

5.5 Maintenance and Administration

Rakaia water supply is owned and managed by the Ashburton District Council. The scheme is administered at the main council offices in Baring Square West, Ashburton. The supply is operated and maintained by Council's utilities contractor Ashburton Contracting Ltd (ACL).

Qualified field staff are appointed to operate and maintain the plant. The personnel involved in the day-to-day management and operation of the water scheme are adequately trained and qualified. ACL staff, including the Rakaia Plant Operator, undertake on-going training.

Water samples are routinely taken by the Plant Operator and Council Environmental Monitoring staff. Bacteriological testing is carried out at the Ashburton District Council laboratory.

6 Water Supply Distribution Map

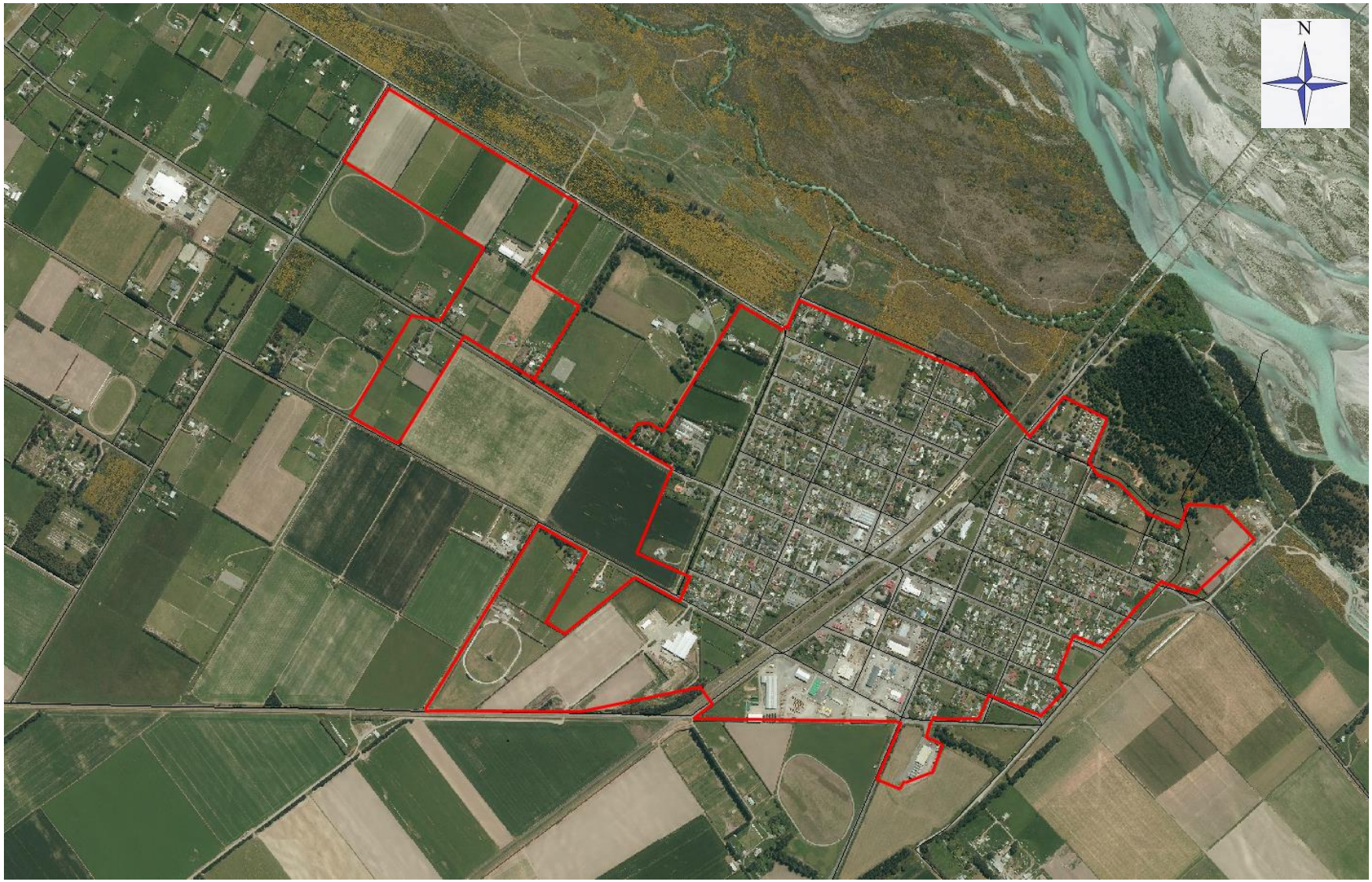

Figure 2: Rakaia Water Supply Distribution Map

7 Critical Points for Hazard Management

Figure 3 (over the page) presents a schematic of the water supply from source to consumer. Critical points, where hazards can be eliminated, minimised or isolated are indicated in blue. Barriers to contamination are indicated in red.

