Wanaka Water Supply
Water Safety Plan

Final

November 2015

QUEENSTOWN LAKES DISTRICT COUNCIL

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DOCUMENT CONTROL SHEET

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Glossary

Term	Definition
Catchment	The surrounding area from which the raw water is obtained for a drinking water supply.
Contamination	A substance or organism in the water that can cause potential public health risks or undesirable aesthetic effects. Refer to Section 69G of the Health (Drinking Water) Amendment Act 2007.
DWA	Drinking Water Assessor: designated Ministry of Health representatives who are trained to assess Ministry of Health registered drinking water supplies and comment on and assist with the compilation of Water Safety Plans (formally PHRMP), among other duties. Refer to Section 69G, 69ZK and 69ZL of the Health (Drinking Water) Amendment Act 2007.
DWAP Facilitator	Drinking Water Assistance Programme (DWAP) Facilitator. This is a member of the Drinking Water Assessment Unit (DWAU) in a Public Health Unit (PHU). The DWAP Facilitator provides technical assistance to any water supplier serving fewer than 5000 people.
DWSNZ	Drinking Water Standards New Zealand 2005 (Revised 2008). This document is published by the Ministry of Health. It stipulates the required quality and safety of drinking water.
E. coli	*E. coli* (which is an abbreviation for *Escherichia coli*) is a bacterium that is used to indicate the level of harmful bacteria present in potable water. *E. coli* live in the lower intestinal tract of animals (including humans). *E. coli* is used as the indicator for possible contamination of drinking water.
HDWAA	Health (Drinking Water) Amendment Act 2007. This is the principal legislation governing drinking water quality.
PHRMP	Public Health Risk Management Plan. These plans are used to identify the public health risks associated with a water supply, and to develop contingency, corrective and improvement plans to mitigate the risks. PHRMP had since been changed to Water Safety Plan (WSP) in line with international nomenclature.
WINZ	Water Information New Zealand. Ministry of Health national database of registered drinking water supplies. The database facilitates water sample scheduling, sample results, evaluating standards compliance, and completing the Annual Review.
WSP	Water Safety Plan. The World Health Organisation (WHO) recommended plans to manage drinking-water quality from catchment to consumer. New terminology to describe the former PHRMP.

Abbreviations

AC	Asbestos Cement
BFPD	Back Flow Prevention Device
DWA	Drinking Water Assessor
DWSNZ	Drinking Water Standards New Zealand 2005 (Revised 2008)
EHO	Environmental Health Officer
FAC	Free Available Chlorine
HDWAA	Health (Drinking Water) Amendment Act 2007
HPO	Health Protection Officer
IANZ	International Accreditation New Zealand
ISO	International Standards Organisation
KPIs	Key Performance Indicators
MAV	Maximum Acceptable Value
MDPE	Medium Density Polyethylene
MoH	New Zealand Ministry of Health
ORC	Otago Regional Council
PE	Polyethylene
PHRMP	Public Health Risk Management Plan
PRV	Pressure Reducing Valve
PVC	Polyvinyl Chloride
QLDC	Queenstown Lakes District Council
SCADA	Supervisory Control and Data Acquisition
UPS	Uninterrupted Power Supply
uPVC	Unplasticised Polyvinyl Chloride
UV	Ultra Violet
VHF	Very High Frequency
VW	Veolia Water
Watercare	Watercare Services Limited
WPS	Water Pumpstation
WSP	Water Safety Plan
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

1 Introduction

1.1 Water Safety Plans

Historically, management of water supplies in New Zealand relied heavily on monitoring the quality of the water that was produced and supplied to the customers and then comparing the results against the Drinking Water Standards for New Zealand (DWSNZ) for compliance. Whilst monitoring will still play an important part in public health management, Water Safety Plans (formally Public Health Risk Management Plans (PHRMPs)) are being introduced to reduce the likelihood and consequence of:

- Contaminants entering the supply in the first place; or
- Contaminants being reintroduced; or
- Contaminants escaping the barriers designed to reduce them.

This Water Safety Plan (WSP) sets out the plan by which Queenstown Lakes District Council (QLDC) intends to meet the requirements of the Health (Drinking Water) Amendment Act 2007 (HDWAA) for the Wanaka Water Supply. This includes taking "all practicable steps" towards compliance with DWSNZ 2005 (Revised 2008), by I July 2012. Planning for risk, in all forms, is regarded as an outcome of good asset management.

The Wanaka Water Supply is registered with the Ministry of Health (MoH) with the Water Information New Zealand (WINZ) Community Code of WAN002.

A Wanaka PHRMP was developed and approved by Public Health South (PHS) in 2010. The 2010 PHRMP was based on a compliance date of July 2010 under the dates originally enacted in 2007. This forms part of the required 5-yearly review of the WSP.

Table 1 Health Act Compliance Dates (Revised 2008)

Type of supplier	Population range	Compliance dates as originally enacted	New compliance dates as announced by the Government in 2009
Large Drinking-Water Suppliers	10,001 or more	1 July 2009	1 July 2012
Medium Drinking-Water Suppliers	5,001 – 10,000	1 July 2010	1 July 2013
Minor Drinking-Water Suppliers	501 - 5,000	1 July 2011	1 July 2014
Small Drinking-Water Suppliers	101 - 500	1 July 2012	1 July 2015
Neighbourhood Drinking-Water Suppliers	25 - 100	1 July 2013	1 July 2016
Rural Agricultural Drinking-Water Suppliers	-	1 July 2013	1 July 2016

This document is to be read in conjunction with the 3-Waters Asset Management Plan (AMP) and the following Operations & Maintenance Manuals; Beacon Point Intake Water Pump Station, Heaton Park Booster Pump Station, Hidden Hills Water Booster Pump Station, Western Intake

Water Pump Station, Western Reservoir & Water Treatment Plant and Beacon Point Intake Water Pump Station–PLC Upgrade Control Philosophy. These can be viewed at the QLDC office.

1.2 The Development Process

This WSP has been developed using the framework provided by the MoH, 2005.

A workshop was held on 8 September 2015 with key QLDC staff and network operators, to carry out a risk assessment of the Wanaka Water Supply.

Those were:

QLDC staff

- Ulrich Glasner, Chief Engineer
- Rob Darby, Senior Project Manager
- Melanie Heather, Environmental Consents Officer

Veolia staff

- Jason Thorburn, Supervisor Wanaka
- Jekabs Rozitis, Contract Manager

The workshop enabled a detailed assessment of current risks, preventative measures and corrective actions compared to those recommended in the MoH (2005) Small Drinking-water Supplies: Preparing a Public Health Risk Management Plan.

1.3 Legal Obligations

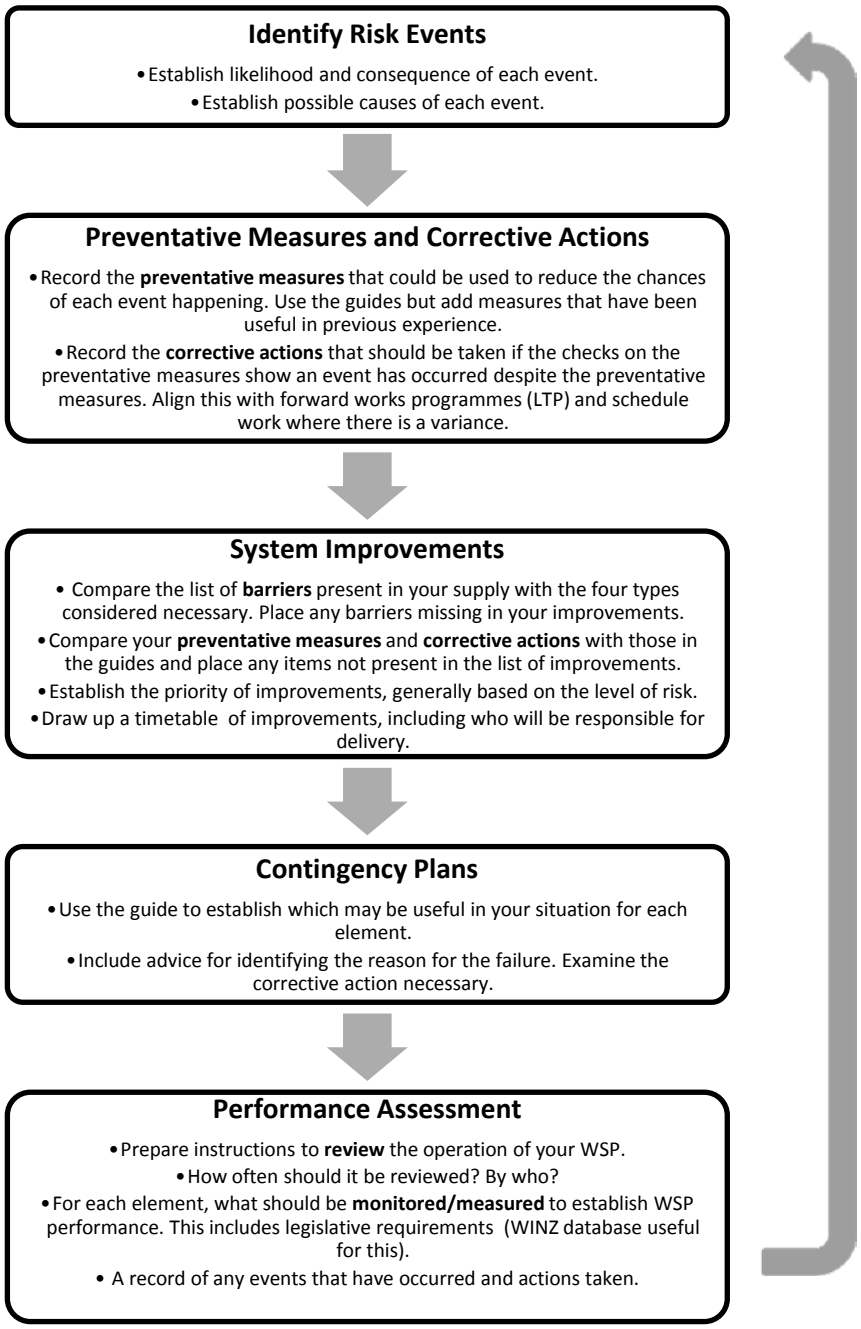
The HDWAA requires all drinking-water suppliers providing drinking-water to over 500 people to develop and implement a PHRMP, now WSP. Specifically, the purpose of this part of the Act is to protect the health and safety of people and communities by promoting adequate supplies of safe and wholesome drinking-water from all drinking-water supplies.

The Health Act gives effect to the Drinking Water Standards New Zealand (DWSNZ) through a duty to take all practicable steps towards compliance with the Standards.

The three main themes of the DWSNZ are:

1. The Maximum Acceptable Values (MAV's) for microbial, chemical and radiological determinands.
2. The compliance criteria and reporting requirements.
3. Remedial actions when a transgression occurs.

Figure 1 WSP Development Process (MoH Guidelines (2005))



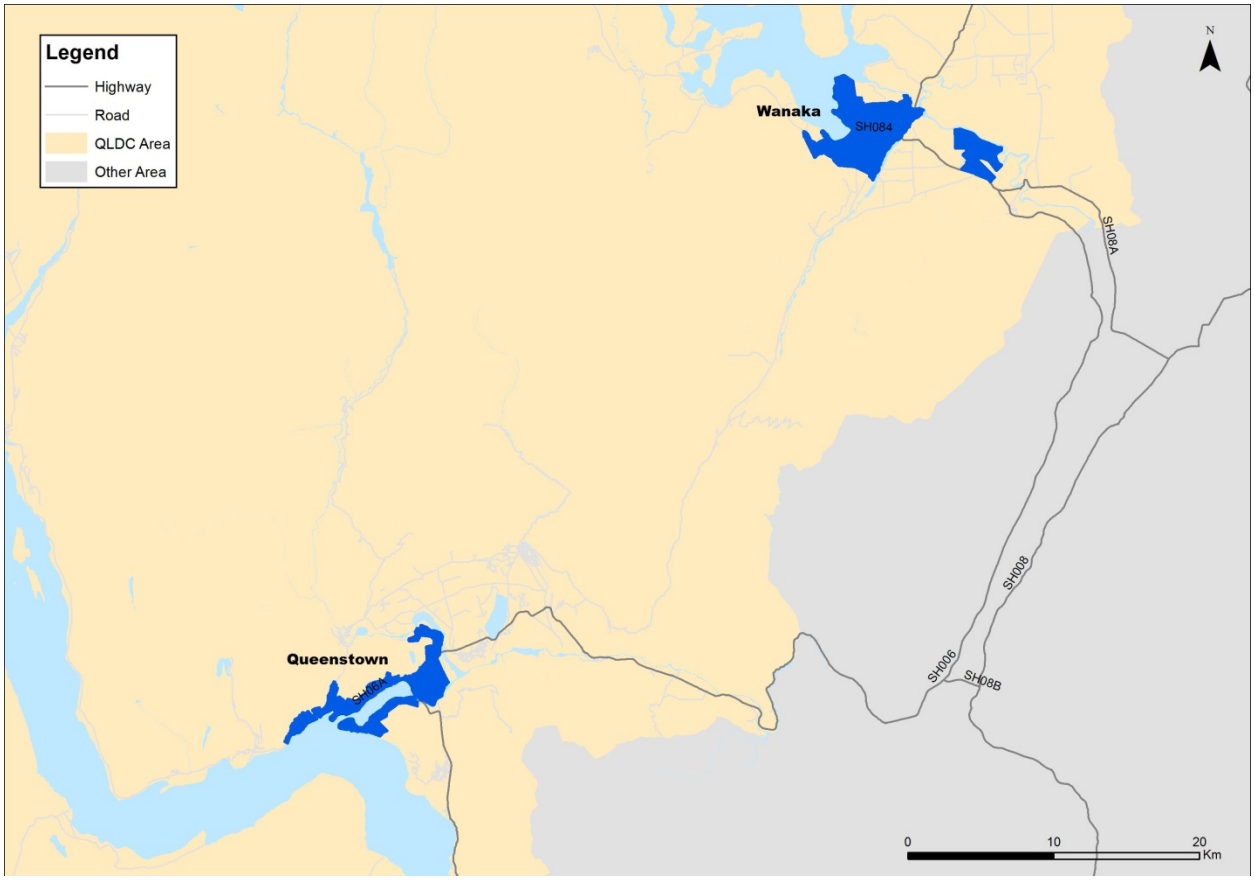
2 Description of Water Supply

2.1 Overview

Wanaka is a popular holiday destination located on the Southern end of Lake Wanaka. Wanaka has a usually resident population of approximately 10,929[1]. The lake is located in Otago at an altitude of 300m. It is New Zealand's fourth largest lake.

The lake covers an area of 192 km² and roughly lies along a north-south axis. Lake Hawea lies in a parallel glacial valley eight kilometres to the east. The water supply for Wanaka is taken directly from the lake.

Figure 2 Location Wanaka Water Supply

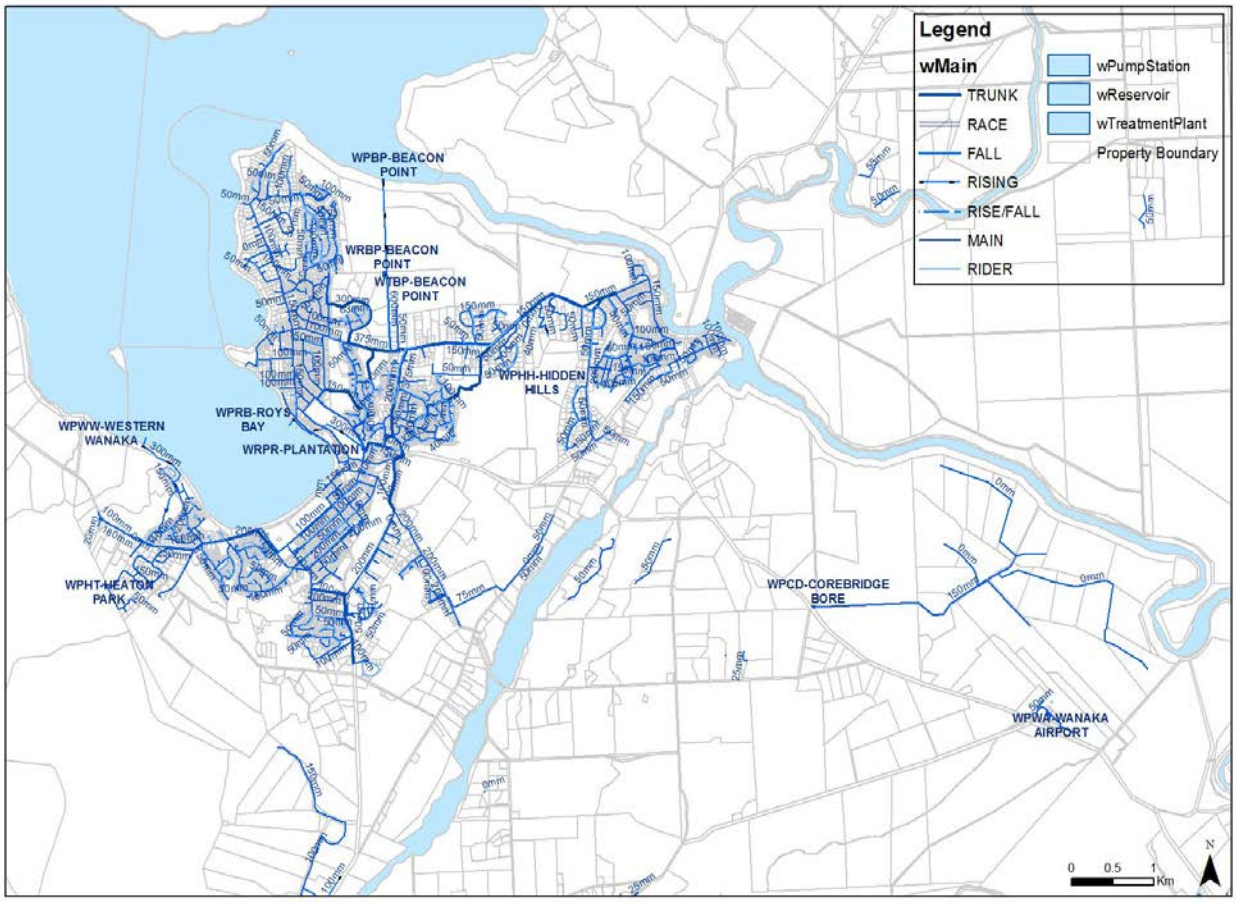


The Wanaka scheme initial commission date is unknown. The water used to be sourced from a spring / bore at the top of Dungarvan Street. This is now used to irrigate the golf course. The supply source was then moved to Roys Bay, Western and Beacon Pt with the following respective commissioning dates; 1985, 1997 and 2003. Raw water is abstracted from two intakes on Lake Wanaka at a maximum allowable take of 40,176 m³/day. Water is pumped to three town supply reservoirs (total storage volume is 6,090m³) from where it is gravity fed to the Wanaka and Albert Town townships below. The water is treated prior to the Western and Beacon Point reservoirs. The original chlorine dosing plant at the Plantation reservoir has been removed post decommissioning of the Roys Bay Intake in 2012.

The community consumes approximately 2,957,280 m³/year[2]. There are 6,207 residential connections in Wanaka and Albert Town[3].

[1] 2013 QLDC Growth Projections 2013 – 2065, Rationale.

Figure 3 Overview Map of Wanaka Water Supply



2.2 Catchment

Wanaka township is located at the southern end of Lake Wanaka. The lake covers an area of 192km² and was formed during the last glaciation. The catchment draining into Lake Wanaka comprises a total area of 2628km².

The Matukituki and Makarora Rivers feed Lake Wanaka from the west and north respectively, while the Clutha River is the sole outlet draining to the south. Numerous small islands (notably Rabbit Island and Harwich Island) are found at the southern end of the lake.

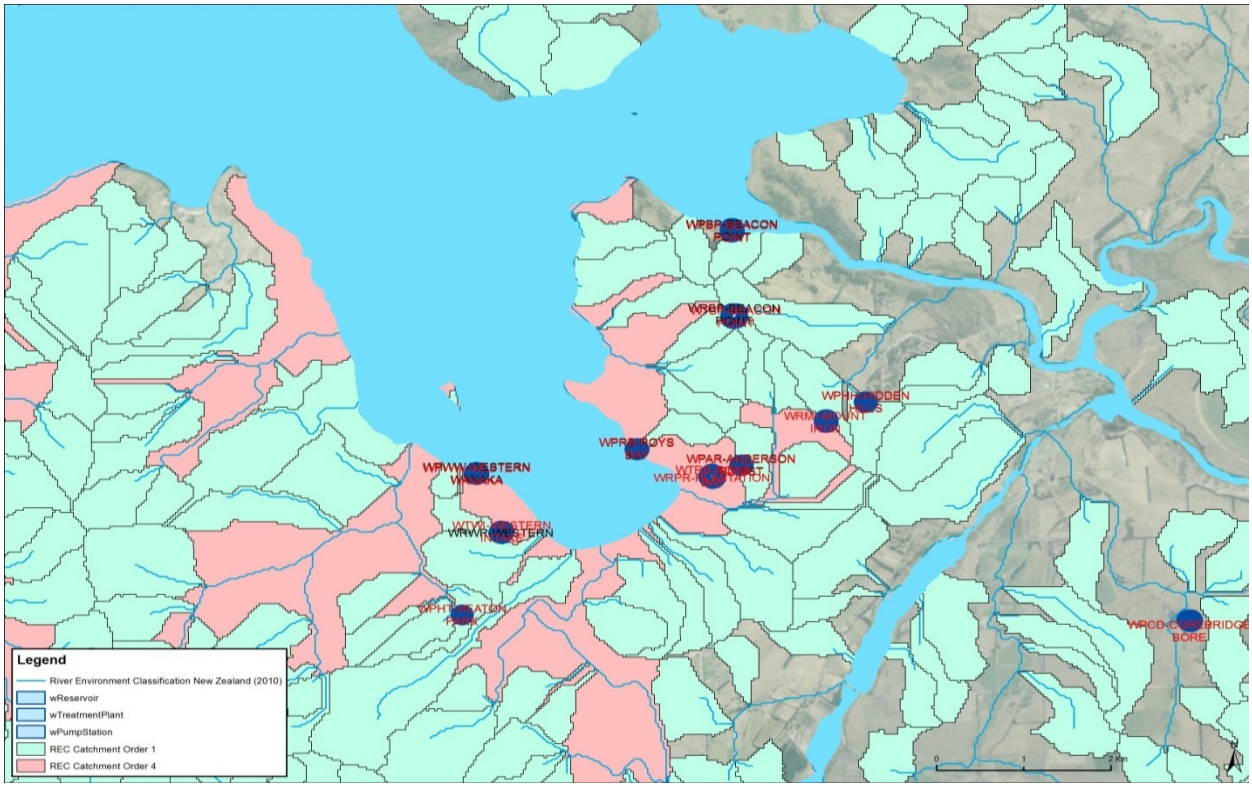
Annual rainfall is 682mm which is half the national average. The predominant wind direction is from the west to north-west and tends to be between 1-20km/hr. Stronger winds (over 21-40km/hr) tend to come from the north-west.

Wanaka's water supply is sourced from Lake Wanaka. Water is abstracted from two intakes; Western Intake and Beacon Point Intake.

[2] SCADA database, August 2015.

[3] Rates database, August 2015.

Figure 4 Catchment



2.2.1 Beacon Point Intake

The Beacon Point Intake, otherwise known as the Outlet Intake, is located at the entrance to the Clutha River. The intake pipe extends 115m into Lake Wanaka to an unknown depth. Water is gravity fed to a wet well and pumpstation on the shore.

Physical Characteristics

The terrain above Beacon Point intake is relatively steep ranging in elevation from about 280m to 403m above sea level. The catchment above the intake is relatively narrow and predominately covered in Manuka, Grey Shrub and low producing grassland. The majority of the peninsula upstream of the intake is covered in high producing grasslands.

Otago (Haast) Schist forms the basement unit of the region. A thin veneer of soils overlie the bedrock.

Land Use

The catchment above the intake area is zoned Rural General under the QLDC Partially Operative District Plan. The adjacent catchment to the north (upstream) is zoned Low Density Residential.

The Clutha Outlet Recreation Reserve is a narrow strip of land situated between the lake and pumpstation at the base of the catchment. The Reserve contains a popular walkway, the Outlet Track, which is frequently used by walkers, runners and mountain bikers. There is a campsite located downstream of the intake structure.

Services

The Outlet Campground located downstream of the intake structure connected to the Council wastewater reticulation in 2012. This included the addition of a pumpstation (Hansen ID: SPOR-Outlet Road).

Stormwater runoff from the catchment above is direct toward the intake and has the potential to carry high sediment loads. Because the intake is located in excess of 100m off shore, it is unlikely that stormwater runoff will affect the water quality of the intake waters.

2.2.2 Western Intake

The Western Intake is located on the western shore of Lake Wanaka adjacent to Rippon Vineyard. The intake structure is 108m long and extends out into Roys Bay in Lake Wanaka to a depth of 4m below the minimum lake level. Water is gravity fed to a wet well and pumpstation on the shore.

Physical Characteristics
The terrain above the intake gently slopes to the north east and is predominantly covered in grape vines to 340m above sea level. Above this elevation, terrain rises steeply to 1630m above sea level. Low producing grassland and fernland cover the low altitude slopes with subalpine shrubland dominating higher altitudes.

Land Use
Access to the area within the vicinity of the intake is relatively limited as the land directly behind the intake facilities is privately owned and operated as a vineyard. The vineyard extends from the pump house to the Wanaka-Mt Aspiring Road. The Waterfall Creek Recreation Reserve is a narrow strip of land situated between the lake and vineyard. The Reserve contains a popular walkway which is frequently used by walkers, runners and mountain bikers.

Boating is a common activity on Lake Wanaka, particularly in the summer months. Most boats are moored at the Wanaka Marina on the eastern side of Roys Bay. No jetties have been identified within 500m of the intake structure.

The land above the Wanaka-Mt Aspiring Road is zoned Rural Lifestyle under the QLDC Partially Operative District Plan. This zone provides for limited farming activities. The predominant land use at elevations above 400m is extensive rural farming.

Services
Wanaka's sewer pipes are located approximately 90m from the edge of Lake Wanaka. They run sub-parallel to the lake shore. The sewer pipes drain domestic wastewater from Wanaka to a treatment facility located by Wanaka Airport.