Critical points where hazards can be eliminated, minimised or isolated are tabulated below.

Critical Point	Description
Wellhead	*Possible point for microbiological contamination* *Possible point for loss of supply*
Chlorine dosing	*Overdosing may exceed chemical MAV* *NOTE: Chlorination is not required for raw water disinfection as the source is secure groundwater*
Treated water storage	*Possible point for microbiological contamination* *Possible point for loss of supply*
Booster pumps	*Possible point for loss of supply*
Reticulation	*Possible point for microbiological contamination* *Possible point for loss of supply*

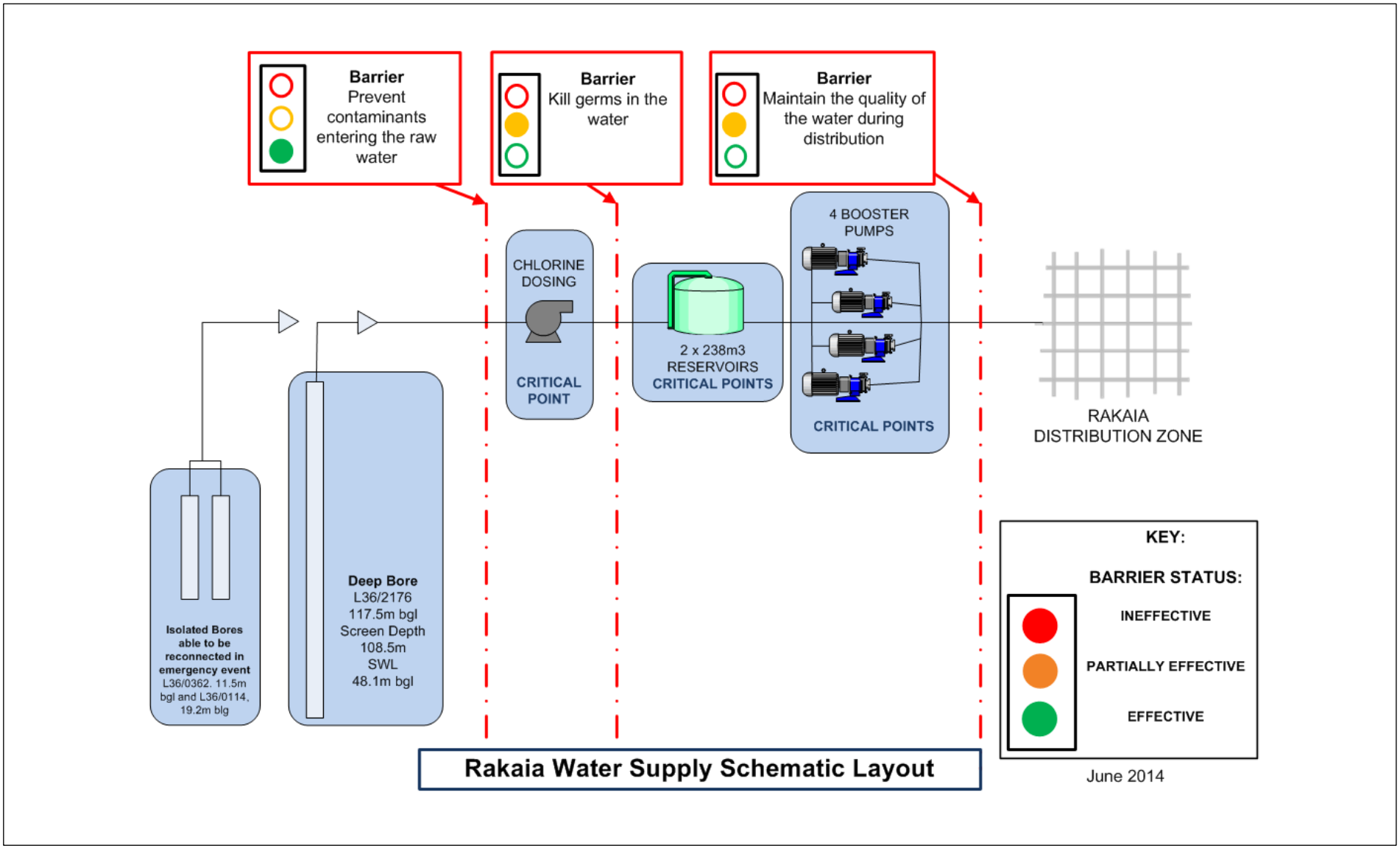

Figure 3: Rakaia Water Supply Critical Points and Barriers to Contamination

8 Barriers to Contamination

The following section discusses what barriers are in place to reduce the risk to public health from the Rakaia drinking water supply. A Framework on How to Prepare and Develop Water Safety Plans for Drinking-water Supplies by the Ministry of Health (2014) states the barriers should:

- Prevent contaminants entering the raw water
- Remove particles from the water
- Kill germs in the water
- Maintain the quality of the water during distribution

1. Prevent Contaminants Entering the Raw Water

The abstraction bore is 117.5m deep; the large depth minimises the risk from surface contamination. The well head is constructed to prevent ingress of contaminants. It has a sealed well cap, a high air vent with a screen, and a surrounding concrete pad. It is housed in a clean, locked concrete chamber that sits below ground.