One discharge consent is located within a 1km radius of the intake structure. The consent allows Rippon Vineyard to dispose of its winery wastewater to land approximately 400m above the lake edge.

Stormwater from the catchment above the intake is primarily disposed of by soakage to ground. Stormwater runoff is likely from the vineyard to the lake. Stormwater is primarily reticulated from the low density residential zone to the south of the intake and discharged directly into the lake, the nearest outlet being 190m from the intake.

2.3 Process Description

2.3.1 Source

Raw water is abstracted from Lake Wanaka via two surface intakes (Western and Beacon Point). Each intake has a wet well and pumpstation on the shore near the intake. The risks to the raw lake water have been covered on the Catchment Risk Assessment (Appendix 8.2).

The lake water is generally of very good quality chemically and microbiologically. Determinants such as pH and alkalinity are stable and acceptable and physical determinants such as colour, organic and inorganic constituents and turbidity are also generally low. However, during a wind or storm event bottom sediments may be disturbed and turbidity in excess of 5 NTU may occur. Turbidity is

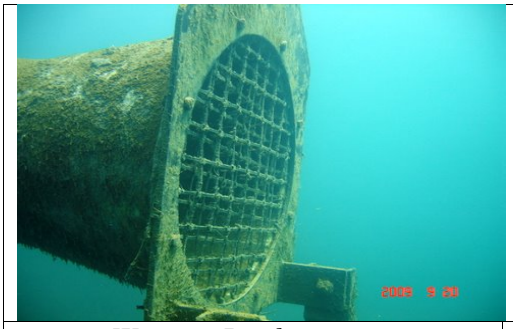
monitored however the meters get clogged with algae. The high turbidity alarms were turned off when algae became more persistent. Available information indicates these turbidity peaks to be occasional and of short duration.

Bacterial cell counts (faecal coliforms) in the lake water are generally low or absent. The water is cold (5°C at times), with a low mineral content and does not readily support bacterial reproduction. However, despite the unfavourable environmental conditions, introduced bacteria can survive for 24-48 hours in such waters. Protozoa's can survive for extended periods of months. Although the microbiological count in the lake is typically low, gross contamination near the intakes (for example from boats) is a possibility.

Western

The Western Intake draws water via a 450mm steel pipe. In 2009 a new intake screen was installed on the Beacon Point Intake. The existing screen at Beacon Point was moved and fitted to the intake pipeline at Western Intake. The inlet is screened by a "Johnson Vee Wire" passive Inlet Screen. The screen has 2mm gap openings. A new submersible bore pump for the Western Intake was installed at the same time.

The Western Intake pumpstation pumps to the Western reservoir and water treatment plant. Western Intake supplies drinking water to a large area of Wanaka, including the CBD.



Western Intake screen

Header pipework off the bore pumps

Pump and valve chambers

The pumpstation consists of three submersible pumps in a wet well. During normal operation, only one pump is needed to keep the reservoir level sufficiently high. The wet wells are securely locked and in good condition. There is no history of vandalism.

There is a 220 kW back-up generator on-site in the event of a power failure.

The raw water sample tap allows samples of raw water to be taken prior to the chlorine dosing stage. The raw water tap is located after the valve chamber and marked clearly.

Figure 5 Western Pressure Zone Map

Beacon Point

The Beacon Point Intake draws water via a 630mm OD MDPE pipe. A new Kleenscreen inlet screen was installed in 2009 with a 0.9mm stainless steel mesh designed to prevent debris and large particulate matter from being drawn into the intake. This mesh was replaced in 2011 with a 20mm mesh due to irreparable damage to the screen.

The Beacon Point Intake pumpstation pumps to the Beacon Point reservoir and water treatment plant. Beacon Point Intake supplies drinking water for the majority of Wanaka and to Albert Town. The pumpstation consists of four submersible pumps in a wet well. Three pumps were replaced in 2013 following failures. The fourth pump was installed in 2014.

The wet well is a sealed circular pre cast structure 3.6m in diameter and over 12m deep. The intake pipe enters the well approximately 4m up from the base of the well at an invert level of 273.50. The position of the intake pipe is designed to ensure the well remains flooded even at low lake levels.

An unfenced concrete building, housing electrical, switch, and communications gear is located at the intake site. The building is directly adjacent to a popular walkway and mountain bike track and has been subject to vandalism. There are signs on the lake shore warning boaters of the intake structure.

A 500 kVa back-up diesel generator was installed on-site in 2013 in the event of a power failure. The generator is sized to start one pump under emergency conditions using the existing switchgear at the site.

There is a booster pump station that pumps water from the Western Reservoir to the Far Horizon Reservoir, however these assets are privately owned.

In the event of a power failure, bore pump failure, communications failure or phase drop are recorded on the SCADA system and the operators are paged.

		
Beacon Point Intake mesh screen	Beacon Point Intake Pump Station generator	Beacon Point Intake pump and valve chambers

2.3.2 Treatment

Western Chlorination: The chlorination at Western Reservoir is a gaseous chlorine system that injects chlorine into the water as it is pumped from the intake into the reservoir. The dosing pumps, equipment, and chlorine bottles are stored in a small and secure concrete building adjacent to the reservoir. The building is away from any residential properties and well locked with appropriate hazard signs.

The chlorine dose is paced to the flow only (there is no feedback system) and manually adjusted. The chlorine is dosed to leave a chlorine residual of between 0.8 and 1.0mg/L. There are four 70kg chlorine gas cylinders; 3 full and one in service. When the cylinder in service is empty there is an automatic changeover to the next full cylinder. There is enough chlorine gas to last for a month. When two cylinders are empty then more are ordered; delivery is usually within the week.

There is a pH meter, turbidimeter and chlorine analyser in the building monitoring these parameters post reservoir only. They all have high and low set points (which for chlorine are 0.6 and 2.0 mg/L) and if the treated water is outside these limits an alarm is sent to the operators who can respond within 20 minutes. The UVT analysers are turned off in summer due to the algae clogging the analysers. These were installed to gain data prior to any proposed UV upgrade, however there is a risk of an incomplete dataset. Compressed air is used to remove algae from the analysers.

The plant is visited weekly. There is a log book which explains what the station attendant duties are; one of which is to record the date, pH, chlorine residuals post reservoir and turbidity.

A 29 kVa back-up diesel generator was installed at the water treatment plant in 2014 in the event of a power failure.

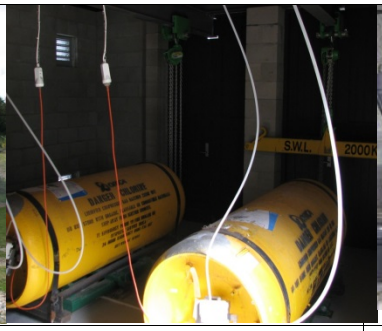
	
Gas bottle and W&T chlorine dosing equipment with gas bottle auto change over	Depolox and turbidity meters

Beacon Point Chlorination: The chlorination at Beacon Point Reservoir is a gaseous chlorine system that injects chlorine into the water as it is pumped from the intake into the reservoir.

The dosing pumps, analysers and two 1 tonne chlorine cylinders are stored in a concrete building adjacent to the reservoir. The building is securely locked, displays the appropriate hazard signs and is away from any residential properties.

The chlorine dose is paced to the flow only (there is no feedback system). The chlorine is dosed to leave a chlorine residual of between 0.8 and 1.0mg/L. There are two 1 tonne chlorine gas cylinders which can each last for around two months. Changeover to the next full cylinder is automatic. The system is fully automated with an alarm system when the gas levels get low (by weight).

There is a pH meter, turbidimeter and chlorine analyser in the building. pH and FAC are measured pre and post reservoir using dual instruments. They all have high and low set points (which for chlorine are 0.6 and 2mg/L) and if the treated water is outside these limits an alarm is sent to the operators who can respond within 20 minutes. The UVT analysers are turned off in summer due to the algae clogging the analysers. Compressed air is used to remove algae from the analysers.

		
Beacon Point reservoir and treatment building securely fenced	Chlorine drums	Typical Depolox 4 set up for pH and FAC on the reservoir inlet and outlet stream

A 33 kVa back-up diesel generator was installed at the water treatment plant in 2014 in the event of a power failure.

2.3.3 Storage

Western Reservoir: This reservoir consists of one cylindrical tank with a volume of 1,040m^3. The reservoir is located off the Wanaka-Mt Aspiring Road on the Rippon Vineyard site. There is on-site chlorine dosing housed in a concrete control building. A small private pump housed in a steel chamber next to the control building and is used to supply water to the Rippon Vineyard site. The reservoir is in good condition with no signs of water ingress on the roof surface. The access manhole lids are all raised and the vents are sealed against animal ingress.

The 2015-25 LTP includes the addition of a reservoir beside the existing one of 1,100m^3 capacity to service the lower areas of Wanaka and the CBD. The need for this reservoir was identified in an Opus report in 2005.

Plantation Reservoir: This consists of two cylindrical tanks and a building that spans between the two reservoirs. This building was installed in 2013. The building was installed to simplify the pipework surrounding the reservoirs (instead of using chambers). The old treatment building was removed at the same time.

The reservoirs are linked and have a volume of 1,550m^3. The reservoir is in good condition with no signs of water ingress on the roof surface. The access manhole lids are all raised and the vents are sealed against animal ingress. A mountain bike track and walkway run alongside the reservoirs. The reservoirs are persistently tagged.

Plantation reservoir

Beacon Point Reservoir: The existing storage capacity of Beacon Point reservoir is 3,500m^3. This reservoir is the largest of all the reservoirs on the Wanaka water supply and can supply water to all other reservoirs in the Wanaka area.

The reservoir is in good condition with no signs of water ingress on the roof surface. The access manhole lids are all raised and the vents are sealed against animal ingress. The reservoir and associated facilities are fenced and locked. The fence has barbed wire on top. There is no light to light the site in the dark however the entire system is automated and therefore it is considered lighting is not required.

Beacon Point reservoir
The building to the right of the reservoir houses the chlorine cylinders.

Mt. Iron Reservoir: This reservoir has a design storage capacity of 383m^3. Originally, this reservoir supplied a small area around Mt Iron Drive only during peak hour flow. However, it is currently not connected to the supply, emptied and not in use.

Far Horizon Reservoir: This is a private reservoir located off Studholme Road. Water is supplied to the reservoir water from the Western Reservoir by the Far Horizon booster pump.

Reservoir level, supply and demand flows are monitored continuously by the SCADA system with alarm set points configured to page operators at the high and low level set points. Operators are able to respond within 30 minutes.

2.3.4 Distribution

The treated water is distributed to various areas around Wanaka from the reservoirs via 109km of predominately AC or uPVC pipe. The majority of the reticulation network is less than 30 years old. The older AC pipes at some locations on the Wanaka reticulation network require upgrading to lessen the risk of major leakages, pipe bursts or backflow incidents.

Free available chlorine equivalent (FACE) values are well above the 0.2mg/L required by DWSNZ 2005/08 reflecting the reliability and effectiveness of the chlorination systems at the treatment plants. Turbidity is variable and can be elevated simply due to the treated water turbidity being higher and/or pickup of sediments from the reticulation piping itself.

The Wanaka water supply is thought to have a moderate risk of backflow. The reticulation system is low lying relative to the reservoirs; therefore there is a risk of backflow. In addition, Wanaka has a small industrial area located off Anderson Road which should be targeted for installation of backflow prevention devices.

QLDC currently has no policy on backflow prevention. Some measures have been taken to install backflow prevention devices in known risk areas and on Council owned properties but this has not been implemented on a district wide basis. QLDC is investigating a policy that will target commercial and agricultural or lifestyle premises for installation of backflow prevention devices and make installation compulsory on new properties.

2.4 Operation and Maintenance

The Wanaka Water Supply is owned and managed by QLDC. The daily operation and maintenance of the supply is outsourced under contract to Veolia. The responsibilities of Veolia are contained within the latest Management, Operation and Maintenance of Utilities Contract document dated 1 July 2015 and the following Operations and Maintenance Manuals: Beacon Point Intake Water Pump Station, Heaton Park Booster Pump Station, Hidden Hills Water Booster Pump Station, Western Intake Water Pump Station, Western Reservoir & Water Treatment Plant and Beacon Point Intake Water Pump Station–PLC Upgrade Control Philosophy.