A testable double-check Wilkins 350 backflow prevention system at the well head prevents any flow of water back into the source. The raw water is tested regularly to ensure that there is no contamination. There is a sampling tap on the outside of the water treatment plant that is labelled.

The source has been classified as secure groundwater by the Ministry of Health (MoH). The source therefore provides a **partial barrier to contamination**.

2. Remove particles from the water

The groundwater source is secure and turbidity is consistently very low and therefore this barrier is not applicable.

3. Kill germs in the water

Although the groundwater source is secure, a chlorination system is used to provide a disinfection residual for protection in the distribution zone. There is a high level of control with a dosing pump that turns on/off when the bore pump turns on/off. The dosing rate is controlled by the flow rate out of the bore.

Although not strictly necessary, the disinfection process further enhances **the partial barrier to contamination** that is provided by the secure groundwater source.

4. Maintain the quality of the water during distribution

Sodium hypochlorite is dosed at a concentration to ensure there is a residual available to protect against microbiological contamination throughout the system.

Sodium hypochlorite residual is measured and reported through SCADA with alarms for high and low results. The level of the sodium hypochlorite storage tank is also measured and reported through SCADA with an alarm for low tank level.

The outflow from the booster pumps can be tested by a sample tap on the outside of the pump shed. Council and the Plant Operator regularly test the chlorine levels in the reticulation system to ensure that FAC is maintained at an appropriate level.

Reservoirs

The reservoirs are covered with screw lid access hatches which are locked to prevent unauthorised access, ingress of rainwater or contaminants. The air vents and overflows have rodent protection.

The access ladders are locked in a vertically retracted position and the reservoirs are located within a locked fenced compound to prevent unauthorised access.

The reservoirs have high level inlets and low level outlets to promote circulation to ensure that water does not remain in the reservoirs for long periods. Each of the reservoirs can be isolated independently, to allow for cleaning, inspection and repair without disrupting supply.

Booster Pumps

There are four variable speed booster pumps and a pressure sensor to ensure that adequate pressure is maintained in the network. Pressure is measured and recorded through SCADA with an alarm for low pressure.

Emergency Generator

The plant is on mains electricity supply with a backup generator that is regularly tested and the results recorded. An on-site generator ensures power is available to maintain water treatment and a constant supply. The generator is in a secure fenced enclosure**.**

Maintenance and Training

Hygiene procedures are documented and followed for all distribution system maintenance. The personnel involved with the operation and maintenance of the plant are trained and experienced.

General

The building housing the treatment equipment and pump station is clean and locked. There is a separate chemical room which is also clean and locked.

New domestic connections are fitted with a backflow prevention device.

These measures contribute to the provision of a **partial barrier against contamination** of water following treatment. This barrier may be enhanced by the adoption and implementation of a backflow prevention policy.

9 Photographs of Supply Elements

Photo 1: Water treatment plant and generator

Photo 2: Borehead cover

Photo 3: Inside bore chamber

Photo 4: Reservoirs

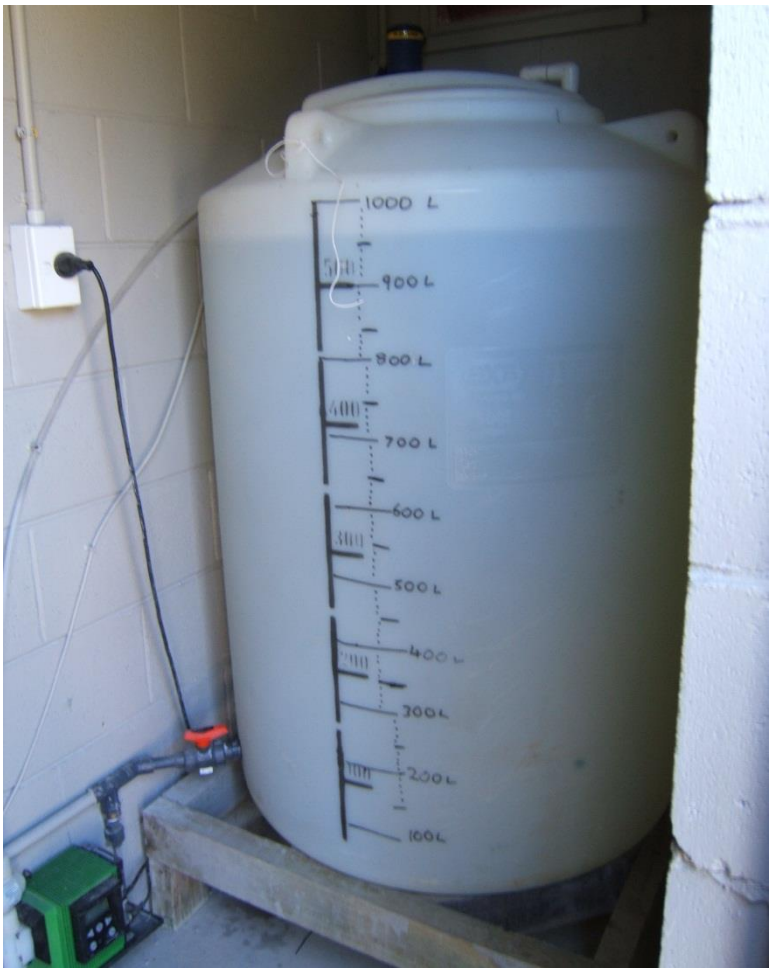

Photo 5: Sodium hypochlorite storage tank and pump

Photo 6: Booster pumps

Photo 7: Control Panel

Photo 8: Water sampling taps

10 Risk Tables

10.1 Risk Assessment Worksheet – Bore Source and Abstraction

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
B1	Bacterial or protozoal contamination in catchment	Contaminated source water – humans, livestock, septic tanks, agricultural activities, surface runoff, etc.	Supply is from deep bore. It is confirmed to be a secure source under Section 4.5 of DWSNZ, therefore contamination is unlikely.	Yes				
B2	Chemical contamination of source – general	Contaminated source water – agrichemicals, surface runoff, etc.	As per above	Yes				

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
B3	Chemical contamination of source water – nitrates	Changing nitrate levels in the groundwater	Regular monitoring of nitrate-nitrogen at the plant and in the distribution zone. Depth of groundwater means that changes are slow and can be planned for.	Yes				
B4	Contamination of source water	Contaminant entry via well head e.g. vandalism, unauthorised entry, flooding	Secure well head (DWSNZ 4.5.1.2) within locked chamber.	Yes				

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
B5	Contamination of source water	Catastrophic failure, e.g. seismic activity disrupting the aquifer confinement or wellhead protection	Inspection of facilities following a significant earthquake. Annual water chemistry profiles to determine that the water quality is relatively unchanged over time. Monthly monitoring of nitrate-nitrogen both in abstracted water and in distribution zone. Monthly E. coli sampling of source water.	Partial	Unusual	Major	High	Develop Emergency Response Plan and implement if water supply cannot be maintained.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
B6	Insufficient water available	Drought, ground water levels drop	New bores must be approved by Ecan; therefore effects on groundwater would be assessed before allowing new supplies. Bore level is monitored on telemetry so any changes would be evident. There is no history of water availability issues at this bore.	Yes				
B7	Insufficient water available	Power supply interruption	Generator provides a permanent source of backup power should power failure occur. Power failure and generator run monitored on telemetry.	Yes				

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
B8	Insufficient water available	Damage to intake structures – vandalism	Wellhead is secured in a locked underground chamber and is not situated in a location prone to vandalism.	Yes				
B9	Insufficient water available	Bore pump failure	There are two reservoirs that have a combined storage of over half an average day's water demand. Bore pump failure is monitored on telemetry.	Yes				
B10	Insufficient water available	Catastrophic failure, e.g. seismic activity damaging equipment	Wellhead and associated equipment inspected following a significant earthquake. Pump status monitored and alarmed through the telemetry system.	Partial	Unusual	Major	High	Develop Emergency Response Plan and implement if water supply cannot be maintained.