2.4.1 Training Requirements

The Water Services activity requires a certain level of training from Council and contracting staff. The Primary Industry Training Organisation and Water NZ training guidelines are incorporated into the MoH protocols for the grading of drinking-water supplies. The management, operations and maintenance of our water assets requires the following industry training:

2.4.1.1 Council Staff

Infrastructure Management (executive)	Registered Chartered Engineer (civil)
Water Services Management	Bachelor of Engineering (civil)
Water Services Engineering & Investigation	National Certificate in Water Treatment or
	National Diploma in Drinking Water Assessors Assessment or

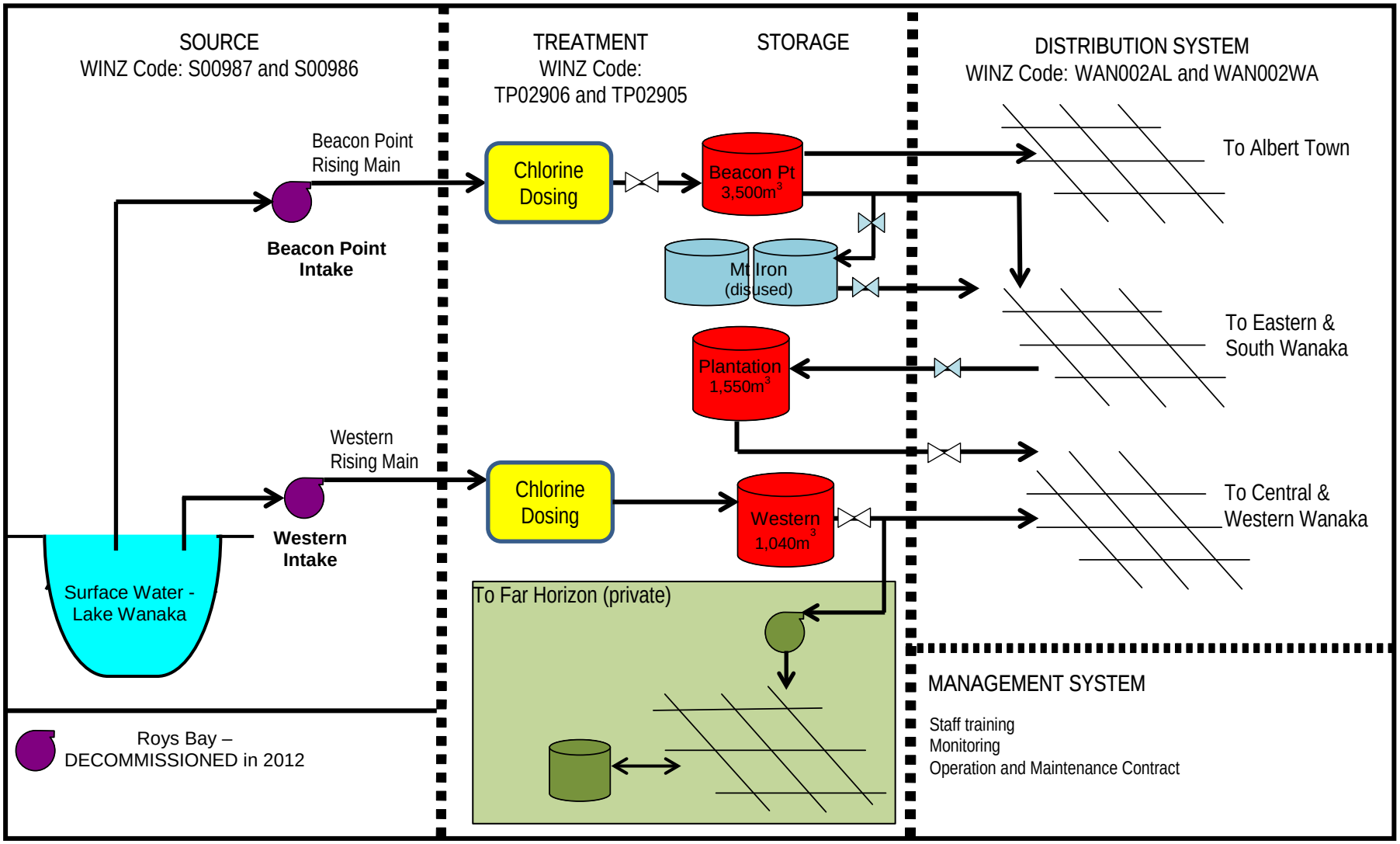
	National Certificate in Reticulation (Planned & Preventative Maintenance Technician) Level 3.

2.4.1.2 Contractor Staff

Water & Wastewater Treatment Operation

1.	Supervision	National Diploma in Water Treatment or National Certificate in Reticulation (Supervisor) Level 4
2.	Operators	National Certificate in Water Treatment or National Certificate in Reticulation (Planned & Preventative Maintenance Technician) Level 3
3.	Subcontractor	Site induction process to gain familiarity and awareness of hazards and public health risks when working on water assets.

2.5 Wanaka Water Supply Flow Diagram



3 Barriers to Contamination

To manage any risks of contamination we need to consider what barriers are in place now. The barriers should:

- prevent contaminants entering the raw water,
- remove particles from the water,
- kill bacteria / protozoa in the water,
- maintain the quality (DWSNZ 2005/08) of the water during distribution.

The greatest protection is gained when all are in place. The current barriers in place for the Wanaka Water Supply to prevent contaminants reaching the public are tabulated below.

Table 2 Wanaka Barriers to Contamination

Barriers to:	Action or supply elements contributing to these barriers	Description	Wanaka Water Supply
Stop contamination of raw water	• Water is drawn from Lake Wanaka.	• Limited formal management of the catchment to control activities that may pollute the water supply.	**Absent**
Remove particles from the water	• There is no coagulation, flocculation, clarification or filtration. • There is an online turbidity meter. Raw water turbidity data is logged to SCADA.	• There is no additional filtration process at the plant for removing particles if present. • Turbidity is generally low although it can become elevated on high rainfall.	**Absent**
Kill bacteria/ protozoa in the water	• There is disinfection by chlorine. • There is no protection against protozoa. • Check for presence of *E. coli* in treated water samples as per DWSNZ 2005/08. • Follow up sampling is done following E. *coli* transgressions as per DWSNZ 2005/08.	• Monitoring has shown the absence of E.*coli*.	**Partially Effective**
Prevent recontamination after treatment	• Measures to stop contamination of storage tanks include covered reservoirs. • Distribution system monitoring of *E. coli* but no residual disinfection. • Actions taken to avoid contamination during distribution system maintenance.	• Hygienic pipe repair procedures under the O&M contract. • Distribution system flow and pressure modelling is complete. • Water carriers are not registered or checked for backflow protection. • Backflow prevention is not consistent and checking of	**Partially Effective**

Barriers to:	Action or supply elements contributing to these barriers	Description	Wanaka Water Supply
Prevent recontamination after treatment		installed devices is not assured under current procedures. • Leakage and consumption rates are excessive indicating numerous pipe leaks which could allow backflow into mains. • A list of Council backflow preventers is maintained within Council's AMS.	

3.1 DWSNZ Compliance and Monitoring

Council aims to comply with the DWSNZ 2005/08. A drinking-water supply complies with the DWSNZ when the following occurs (MoH, 2008).

1. The concentration of a determinand in a sample of the drinking-water does not exceed the MAV more often than is permitted.

2. An operational requirement does not move outside its limit for more than it's allowed frequency or duration of the compliance monitoring period.

3. The number of measurements made for each compliance criterion is equal to or greater than that specified in the DWSNZ; for intermittent supplies, variations must be agreed with the Drinking-Water Assessor (DWA).

4. Sampling, standardising, testing and reporting procedures meet the requirements of the DWSNZ.

5. The requirements of the compliance criteria have been met throughout the previous 12 months.

6. The remedial actions specified in the DWSNZ have been carried out when there has been a transgression or an excursion beyond an operational requirement.

As soon as a supplier is aware that there has been a failure to meet any of these requirements, they must advise the DWA and take the appropriate remedial action(s). The table overleaf identifies the requirements that Wanaka must meet to achieve the DWSNZ 2005/08 and current compliance status.

Table 3 DWSNZ 2005/08 Monitoring Requirements and Compliance Status

DWSNZ Monitoring Requirements			MoH Annual Survey Results 2014/15	Comments
	Criteria	Monitoring Requirements		
Bacterial Compliance				
***E. coli* Treatment Plant Monitoring**	2A	Criterion 2A applies to drinking-water that receives continuously monitored chlorination before leaving the treatment plant. It allows bacterial compliance to be demonstrated without E. coli monitoring.	Compliant for Criteria 2A	pH, FAC and turbidity continuous monitoring. E.coli sampling is carried out despite the fact that this is not a requirement for compliance under the DWSNZ 2005/08.
***E. coli* Distribution Zone Monitoring**	6A	Frequency = 19 per quarter Max days between samples = 8 Min days of week used = 6 Total number of samples required per year = 76	Compliant for Criteria 6A	Distribution zone sampling is compliant with weekly *E. coli*, pH and turbidity samples taken from a number of sites in the reticulation at the remote ends as required by DWSNZ 2005/08. Sampling is scheduled in WINZ 6.0. The schedule is designed to have at least 10% more samples in the quarter to help reduce the risks associated with transportation. 83 samples were taken through the 2013/14 year.
Protozoal Compliance				
	TBC	Dependant on log credit agreed by DWA and additional treatment process chosen.	Not Compliant	The 2010 Catchment Sanitary Survey Assessment suggests a low to moderate risk from protozoa and a 3 log credit removal rate seems appropriate, provided sewage spills into the Lake are minimised by in a pro-active way under the O&M contract.
Cyanotoxin Compliance				
	N/A	There has been a history of algal and diatom problems in Lake Wanaka but not Cyanobacterial blooms.	Not reported	Consumer complaints related to algae clogging applicate filters. Source upgrade to a lake side bore will potentially reduce algal ingestion into the reticulation.
Chemical Compliance				
Chemical Compliance	P2a	No P2a chemical determinand monitoring requirements registered.	Not reported	Raw water chemical organic and inorganic constituents are at low levels and well below the GV and MAV values set out in DWSNZ 2005/08.
	P2b	No disinfection by-products (DBP's) currently registered on WINZ as P2b monitoring requirements.	Not reported	Raw water sampling required to include natural organic matter, measurements after moderate to heavy rainfall events to gauge the extent of likely DBP formation. If it's deemed important for future plans, can assess likely DBP formation potential through UV254 absorbance testing.
	P2c	6-monthly public notices are required (DWSNZ 2005/08 section 8.2.1.4) to warn the public to flush taps for plumbosolvent water.	Not reported	No testing has been done to demonstrate that it is not plumbosolvent. Public notices are issued through the Council magazine, Scuttlebutt.

DWSNZ Monitoring Requirements			MoH Annual Survey Results 2014/15	Comments
	Criteria	Monitoring Requirements		
Radiological Compliance				
		The monitoring of radiological determinands is not required for surface waters.	Not reported	N/A.
Viral Compliance				
		Water sourced from a catchment in which there is human activity, in particular one with a sewage contamination is likely to contain some human-pathogenic viruses. DWSNZ 2005/08 at the time of revision in 2008, did not include viral criteria due to uncertainties in the detection methods and the degree of inactivation during treatment. Guidance will be included in a future standard.	Not reported	The risk of human effluent being present in the catchment does exist in the Wanaka Water Supply. There are septic tank systems within the catchment.

3.2 Water Grading

The Wanaka Water Supply is registered on the MoH national water supply database (WINZ). The MoH Register of Community Drinking-Water Supplies has re-graded all schemes that have gradings older than 2003 as "U", ungraded. The MoH carry out grading exercises however the Wanaka Water Supply remains "Uu", ungraded. The MoH is currently reviewing grading of a drinking water supply practices.

The grading is a measure of confidence that a drinking-water supply system will not become contaminated, rather than an absolute indication of quality at a specific time. The first letter (capital) represents the source and treatment grading, while the second letter (lower case) grades the water in the distribution zone (MoH, 2003).

While the supply remains ungraded, consideration to grading the supply will be given in the future. The MoH suggests that the minimum acceptable grading for the Wanaka Water Supply is "Ba" as shown in the table below. This equates to 'satisfactory, very low level of risk when the water leaves the treatment plant' for the source and treatment and 'completely satisfactory, extremely low level of risk' for the distribution zone.

Table 4 Minimum Acceptable Grading

Community size	Source and treatment	Distribution
Greater than 10,000	B	a
From 5001 to 10,000	B	b
5000 or less	C	c

4 Risk Management

4.1 Risk Evaluation Process

The risk analysis methodology used for this WSP was based on that recommended by the MoH. Workshops were held with key QLDC staff and the Veolia network operators to assess the risks to each supply element.

Each supply element of the water supply is exposed to risk events of varying likelihood and consequence. In establishing a management plan, the level of risk to public health within each supply needs to be understood, quantified and managed.

All risks have been assessed against the criteria of public health impact. Additional risks exist within the water supply, such as that posed by natural disasters and financial risks from taking on new debt for treatment upgrades. The latter risks are not dealt with in this document but rather within the AMP and Long Term Plan (LTP).

The method of scoring each of the risks to public health is tabulated below.

Table 5 Risk Scoring Method

Likelihood	Consequences				
	Insignificant	*Minor*	*Moderate*	*Major*	*Catastrophic*
Almost certain	High	High	Extreme	Extreme	Extreme
Likely	Moderate	High	High	Extreme	Extreme
Possible	Low	Moderate	High	Extreme	Extreme
Unlikely	Low	Low	Moderate	High	Extreme
Rare	Low	Low	Moderate	High	High

Where the likelihood and consequence of each risk are defined as follows:

Likelihood ranking	Description
Rare	May occur only in exceptional circumstances (once in 1,000 years)
Unlikely	Could occur (once in 100 years)
Possible	Might occur at some time (once in 10 years)
Likely	Will probably occur (once in 1 or 2 years)
Almost certain	Is expected to occur in most circumstances

Consequence ranking	Description
Insignificant	Insignificant, not detectable
Minor	Some illness, service disruption or operator level costs
Moderate	Pockets of illness, on-going service disruption or manager level costs
Major	Widespread illness, significant service disruption or CEO level costs
Catastrophic	Fatalities, total service disruption or Council level costs

The Extreme and High priority risks and actions are tabulated in Sections 4.2 to 4.5. The full register of risks assessed is tabulated within Section 8. A preventative measure has been identified to reduce the likelihood of each event and an action to reduce its consequence. Actions are scheduled for implementation within Section 5.

Overall, the risks were found to fit into common bands. An explanation of their description is given overleaf:

4.2 Source Risks

The highest risks to the existing source are related to contamination of Lake Wanaka. The table below lists possible events and the preventative measures and actions planned to mitigate each event.

Process and Event	Indicators / Cause	Total Risk	Likelihood	Consequence	Preventative Measure	Action	Risk Reference
Source: Source water experiences algal bloom	Conditions are suitable for algal growth: elevated nutrient level, sunshine, warmth, relatively still water. Algal bloom due to seasonal turnover and nutrient enrichment. Wanaka experiences algal problems (**not toxic**), primarily in the summer and on occasion in winter. The algae can settle in the reservoirs.	High	Almost certain	Minor	Visual checks and algal cell testing during the most likely months from September to April if blooms are detected.	Wanaka Yacht Club borefield stage 1: This will potentially reduce algae ingestion into reticulation. The two surface water intakes will remain. Consider routine sampling. Consider lamella plates and a small amount chlorine dosing or a coagulant to settle out the algae.	S1.1.21
Source: Source water receives discharge from domestic or industrial processes, either directly or indirectly	Sewer overflows due to blockage or flooding. Non-permitted or permitted activities within the catchment. Council plan classes activity as permitted, and hence consent conditions do not exist. Poor water quality results. Conditions of the consent are not followed. Discharge from marine craft into the lake. More of a risk in Glendhu Bay.	Extreme	Possible	Major	Veolia has a pro-active sewer cleaning programme in place. Resource consents are required for the point discharges of treated effluent. Turbidity is monitored but not alarmed. Councils RFS system records public alerts of leaking sewers and allows rapid response. Trunk sewers near the lake are checked and jetted clean on a regular basis by the contractor to prevent blockages.	Wanaka Yacht Club borefield stage 1: This will address LOS, fire-fighting capability and potentially reduce algae ingestion into reticulation. The two surface water intakes will remain. The borefield adds more resilience to the supply.	S1.1.2
Source: Source water receives spillage, or leakage, arising from the storage or use of hazardous substances	Non-permitted or permitted activities within the source protection zone. Accidental spillage of wastes or chemicals during handling or transport. Marine craft release contaminants (fuel or sewage) near to the intake.	Extreme	Possible	Major	Develop an understanding of the extent of the source catchment. Obtain information about non-permitted and permitted activities that are potential causes of contamination in the catchment. Leaked hydrocarbons from marine craft float above the intake level and are massively diluted. Ensure Council is informed of new discharge consent applications in the catchment.		S1.1.6
Source: Source water receives faecal matter from livestock or feral animals	Poor understanding of catchment. The majority of the catchments' area is not farmed or is low density stocked. Poor water quality results. Livestock and other animals within the catchments contaminate the source by direct and indirect run off.	Extreme	Possible	Major	Regional Fresh Water Plan and Clean Streams Accord encourage farmers to minimise contamination of water ways. Monitor water quality for evidence of health-significant contaminants. Significant dilution is available in the Lake to render any chemical run-off to <50% of MAV values and microbiological contamination to low levels under most circumstances.		S1.1.13

4.3 Treatment Risks

The highest risks to the existing source are related to contaminants entering the network via pipe breaks and leaks and there not being enough treatment to deal with algal entering the water supply. Any new type of treatment plant will be conditional to the cumulative log credits of the water source. These improvements are primarily around asset renewals and finding an additional source.

Process and Event	Indicators / Cause	Total Risk	Likelihood	Consequence	Preventative Measure	Action	Risk Reference
Treatment: Contamination gets into the trunk mains	Mains fail between intake and treatment (reservoirs in this instance). Rising main breaks from poor condition or installation, or a catastrophic event. Poor repairs of breaks, leaks, incidental damage, and penetration of trunk mains.	High	Possible	Moderate	Carry out a condition monitoring programme. Lifelines work. Leak detection programme. Repairs are carried out under strict Veolia hygiene practices (i.e. chlorination).	Wanaka reticulation renewals. Replace existing reticulation and facility assets as identified by valuation.	P2.1

Process and Event	Indicators / Cause	Total Risk	Likelihood	Consequence	Preventative Measure	Action	Risk Reference
Treatment: No flow through the trunk mains	Mains breaks or pump failures.	High	Possible	Moderate	Carry out a condition monitoring programme. Lifelines work. Leak detection programme.	Carry out a condition monitoring programme and a leak detection programme.	P2.4.1
Treatment: Treatment plant cannot produce water of satisfactory quality	There is no 'treatment plant' in Wanaka. Chlorine is dosed at the reservoirs. Inadequate monitoring. Inadequate security measures to prevent vandalism. Unhygienic practices (i.e. separation between water & wastewater). Events affecting the source with the result the plant cannot treat the raw water. Power failure. Lack of chemical supplies due to industrial action. There is no treatment option for dealing with fluctuating turbidity.	High	Likely	Minor	Have redundancy / backup at the plant (assets, fuel etc). Undertake periodic inspections and maintenance. Staff aware of WSP. Provide a lockable fence / doors / hatches. Make sure staff are trained in the correct procedures for handling the chemicals used at the treatment plant.	Wanaka Yacht Club borefield stage 1: This will address LOS, fire-fighting capability and potentially reduce algae ingestion into reticulation. The two surface water intakes will remain. The borefield adds more resilience to the supply. This will include UV treatment. Consider lamella plates and a small amount chlorine dosing or a coagulant to settle out the algae.	P11.1

4.4 Distribution Risks

The highest assessed risk relate to introduction of contaminants into the distribution system, and, backflow prevention. Ongoing inspection of backflow preventers, existing and new is necessary.

Process and Event	Indicators / Cause	Total Risk	Likelihood	Consequence	Preventative Measure	Action	Risk Reference
Distribution: Not enough water in post-treatment storage to meet demand	Insufficient supply of raw water. Inadequate post treatment storage capacity. Insufficient treatment capacity. High water demand and excessive water leaks leads to inadequate storage capacity. Structural failure of the reservoir (leakage). Low level alarms at reservoirs not communicating to pumps. Falling main failure through condition failure or earthquake / catastrophic event.	High	Unlikely	Major	Reservoir low level probe is linked to SCADA and initiates plant start-up. Plant flows logged to SCADA. Records of complaints (e.g. regarding low pressures or loss of supply) through the RFS database. Pumps have a standby generator. Implement the Water Demand Management Plan and Water Supply by-law to reduce water losses. Modelling of Western reservoir shows Wanaka does not need another reservoir at that location (from a demand perspective) however extra storage is still deemed appropriate by the contractor at Western and on occasion at Beacon Pt. The reservoirs are in good condition.	Upgrade capacity of the supply. A 1100m^3 reservoir to be placed adjacent to the existing Western Reservoir.	D1.1
Distribution: Development, or re-suspension, of sediment within tank or reservoir	Sediment/ slime accumulation and release due to rapid fill and poor cleaning. High rainfall events bring turbid water into the reservoir.	High	Likely	Minor	Chlorine residual provides protection against bacterial contaminants. Reservoir is in good condition and well sealed against outside influence.	Cleaning reservoirs is not on the programmed maintenance schedule. Reservoirs are currently cleaned on a case by case basis. The reservoirs have never been cleaned due to the difficult nature of it. Western reservoir can be taken offline to be cleaned but Beacon Pt can't. Potable water divers could be used, and it would be best to do this in winter. Investigate need to clean the reservoirs and if it should be added to programmed maintenance schedule.	D1.3

Process and Event	Indicators / Cause	Total Risk	Likelihood	Consequence	Preventative Measure	Action	Risk Reference
Distribution: Introduction of contamination by pressure fluctuations	High demand causing low pressure areas and backflow risk. Burst or leaking mains causes water and pressure loss. Unpredicted events such as a major fire. There is little backflow prevention in the network with the exception of new sub-divisions. Algae in the water supply is making backflow prevention devices less effective.	High	Possible	Moderate	Emergency water restrictions. Condition assessment of assets. Record incidences of pipe failure and repairs undertaken in Hansen. Veolia monitors pressure via network flowmeters and pressure transducers. Pressure readings are linked to SCADA and can be viewed via the ASPEX GUI.	Carry out water modelling to identify potential problem pressure areas. A water pressure field survey is planned from December 2015. This information will feed in to re-building the water models. Leak detection programme.	D2.2.1
Distribution: Introduction of contaminating material into the distribution system	Breaks, leaks, incidental damage to mains. System pressure drop. Standard hygiene practices not adopted. Inadequate flushing and disinfection practices. Flow direction in affected area unknown or uncontrollable. Inappropriate materials used. Cross connections are not seen to be an issue in Wanaka. Unsatisfactory location of water reticulation pipes. There is no enforcement of unauthorised water takes. Water carts often take water for dust suppression.	High	Possible	Moderate	Planned maintenance & inspections programme part of the O&M contract. Quality plan and training programme. Hydraulic modelling and pressure testing to identify risk areas of network. Improve asset knowledge.	Sunrise Bay pond is fed by the reticulation. This has been identified as a risk. Turn off and cap.	D2.3.1
Distribution: No, inadequate, faulty, or incorrectly installed backflow prevention device	No, or faulty, backflow devices installed. Water Carriers introduce contaminants while filling up tankers. An illegal cross connection. All wastewater pumpstation washdowns have backflow prevention, either acuflows or non-return valves.	High	Possible	Moderate	Council policy (in Bylaw) on backflow prevention requires existing at-risk commercial consumers to have backflow preventers installed. Pressure in the retic is generally maintained at 300 kPa. Controls on taking of water from Council hydrants. Compliance with S11 DWSNZ 2005 Tankered Drinking water compliance criteria. Check reticulation pressures under high demand in known vulnerable areas. Veolia test network BFPs annually but it is up to property owners to test private ones under the WOF requirements.	Identify backflow risk in the District. Talk to the Building inspectors about process for checking commercial premises for backflow testing (WOF).	D2.4.2

4.5 General Risks

General risks are those not specific to a supply process. The highest level risk is that pertaining to water quality data and housing it in one central location.

Process and Event	Indicators / Cause	Total Risk	Likelihood	Consequence	Preventative Measure	Action	Risk Reference
General: Incorrect water quality data used for supply management	Delay in obtaining test results from lab. SCADA failure – no data received. Water Safety Plan not properly understood and followed by staff or not reviewed on schedule. Failure of staff to follow the analytical method and other related quality assurance procedures. Inappropriate/ incorrect sampling and / or calibration. Inadequate or incorrect monitoring records. Failure of staff to follow the analytical method and other related quality assurance procedures. Use of a non-MoH-approved laboratory.	High	Possible	Moderate	Training programme in place and monitored. Regular monthly audit of Contractor performance under the O&M contract to ensure the required 'Levels of Service' are met. Only an MoH approved laboratory is used, (Watercare), and alert notices for non-compliant test results. SCADA monitors continuously and alarms are raised. Include key staff in the WSP process and provide training before and during implementation. WSP reviewed as per the WSP schedule. Advise the lab of any incorrect or erroneous results. Carry out E. coli follow-up sampling following all transgressions. Update the O&M manual when deficiencies are found.	Build lab results database that will house all water quality and environmental data.	G2

5 The Improvements Needed to Manage the Risks

This section summarises the improvements necessary to mitigate the identified public health risks to more acceptable levels. Managing risk in all its forms is an outcome of good asset management.

The improvements were developed during the risk identification workshops and are broken down into three areas of asset management: operations, maintenance and new assets. An indicative benefit-cost estimate has also been included to give further consideration to priority, particularly where improvements are yet to be budgeted.

These improvements have been integrated into the water supply asset management and long term plan except where stated as:

- "To be budgeted" – indicating that this work has been identified within this WSP as an option to mitigate risk.
- "To be scheduled" – indicates that this work has been identified within this WSP, is budgeted for but should be prioritised for action.

The tables overleaf detail these improvements.

5.1 Operational Improvements

Operational improvements are changes or improvements to day to day decisions and procedures used to run the water supply. These improvements are prioritised on risk and an indicative benefit-cost level.

Process	Event / Risk Mitigated	Priority	Action	Cost and Timeframe	Responsibility / Delivered by	Budgeted in LTP?
Source	Source water experiences algal bloom S1.1.21	High Risk and High Benefit-Cost	Consider routine sampling. Investigate lamella plates and a small amount chlorine dosing or a coagulant to settle out the algae.	To be confirmed 2016/17	Chief Engineer	To be budgeted
Distribution	Introduction of contamination by pressure fluctuations D2.2.1	High Risk and High Benefit-Cost	Carry out water modelling to identify potential problem pressure areas. A water pressure field survey is planned from December 2015. This information will feed in to re-building the water models. Leak detection programme.	In progress 2016/17	Chief Engineer	In Progress
	Dissolution of chemicals from construction materials D2.1.1	Low Risk and Med Benefit-Cost	Issue the public notices (plumbosolvency and the need to flush taps) every 6 months. Investigate plumbosolvency testing in water as per DWSNZ 2005/08, S8.2.1.4.	On-going	Resource Consents Officer	Budgeted in LTP
General	Inadequate staff training G1	Moderate Risk and High Benefit-Cost	Continue with a training needs assessment and training recording system for staff. Train all staff to National Diploma or National Certificate levels as detailed in the WSP.	Internal & O&M contract On-going	Network Operator (Veolia) / Chief Engineer	Budgeted in LTP

5.2 Maintenance Improvements

Maintenance improvements are changes or improvements to the way maintenance is undertaken or planned. The improvements are prioritised by highest risk and highest benefit-cost.