10.2 Risk Assessment Worksheet – Treatment

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
T1	Inadequate disinfection (not enough free available chlorine)	Dosing pump malfunction, control system malfunction, or power supply interruption.	The bore is confirmed to be a secure source under Section 4.5 of DWSNZ, therefore disinfection is not required as a primary means of treatment. The chlorination process is aimed at disinfection in the reticulation network. Routine checks and inspections. Standby power generation. Power failure SCADA alarm. FAC monitored on telemetry. Low FAC alarm on SCADA. E. coli monitoring.	Yes				

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
T2	Inadequate disinfection (not enough free available chlorine)	Incorrect dose rate or solution strength too low or run out of chlorine solution.	As per T1, item 1. E. coli monitoring. Low FAC alarm on SCADA. Low sodium hypochlorite tank level alarm on SCADA. FAC monitored on telemetry. Sodium hypochlorite level in tank monitored on telemetry. Sodium hypochlorite solution is diluted to reduce rate of decay while in storage. Instructions for refilling the chlorine solution are on site.	Yes				

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
T3	Inadequate disinfection (not enough free available chlorine)	Short-circuiting through reservoir reducing contact time	As per T1, item 1. High level inlets, low level outlets to each tank promote circulation. E. coli monitoring. Low FAC alarm on SCADA. FAC monitored on telemetry.	Yes				

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
T4	Over-chlorination (too much free available chlorine)	Dosing pump or control system malfunction.	High FAC alarm on SCADA. FAC monitored on telemetry. The dosing pump only switches on when the bore pump is running. Chlorine dosing uses 1% solution and is flow paced.	Yes				

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
T5	Over-chlorination (too much free available chlorine)	Incorrect dose rate or solution strength too high	High FAC alarm on SCADA. FAC monitored on telemetry. Chlorine dosing is flow paced and uses 1% solution. Instructions for refilling the chlorine solution are on site.	Yes				
T6	Failure to remove chemical contaminants from raw water	Treatment system inadequate	No known chemical contaminants in source water (i.e. no P2 determinands in source water).	Yes				

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
T7	Inadequate protozoa removal/inactivation	Treatment system inadequate	The supply bore is confirmed to be a secure source under Section 4.5 of DWSNZ, therefore treatment is not required.	Yes				
T8	Insufficient water available	Inadequate treatment plant capacity	Capacity adequate for existing peak day and peak instantaneous flow rate.	Yes				

10.3 Risk Assessment Worksheet – Storage and Distribution

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
S1	Stored water quality deterioration	Inadequate reservoir turnover	High level inlets, low level outlets. Less than one day's storage in reservoirs.	Yes				
S2	Introduction of contaminants into the distribution system	Contamination via storage reservoirs – bird/vermin entry, roof runoff, unauthorised access	Reservoirs are covered and locked. Access ladders are locked in a vertically retracted position. Reservoirs are in a locked fence compound. Vents are screened for bird/vermin protection. Chlorine residual maintained in system.	Yes				

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
S3	Introduction of contaminants into the distribution system	Backflow from customer connections	Chlorine residual maintained in system. All new and replaced service connections contain a double check valve.	Partial	Unlikely	Medium	High	Adopt and implement backflow prevention policy for customer connections.
S4	Introduction of contaminants into the distribution system	Operation and maintenance activities	Operators follow documented hygiene procedures to minimise risk. Chlorine residual maintained in system.	Yes				
S5	Introduction of contaminants into the distribution system	Pipe materials, age and condition, plumbosolvency	Customers are notified of plumbosolvency twice per year as required by DWSNZ. Activity Management Plans and associated asset renewal programmes in place.	Partial	Unlikely	Medium	High	Review and maintain activity management plans and associated asset renewal programmes to minimise breakages and potential for contamination.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
S6	Insufficient water	Reservoir failure	There are two reservoirs, each of which can be isolated. Reservoir levels are monitored on telemetry. Reservoir low level alarms on SCADA. Reservoirs are relatively new and are inspected regularly.	Yes				
S7	Insufficient water	Vandalism of reservoirs	Reservoirs are not situated in a location prone to vandalism. Reservoir levels are monitored on telemetry. Reservoir low level alarms on SCADA.	Yes				

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
S8	Insufficient water	Water main failure	Activity Management Plans and associated asset renewal programmes in place.	Partial	Unusual	Medium	Medium	Review and maintain activity management plans and associated asset renewal programmes to minimise breakages and potential loss of supply. Undertake criticality analysis of the network to assist renewals planning.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
S9	Insufficient water	Pump or power failure	The generator provides backup power. Power failure alarms on SCADA. Booster pump failure alarms. Booster pump flow and on/off monitored on SCADA. System can provide peak demand flow with 3 of the 4 booster pumps.	Yes				
S10	Insufficient water available	Catastrophic failure, e.g. seismic activity damaging equipment	Wellhead and associated equipment inspected following a significant earthquake. Pump status monitored and alarmed through the telemetry system.	Partial	Unusual	Major	High	Develop Emergency Response Plan and implement if water supply cannot be maintained.