Process	Event / Risk Mitigated	Priority	Action	Cost and Timeframe	Responsibility / Delivered by	Budgeted in LTP?
Distribution	No, inadequate, faulty, or incorrectly installed backflow prevention device D2.4.2	High Risk and High Benefit-Cost	Identify backflow risk in the District. Talk to the Building inspectors about process for checking commercial premises for backflow testing (WOF).	Internal 2016/17	Manager - Strategy & Performance / Environmental Consents Officer	Budgeted in LTP
	Development, or re-suspension, of sediment within tank or reservoir D1.3	High Risk and Med Benefit-Cost	Cleaning reservoirs is not on the programmed maintenance schedule. Reservoirs are currently cleaned on a case by case basis. The reservoirs have never been cleaned due to the difficult nature of it. Western reservoir can be taken offline to be cleaned but Beacon Pt can't. Potable water divers could be used, and it would be best to do this in winter. Investigate need to clean the reservoirs and if it should be added to programmed maintenance schedule.	O&M contact 2016/17	Chief Engineer	Budgeted in LTP
	Introduction of contaminating material into the distribution system D2.3.1	High Risk and Low Benefit-Cost	Sunrise Bay pond is fed by the reticulation. This has been identified as a risk. Turn off and cap.	O&M contact 2015/16	Network Operator (Veolia)	To be scheduled
	Germs enter the distribution system through failed construction materials D2.1.2	Moderate Risk and Low Benefit-Cost	Carry out a condition assessment programme and a leak detection programme.	O&M contract On-going	Chief Engineer & Network Operator (Veolia)	Budgeted in LTP
	Entry of chemical contaminants through pipe materials D2.1.3 and .4					
Treatment	No flow through the trunk mains P2.4.1	High Risk and Med Benefit-Cost				
General	Incorrect water quality data used for supply management G2	High Risk and High Benefit-Cost	Build lab results database that will house all water quality and environmental data.	Internal 2016/17	Environmental Consents Officer	Budgeted in LTP

5.3 New Infrastructure

The construction of new infrastructure is necessary where improvements to operations and maintenance are not sufficient to mitigate risks. The most significant improvement is the establishment of a new source and providing more storage. This will mitigate the most extreme risks to public health.

Process	Event / Risk Mitigated	Priority	Action	Cost and Timeframe	Responsibility / Delivered by	Budgeted in LTP?
Source	Source water receives faecal matter from livestock or feral animals S1.1.13	Extreme Risk and Med Benefit-Cost	Wanaka Yacht Club borefield stage 1: This will address levels of service, fire-fighting capability and potentially reduce algae ingestion into reticulation. The two surface water intakes will remain. The borefield adds more resilience to the supply. UV will still be required. Upgrade capacity of the supply. A 1100m^3 reservoir to be placed adjacent to the existing Western Reservoir.	$320k - $1.6m 2015 - 2023	Project Manager & Network Operator (Veolia)	Budgeted in LTP
	Source water receives discharge from domestic or industrial processes, either directly or indirectly S1.1.2					
	Source water receives spillage, or leakage, arising from the storage or use of hazardous substances S1.1.6					
	Source water experiences algal bloom S1.1.21	High Risk and High Benefit-Cost				
	Source water receives Agrichemicals or poisons, run-off from urban or sealed surfaces, waste discharge to land S1.1	Moderate Risk and Med Benefit-Cost				
	Source water receives contaminants from irrigation, fertilizers, waste disposal down holes, septic tanks, effluent ponds, abandoned wells. S1.1	Low Risk and Med Benefit-Cost				
	Not enough water available S1.1.22	Moderate Risk and High Benefit-Cost				
Distribution	Not enough water in post-treatment storage to meet demand D1.1	High Risk and High Benefit-Cost				
Treatment	Not enough source water available for abstraction P1.2.1	Moderate Risk and High Benefit-Cost				
	Treatment plant cannot produce water of satisfactory quality P11.1	Low Risk and High Benefit-Cost				
	Raw water quality too poor to treat P1.2.2	Moderate Risk and Med Benefit-Cost				
	Contamination of the lake or reservoir P1.2.3					
	Too little water can be drawn from the intake to meet demand P1.2.4					
	Contamination gets into the trunk mains P2.1	High Risk and High Benefit-Cost	Wanaka reticulation renewals. Replace existing reticulation and facility assets as identified by valuation.	$6.8m 2015 - 2025	Chief Engineer & Project Manager	Budgeted in LTP

6 Performance Assessment

To ensure that the WSP is working properly, the plan will be regularly reviewed and updated as described below. The review should update the following areas:

Table 6 Performance Review Checklist and Reporting Requirements

Performance Review Checklist		Reporting Requirements				
Task	**Responsibility**	**Event or Purpose**	**Source**	**Who**	**Reported to**	**When**
Tracking Incidents What (if any) incidents have occurred in the period since the last review? What actions were taken? What improvements are needed to mitigate the risk of future incidents? (i.e. changes to O&M Procedures, Capital Works, training etc.)	Network Operator (Veolia)	Customer complaints.	RFS database	Customer	QLDC via RFS	Event
		Reporting as required by consent conditions.	CS-VUE	Environmental Consents Officer / Veolia	ORC	As required by consent
		Reporting incidents or operational issues.	RFS / Veolia email event notification	Veolia	Chief Engineer	Event / monthly contract meeting
		Pollution, spillage or public health risk (potential).	Veolia email event notification	Veolia	ORC pollution hotline, PHS, DWA, EHO, Chief Engineer	Event
Management / Training Are all existing and new staff adequately trained to operate and maintain the network? Are all existing and new staff aware of the WSP and the DWSNZ 2005/08?	Chief Engineer / Network Operator (Veolia)	Operator training review.	Veolia	Veolia	Internal	Annual
		Ensuring new staff are aware of the WSP and DWSNZ 2005/08.	-	Environmental Consents Officer / Veolia	Internal	New staff within I&A Department and Veolia
		Have roles and responsibilities / personnel changed?	Veolia & QLDC management	-	-	-
Drinking Water Standards Compliance Has the water supply complied with DWSNZ 2005/08? What (if any) transgressions taken place in the period since last review? What improvements are needed to mitigate the risk of future transgressions?	Network Operator (Veolia)	Completion of WINZ database to capture monitoring information with regards to water quality as required for compliance to DWSNZ 2005/08.	Lab certificates / WINZ	Veolia	DWA/ MoH	Monthly to WINZ, annual to DWA/ MoH

Performance Review Checklist		Reporting Requirements				
Task	Responsibility	Event or Purpose	Source	Who	Reported to	When
Tracking Improvements Have all improvements to maintenance and operations procedures been implemented? Is all necessary monitoring being reported as needed?	Network Operator (VW) / Chief Engineer	Network operator audit		Chief Engineer	I&A General Manager	Annual
Tracking New Assets / Upgrades Have all the new assets identified in the WSP been implemented? Are future improvements included within the latest AMP and LTP?	Chief Engineer	Annual Plan review		Chief Engineer	Council	Annual
Has the water supply changed or been upgraded in the period of the last review (check asset register for changes)? How does this change the level of public health risk and mitigation necessary?	Chief Engineer	Review WSP		Environmental Consents Officer	Chief Engineer / DWA	WSP review – 3 yearly

6.1 Responsibility

The Chief Engineer is responsible for delivery of the WSP review.

6.2 Frequency

WSP reviews will be carried out after significant changes have occurred, but not less than every five years.

Next Review: January 2021

7 Contingency Planning

Despite the preventive and corrective actions put in place, events can arise that are beyond the immediate control of the Network Operator or Council. A contingency plan provides the actions to take in order to protect public health before recovering the water supply.

Risks to public health have been categorised into two general scenarios.

1. Contamination event – water quality is poor to treat or consume, or a public health risk as a result of either;
    a. Source water – high turbidity, biological (*E. coli*, protozoa), chemical contamination;
    b. Asset/equipment failure – treatment plant, power failure, SCADA failure, natural disaster.
2. Loss of supply – low or no water event
    a. Water demand is too high – dry and hot periods, excessive consumer demand.
    b. Low or no water availability – burst mains/reservoirs, natural disaster.

The limitations of this contingency plan are those events of regional or national significance such as a natural disaster. The declaration of an emergency by a Civil Defence Emergency Manager will take precedence of plans in this instance.

A flow chart has been developed for each of the above scenarios showing the procedural steps and the personnel responsible. The flow charts show the general procedures only and give guidance to Operators who should be aware of the operational requirements of the water supply system. Additional guidance can be found in the operational manuals for each water supply. Furthermore, DWSNZ 2005/08 sets out response measures for performance transgressions which these procedures are based on. These are shown in Figure 4.1 and Figure 4.2.

In addition, where an event is of a scale or its nature is beyond the day to day capabilities of the Network Operator, reference should be made to the 'QLDC Emergency Management Plan'. This plan covers events which require significant additional resources or co-ordination across multi utilities or services.

Figure 6 Contaminated Water Contingency Plan

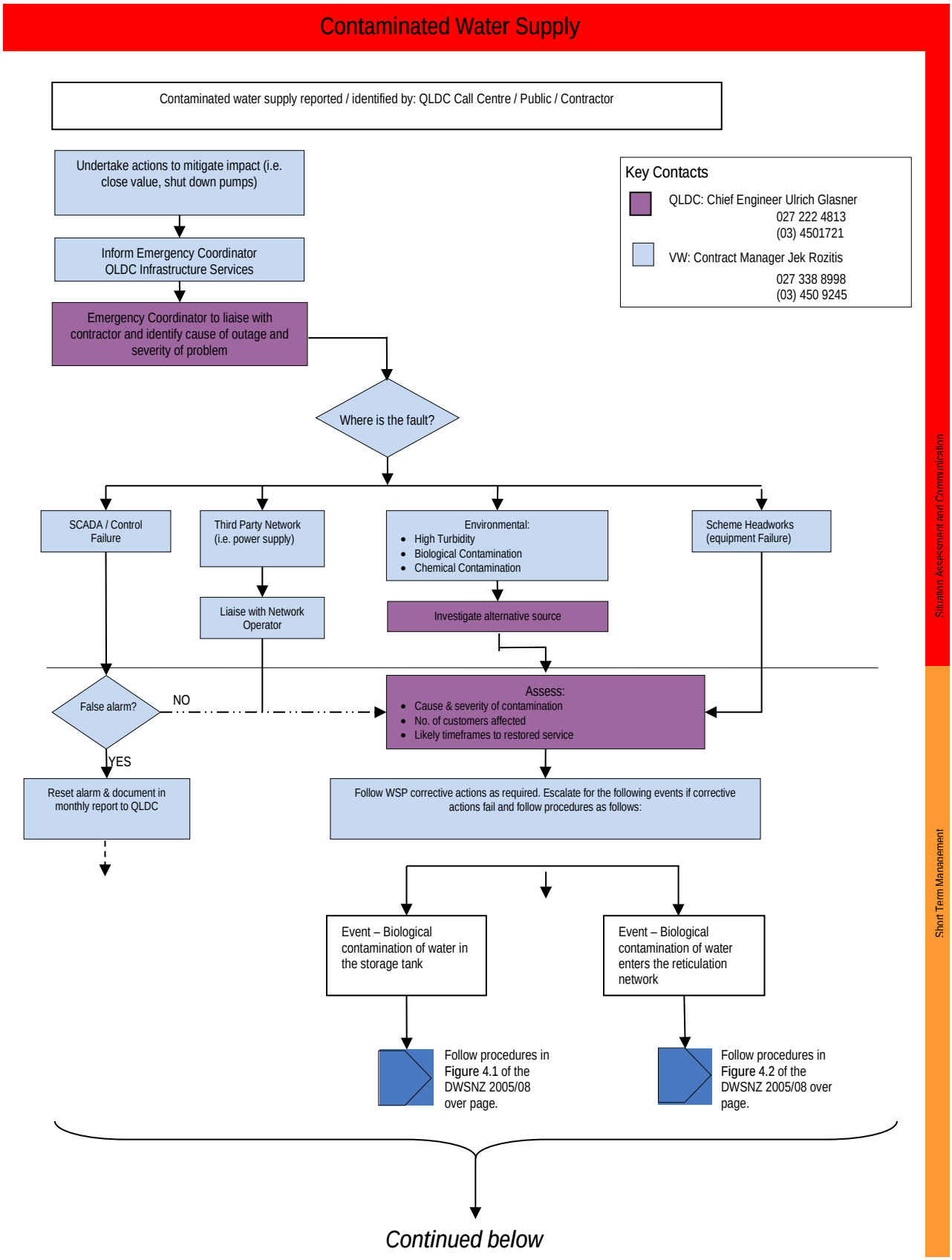


Figure 4.1: Response to *E. coli* contamination of drinking-water leaving treatment plant