10.4 Risk Assessment Worksheet – Other

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
O1	Incorrect water quality data used for supply management (failure to identify inadequate water quality)	Inappropriate/inadequate/ incorrect sampling and reporting	Council have a sampling calendar for sampling compliance. Staff are trained to take samples and alternate personnel are available to cover for absences. Results are reported through WINZ system to Drinking Water Assessor. Sampling locations are clearly labelled.	Yes				

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
O2	System does not perform as intended	Incorrect operation, inadequate maintenance	Operators have sound knowledge of systems. There is an Operation and Maintenance manual. Key operation instructions are displayed permanently on site. An operations log is kept on site. Plant records are copied and filed.	Partial	Unusual	Medium	Medium	Implement and use Asset Management System (AMS) for programming and monitoring regular maintenance and inspection/monitoring tasks. Ensure all plant records – including manuals, drawings, procedure instructions and emergency response plan are up to date and available at the plant.
O3	System does not perform as intended	Inadequate skills or training	Staff are qualified and experienced.	Partial	Unusual	Medium	Medium	Council to place a requirement on the service provider to provide staff with relevant training and skills.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
O4	System damaged or contaminated by construction/ maintenance work	Inadequate controls on construction and maintenance work	All maintenance is undertaken by contractor's trained/authorised staff. Construction work is appropriately supervised. ADC approval is required for third parties to work in the road corridor.	Partial	Unlikely	Moderate	Moderate	Ensure accurate as-constructed records are maintained and made readily available to all parties working on or in vicinity of system.
O5	Inability to access site(s) for operation/ maintenance/ emergency works	Flood, slip, bridge washout, snow fall or other hazard preventing vehicular access	Access roads are in good condition and are not generally vulnerable to natural hazards. Operations staff are equipped with 4WD vehicles.	Yes				

11 Improvement Schedule

The following Improvement Schedule has been derived from the Risk Tables presented in Section 10 and is prioritised according to the assessed level of public health risk associated with hazards that are not adequately controlled at present.

The Improvement Schedule is presented in two sections:

Part I: Major Projects and Capital Works

These projects will generally provide the greatest benefits in terms of addressing public health risks but typically require high levels of funding that may not be realistic for the community involved. It is noted that Council operate a targeted rating system such that capital costs associated with each water supply are borne by those ratepayers with connections to the supply. Implementation of these improvements will be subject to consultation through the Long Term Plan. Where funding is not allocated it may not be possible to implement these works as proposed in the improvement schedule.

Part II: Management and Operational Improvements

These improvements will generally not provide the same degree of risk reduction as the proposed capital works upgrades but collectively they contribute to providing and maintaining effective barriers to contamination and can often be undertaken within existing operational budgets. These works are prioritised on the basis of the risk level identified and budget/resource availability.

Prioritisation

The priority for implementation is initially based on the identified risk level as follows:

Extreme risk = Priority 1
High risk = Priority 2
Medium risk = Priority 3
Low risk = Priority 4

Priorities have then been modified (generally elevated) where improvement items are related or need to be sequenced together.

Responsibility

Responsibility for implementation of specific improvement items have been identified.

AM = Assets Manager ACL = Ashburton Contracting Ltd CL = Council

Cost Estimates

Cost estimates presented in the improvement schedule are intended to provide an indication of the typical cost associated with the item. In particular, the capital works improvements cost estimates presented here are initial estimates and additional work is required to adequately scope and cost these works. In some instances there is no direct cost other than Council staff time.

Timeframes

The proposed timeframe for implementation reflects the assessed priority, anticipated funding arrangements and availability of resources. Some lower priority, low cost improvements may be completed at an earlier date where staff resources are available.

11.1 Improvement Schedule - Part I

Rakaia Water Supply Improvement Schedule			Part I: Major Projects and Capital Works			
Priority	**Water Supply Area**	**Reference to Risk Table**	**Details of Proposed Works**	**Person Responsible**	**Expected Cost**	**Intended date of Completion**
No major projects or capital works are anticipated at this stage.						

11.2 Improvement Schedule - Part II

Rakaia Water Supply Improvement Schedule				Part II: Minor Projects and Operational Improvements			
Priority	**Risk Level**	**Water Supply Area**	**Reference to Risk Table**	**Details of Proposed Works**	**Person Responsible**	**Expected Cost**	**Intended date of Completion**
3	High	Source and Distribution	B5, B10, S10	Develop Emergency Response Plan and implement if water supply cannot be maintained.	AM	$5,000 + staff time	1/7/18
3	High	Distribution	S3	Adopt and implement backflow prevention policy for customer connections.	AM	$15,000 + staff time	1/7/16
3	High	Distribution	S5, S8	Review and maintain Activity Management Plans and associated asset renewal programmes to minimise failures, potential loss of supply and contamination.	AM	Staff time	1/7/16
4	Medium	Distribution	S8	Undertake a criticality analysis of the network to assist renewals planning.	AM	Staff time	1/7/18
4	Medium	Other	O2	Implement and use Asset Management System (AMS) for programming and monitoring regular maintenance and inspection/monitoring tasks.	AM	$$ not yet specified + staff time ongoing	1/7/18
4	Medium	Other	O2, O4	Ensure all plant records – including manuals, drawings, procedure instructions and emergency response plan are up to date and available at the plant.	ACL	Staff time	1/7/15
4	Medium	Other	O3	Council to place a requirement on the service provider to provide staff with relevant training and skills.	CL	Staff time	1/7/15

12 Contingency Plan

The following contingency plan outlines appropriate responses to a range of potential situations where risk control measures fail to prevent a hazard event that may result in a situation of acute risk to public health.