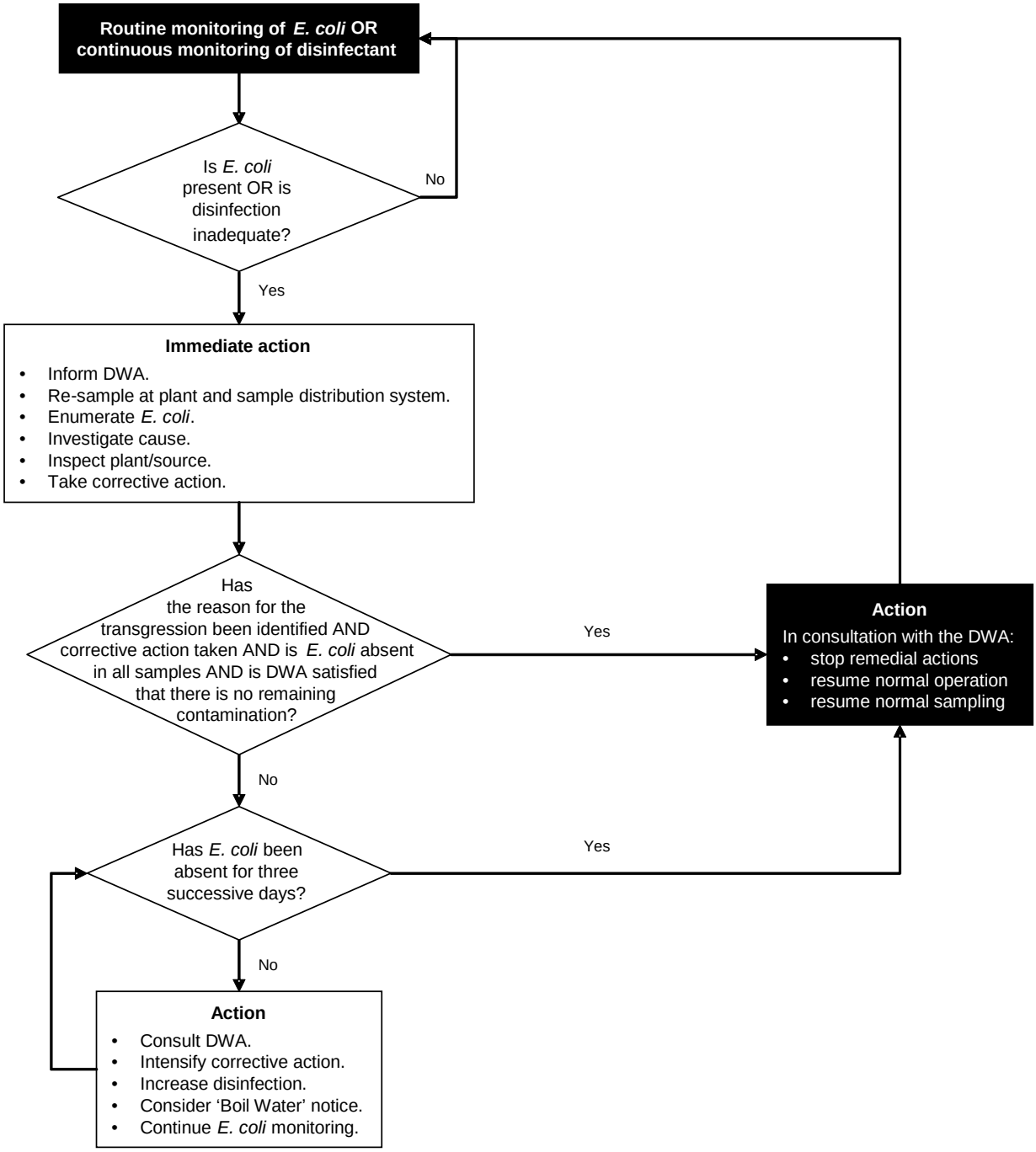
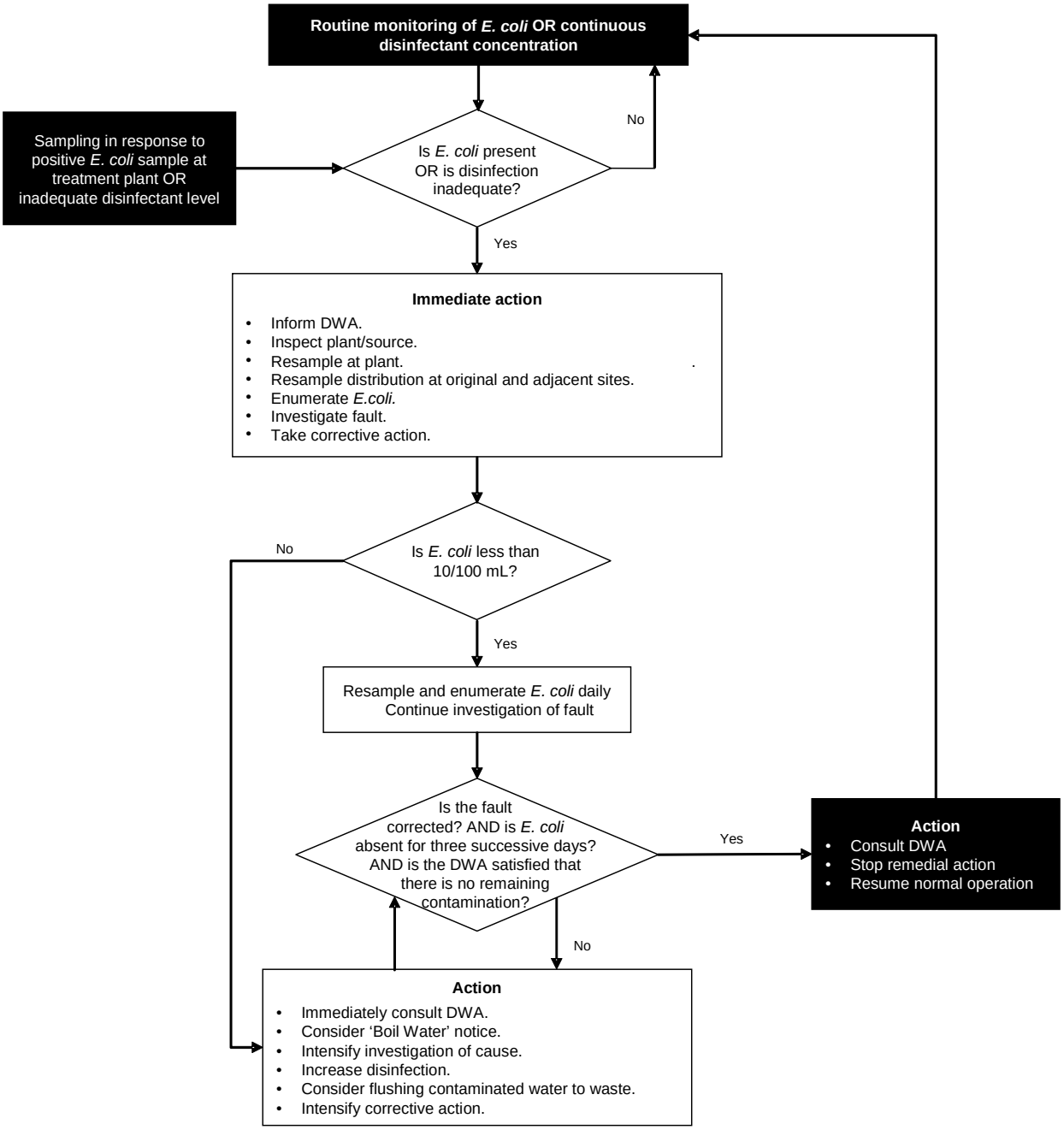


Figure 4.2: Response to *E. coli* contamination of a drinking-water supply distribution zone