The occurrence of a hazard, or risk event, may be indicated by monitoring systems, observed by ADC or ACL staff or reported by the public. Consumer complaints of illness or water quality issues may also indicate that a risk event has occurred.

The contingency actions identified are intended to provide a general guide and may need to be adapted to suit specific hazard situations.

12.1 Severe Microbiological Contamination of Source Water

Indicators	A contamination event in the catchment may be observed by or reported to ADC staff Reported illness among consumers Positive E. coli monitoring results
Actions	Issue "Boil Water' notice Advise Drinking Water Assessor (DWA) Inspect catchment and intake to identify source of contamination and rectify problem as quickly as possible Consider provision of emergency treatment or alternative water supply (e.g. reinstate decommissioned bore or use tankers) Disinfect contaminated reservoirs and flush mains Keep customers informed and advise once regular service is restored
Responsibility	Assets Manager

12.2 Chemical Contamination of Source Water

Indicators	A contamination event in the catchment may be observed by or reported to ADC staff Reported water quality concerns from consumers (taste, odour, colour) Illness among consumers
Actions	Advise Drinking Water Assessor (DWA) Assess situation and advise customers regarding use/treatment/disposal of contaminated water Arrange emergency water supply if necessary Inspect catchment and intake to identify source of contamination and rectify problem as quickly as possible Flush contaminated reservoirs and mains Keep customers informed and advise once regular service is restored
Responsibility	Assets Manager

12.3 Insufficient Source Water Available

Indicators	Observed or reported low ground water levels
Actions	Advise customers to conserve water Implement demand management strategies as required Arrange emergency water supply if necessary Keep customers informed and advise once regular service is restored
Responsibility	Assets Manager

12.4 Insufficient Water Available due to Leakage

Indicators	Observed or reported reduction in pressure or water availability
Actions	Advise customers to conserve water Implement demand management strategies as required Arrange emergency water supply if necessary Investigate system leakages Keep customers informed and advise once regular service is restored
Responsibility	Assets Manager

12.5 E. coli Transgression in Water Leaving Treatment Plant

Indicators	E. coli transgression reported following routine monitoring
Actions	Follow transgression response procedure in DWSNZ Advise Drinking Water Assessor (DWA) Commence daily E. coli testing at Water Treatment Plant Use an enumeration test method Sample 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, consider alternative supply
Responsibility	Assets Manager

12.6 Over-Chlorination

Indicators	Monitoring shows high FAC
Actions	Assess potential hazard to consumers and advise accordingly Inspect treatment plant to identify cause of problem and rectify as quickly as possible Flush system if necessary Keep customers informed and advise once regular service is restored
Responsibility	Assets Manager

12.7 Inadequate Disinfection

Indicators	Monitoring shows low or no FAC
Actions	Identify cause of contamination and rectify problem as quickly as possible Assess the situation and consider issuing a precautionary boil water notice if deemed appropriate Notify DWA of situation and actions taken Consider provision of emergency treatment equipment or alternative water supply (e.g. tankers) Disinfect contaminated reservoirs and flush mains Keep customers informed and advise once regular service is restored
Responsibility	Assets Manager

12.8 E. coli Transgression in Water in the Distribution Zone

Indicators	E. coli transgression reported following routine monitoring
Actions	Follow transgression response procedure in DWSNZ (Figure 4.2 in 2008 version), and ADC response procedures Advise Drinking Water Assessor (DWA) Inspect plant/source Collect sample at plant for E. coli test Resample distribution at original and adjacent sites Enumerate E. coli Investigate cause Take remedial action If E. coli < 10 per 100mL consult DWA, resample distribution zone and enumerate for E. coli for three days, continue investigation of fault If E. coli > 10 per 100mL consult DWA, consider 'Boil Water' notice, continue investigation of cause, begin disinfection, consider flushing contaminated water to waste, intensify action, consider providing alternative supply Continue until fault is corrected and E. coli is absent for three consecutive days and DWA is satisfied that there is no remaining contamination
Responsibility	Assets Manager

12.9 Chemical Contamination of Water in Distribution Zone

Indicators:	Chemical contaminant in distribution zone (including over-chlorination)
Actions:	Advise Drinking Water Assessor (DWA) Assess situation and advise customers regarding use/treatment/disposal of contaminated water Arrange emergency water supply (tankers) if necessary Inspect catchment and intake to identify source of contamination and rectify problem as quickly as possible Flush contaminated reservoirs and mains If necessary Keep customers informed and advise once regular service is restored
Responsibility:	Assets Manager

12.10 Insufficient Water Available in the Distribution Zone

Indicators	Low pressure and flow in the distribution
Actions	Advise customers to conserve water Implement demand management strategies as required Arrange emergency water supply if necessary Keep customers informed and advise once regular service is restored
Responsibility	Assets Manager

12.11 Insufficient Water Available due to Unplanned Shutdown

Indicators	Unplanned shutdown will be reported to ADC staff by contractor
Actions	Keep customers informed and advise once regular service is restored Arrange emergency water supply if necessary
Responsibility	ACL and Assets Manager

13 Critical Control Points

13.1 Chlorine Disinfection - Plant

Process objectives:

- Provide **residual disinfection Quality Control Point** to help inactivate pathogens entering downstream of the dosing point

Operational monitoring of control process:	
What	Free available chlorine (FAC) concentration in mg/L
When	Continuous
Where	An analyser is installed at the treatment plant
How	Online chlorine analyser
Who	ACL Operator (monitoring)
Records	SCADA historian

Process performance criteria at the operational monitoring point:		**Correction if operating criteria are not met:**
Target Range:	FAC: 0.4-0.6 mg/L	Operator to adjust dosing system to achieve target range if noticed to be outside of target range during routine checking procedures.
Action Limits:	FAC: < 0.3 mg/L (upon inspection or SCADA) > 0.8 mg/L (upon inspection or SCADA)	Duty Operator to respond by adjusting dosing to within target limits[1]. Duty Operator to notify Duty Supervisor.
Critical Limits:	FAC: < 0.25 mg/L (upon inspection or SCADA) > 1.0 mg/L (upon inspection or SCADA)	Duty Operator to respond by adjusting dosing to within target limits[1]. Duty Operator to notify Duty Supervisor. Duty Supervisor to contact ADC Compliance Officer. Contingency plan 12.6 (over-chlorination) or contingency plan 12.7 (inadequate disinfection) is to be followed.

Notes:

1. In the longer term this will be moved to automatic dose control with the analyser controlling the set point and the dosing point output to maintain a constant residual.

Supporting programs:

- Monthly monitoring (or manufacturer timescales) instrument checking and calibration by Operator as necessary.
- Monthly Operator check of accuracy of reagents and discarding of outdated reagents.
- Training and competency of Operator in chlorination of drinking water.
- Only utilise potable water grade chlorine stock solution from approved supplier.

13.2 Chlorine Disinfection - Reticulation

Process objectives:

- Provide **residual disinfection Quality Control Point** to help inactivate pathogens entering downstream of the dosing point

Operational monitoring of control process:	
What	Free available chlorine (FAC) concentration in mg/L
When	ADC: weekly ACL: twice weekly
Where	ADC staff: Rakaia has three zone sample taps, located on Martins Road, Rakaia Barrhill Methven Road, and Michael Street East. ACL operators: Sampling bollards as above
How	Hand-held pocket colorimeter with vendor-supplied reagents
Who	ADC Environmental Monitoring Officer and ACL Operator
Records	ACL: Plant log-book

Process performance criteria at the operational monitoring point:		**Correction if operating criteria are not met:**
Target Range:	FAC: 0.4-0.6 mg/L	Operator to adjust dosing system to achieve target range if noticed to be outside of target range during routine checking procedures.
Action Limits:	FAC: < 0.3 mg/L (upon inspection or SCADA) > 0.8 mg/L (upon inspection or SCADA)	Duty Operator to respond by adjusting dosing to within target limits[1]. Duty Operator to notify Duty Supervisor.
Critical Limits:	FAC: < 0.25 mg/L (upon inspection or SCADA) > 1.0 mg/L (upon inspection or SCADA)	Duty Operator to respond by adjusting dosing to within target limits[1]. Duty Operator to notify Duty Supervisor. Duty Supervisor to contact ADC Compliance Officer. Contingency plan 12.6 (over-chlorination) or contingency plan 12.7 (inadequate disinfection) is to be followed.

Notes:

1. In the longer term this will be moved to automatic dose control with the analyser controlling the set point and the dosing point output to maintain a constant residual.

Supporting programs:

- Monthly monitoring (or manufacturer timescales) instrument checking and calibration by Operator as necessary.
- Monthly Operator check of accuracy of reagents and discarding of outdated reagents.
- Training and competency of Operator in chlorination of drinking water.
- Only utilise potable water grade chlorine stock solution from approved supplier.