Contaminated Water Supply

Continued from above

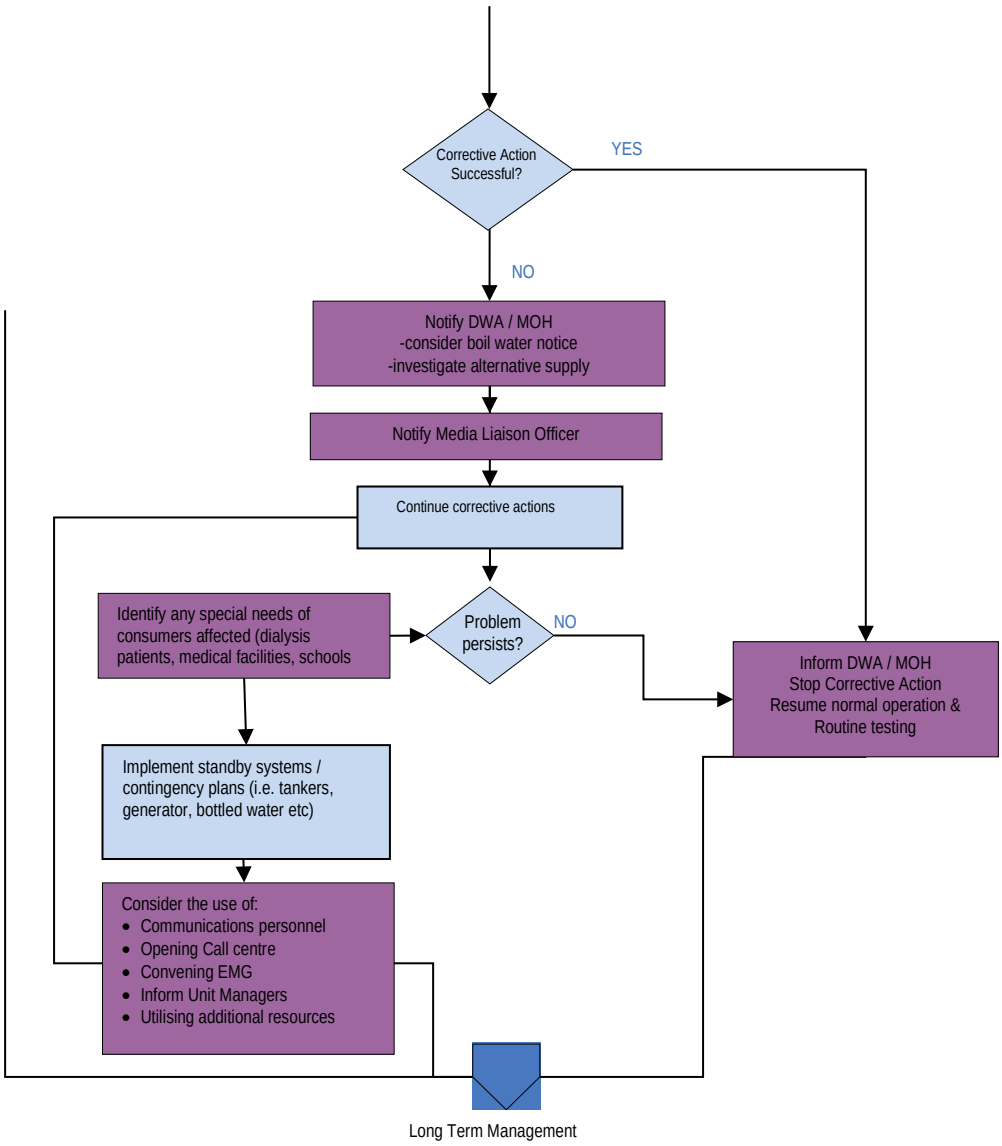


Figure 7 Loss of Water Contingency Plan

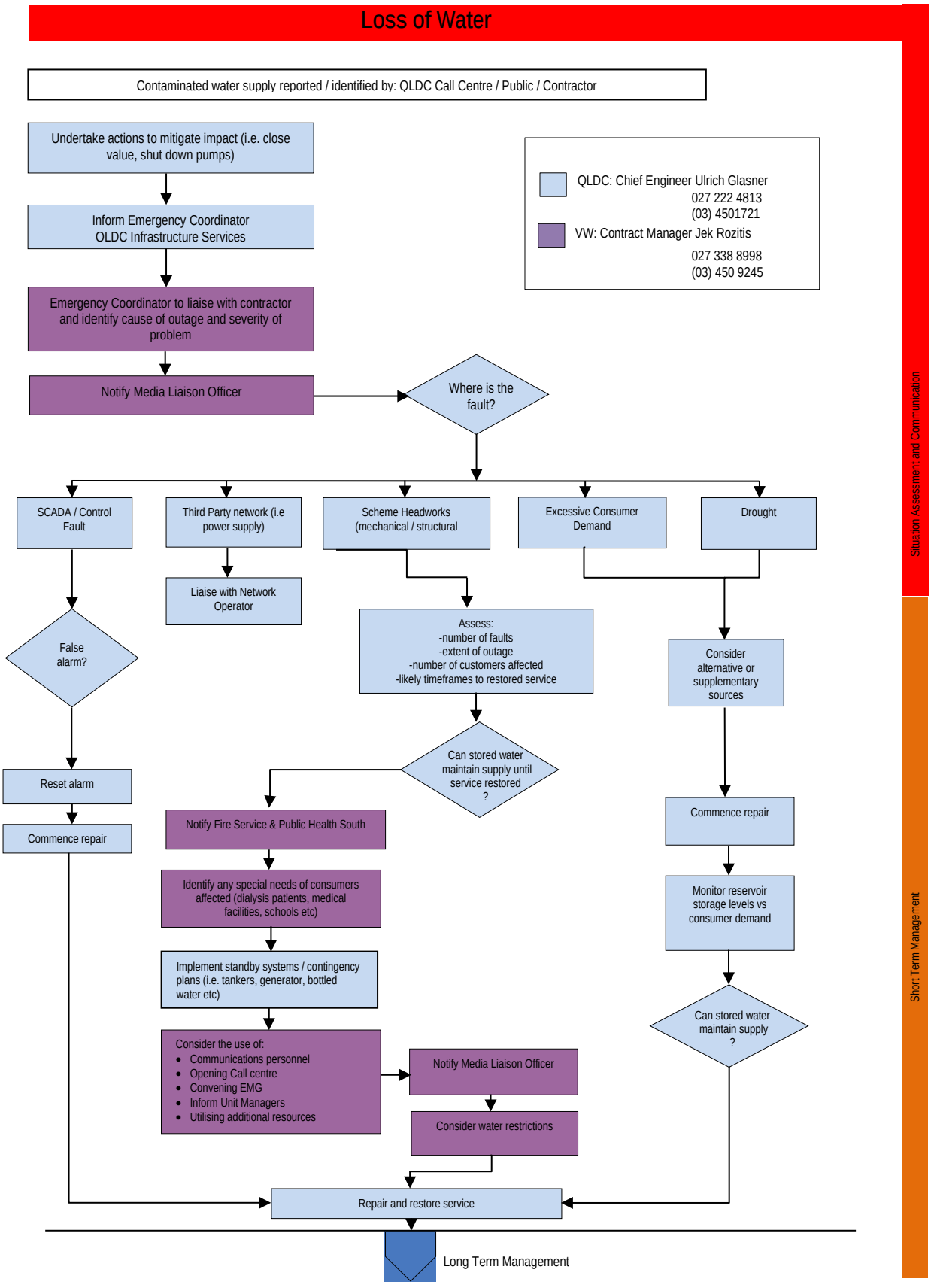
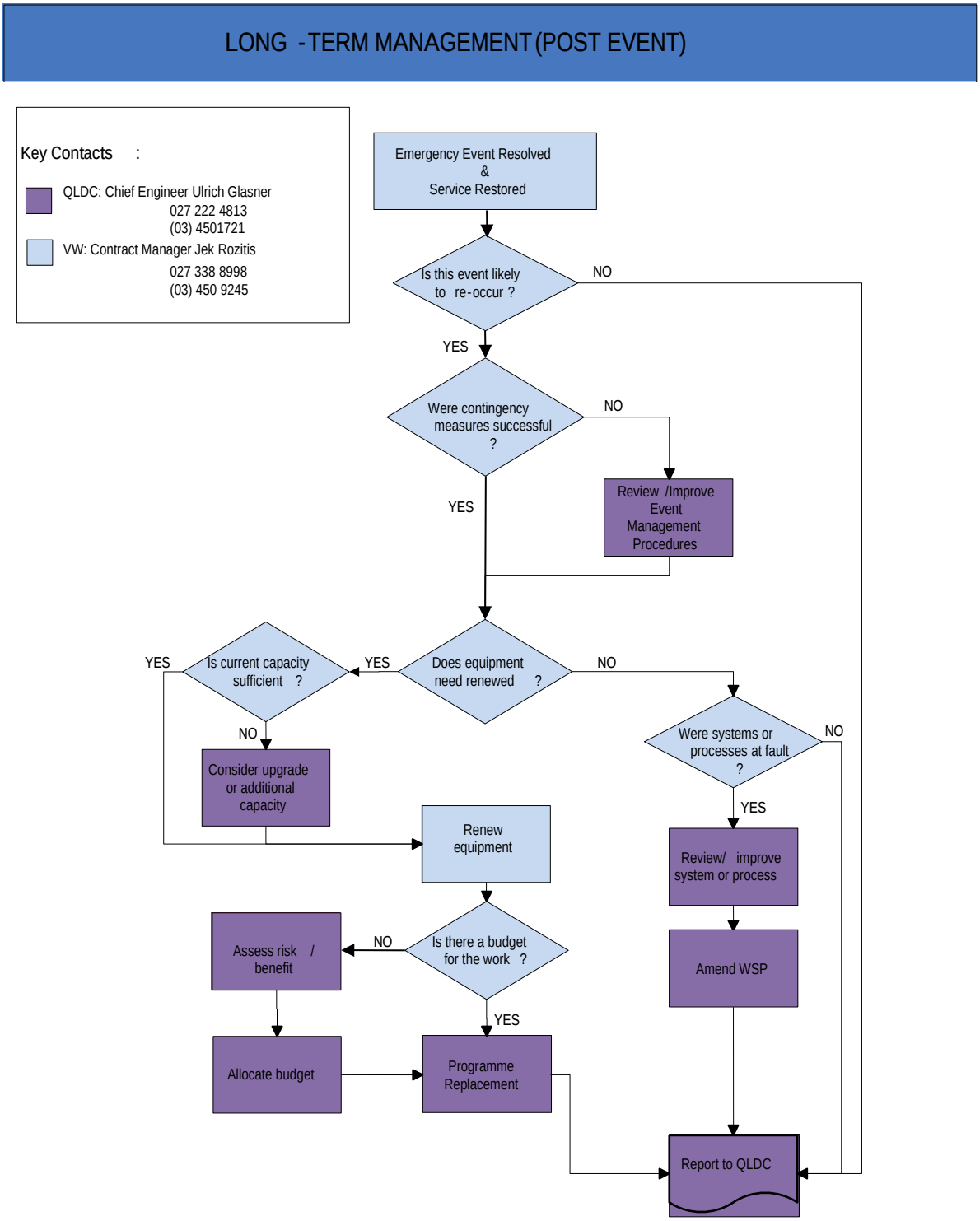


Figure 8 Long Term Management (post-event)



8 Appendices

8.1 Risk Management Tables

Risks to Public Health							Preventative Measures List the measures that could be used to reduce the likelihood of each event happing. There needs to be at least one preventative measure for each cause.			Corrective Actions Actions to take if preventative measures fail.				
Ref	Process	Event	Likelihood	Consequence	Risk	Indicators / Cause	Preventative Measure	Responsibility / Delivered by	Sign that Action is Needed	Action	Project ID	Cost	Timeframe	Responsibility / Delivered by
S1.1.1	Source	Source water receives discharge or leachate from a contaminated site			#N/A									
S1.1.2	Source	Source water receives discharge from domestic or industrial processes, either directly or indirectly	Possible	Major	Extreme	Sewer overflows due to blockage or flooding. Non-permitted or permitted activities within the catchment. Council plan classes activity as permitted, and hence consent conditions do not exist. Poor water quality results. Conditions of the consent are not followed. Discharge from marine craft into the lake. More of a risk in Glendhu Bay.	Veolia has a pro-active sewer cleaning programme in place. Resource consents are required for the point discharges of treated effluent. Turbidity is monitored but not alarmed. Councils RFS system records public alerts of leaking sewers and allows rapid response. Trunk sewers near the lake are checked and jetted clean on a regular basis by the contractor to prevent blockages.	Chief Engineer	Median E. *coli* count over 12 months > 500/100mL. Elevated levels of contaminants in source water (not compliant with ANZECC guideline). Lack of knowledge of catchment/ recharge zone, and sources of contamination in the area.	Wanaka Yacht Club borefield stage 1: This will address LOS, fire-fighting capability and potentially reduce algae ingestion into reticulation. The two surface water intakes will remain. The borefield adds more resilience to the supply. UV will still be required.	6256	$320k	2015/16	Project Manager
S1.1.3	Source	Source water receives discharge from mining operations			#N/A									
S1.1.4	Source	Source water receives leachate from landfill site			#N/A									
S1.1.5	Source	Source water receives waste originally discharged to land	Rare	Moderate	Moderate	Non-permitted or permitted activities within the source protection zone. Manure spreaders near the lake.	Develop an understanding of the extent of the source catchment. Obtain information about non-permitted activities in the catchment or recharge zone from the Council. Obtain a list of permitted activities that are potential causes of contamination. Ensure water supplier is informed of new discharge consent applications in the catchment.	Chief Engineer	Median E. *coli* count over 12 months > 500/100mL. Elevated levels of contaminants in source water (not compliant with ANZECC guideline). Reticulated water not compliant with DWSNZ.	Wanaka Yacht Club borefield stage 1: This will address LOS, fire-fighting capability and potentially reduce algae ingestion into reticulation. The two surface water intakes will remain. The borefield adds more resilience to the supply. UV will still be required.	6256	$320k	2015/16	Project Manager

Risks to Public Health							Preventative Measures List the measures that could be used to reduce the likelihood of each event happing. There needs to be at least one preventative measure for each cause.			Corrective Actions Actions to take if preventative measures fail.				
Ref	Process	Event	Likelihood	Consequence	Risk	Indicators / Cause	Preventative Measure	Responsibility / Delivered by	Sign that Action is Needed	Action	Project ID	Cost	Timeframe	Responsibility / Delivered by
S1.1.6	Source	Source water receives spillage, or leakage, arising from the storage or use of hazardous substances	Possible	Major	**Extreme**	Non-permitted or permitted activities within the source protection zone. Accidental spillage of wastes or chemicals during handling or transport. Marine craft release contaminants (fuel or sewage) near to the intake.	Develop an understanding of the extent of the source catchment. Obtain information about non-permitted and permitted activities that are potential causes of contamination in the catchment. Ensure Council is informed of new discharge consent applications in the catchment. Leaked hydrocarbons from marine craft float above the intake level and are massively diluted.	Chief Engineer	Median E. *coli* count over 12 months > 500/100mL. Elevated levels of contaminants in source water (not compliant with ANZECC guideline). Reticulated water not compliant with DWSNZ. Lack of knowledge of catchment/ recharge zone, and sources of contamination in the area.	Wanaka Yacht Club borefield stage 1: This will address LOS, fire-fighting capability and potentially reduce algae ingestion into reticulation. The two surface water intakes will remain. The borefield adds more resilience to the supply. UV will still be required.	6256	$320k	2015/16	Project Manager
S1.1.7	Source	Source water receives septic tank discharges	Unlikely	Insignificant	**Low**	Septic tanks within the catchment.	Obtain information about the number and location of septic tank discharges in the catchment or recharge zone.	Chief Engineer	Median E. *coli* count over 12 months > 500/100mL. Elevated levels of nitrate, nitrite in source water. Reticulated water not compliant with DWSNZ.	Wanaka Yacht Club borefield stage 1: This will address LOS, fire-fighting capability and potentially reduce algae ingestion into reticulation. The two surface water intakes will remain. The borefield adds more resilience to the supply. UV will still be required.	6256	$320k	2015/16	Project Manager
S1.1.8	Source	Source water receives run-off from urban or sealed surfaces	Likely	Insignificant	**Moderate**	Stormwater run off into the lake from buildings and sealed surfaces during heavy rainfall. Urban or industrial area within catchment. Poor understanding of catchment and poor identification of areas where run-off may be influenced by land use activities. Inadequate collection, or treatment, of run-off, and inappropriate disposal. New activity in source protection zone. The Western intake is more of a concern than the Beacon Pt intake due to the nature of the Bay that Western draws from.	Stormwater run-off is diluted by the lake volumes for the most part. Obtain information about all sources of urban and industrial run-off and its treatment and disposal in the catchment or recharge zone.	Chief Engineer	Median E. *coli* count over 12 months > 500/100mL. Elevated levels of contaminants in source water. Treated water not compliant with DWSNZ. Lack of knowledge of catchment, and sources of contamination in the area.	Wanaka Yacht Club borefield stage 1: This will address LOS, fire-fighting capability and potentially reduce algae ingestion into reticulation. The two surface water intakes will remain. The borefield adds more resilience to the supply. UV will still be required.	6256	$320k	2015/16	Project Manager

Risks to Public Health							Preventative Measures List the measures that could be used to reduce the likelihood of each event happing. There needs to be at least one preventative measure for each cause.			Corrective Actions Actions to take if preventative measures fail.				
Ref	Process	Event	Likelihood	Consequence	Risk	Indicators / Cause	Preventative Measure	Responsibility / Delivered by	Sign that Action is Needed	Action	Project ID	Cost	Timeframe	Responsibility / Delivered by
S1.1.9	Source	Source water receives material from surface impoundments (waste ponds or lagoons) either treated discharge or leakage	Unlikely	Minor	Low	Impoundments within the source protection zone.	Develop an understanding of the extent of the source catchment. Obtain information about non-permitted activities in the catchment or recharge zone from the Council. Obtain a list of permitted activities that are potential causes of contamination. Establish a strategy to monitor and manage the risk. Ensure water supplier is informed of new discharge consent applications in the source protection zone.	Chief Engineer	Median E. *coli* count over 12 months > 500/100mL. Elevated levels of contaminants in source water (not compliant with ANZECC guideline). Reticulated water not compliant with DWSNZ.	Wanaka Yacht Club borefield stage 1: This will address LOS, fire-fighting capability and potentially reduce algae ingestion into reticulation. The two surface water intakes will remain. The borefield adds more resilience to the supply. UV will still be required.	6256	$320k	2015/16	Project Manager
S1.1.10	Source	Source water receives treated effluent or untreated (leakage) from effluent ponds	Unlikely	Insignificant	Low	There are no known effluent ponds within source protection zone.								
S1.1.11	Source	Source water quality influenced by waste disposal down hole or bores	Rare	Insignificant	Low	Waste disposal down holes or bores within source protection zone. This is unlikely.								
S1.1.12	Source	Source water receives leakage of contaminants down abandoned or decommissioned wells	Rare	Insignificant	Low	Abandoned or improperly decommissioned wells within source protection zone. This is unlikely.								
S1.1.13	Source	Source water receives faecal matter from livestock or feral animals	Possible	Major	Extreme	Poor understanding of catchment. The majority of the catchments' area is not farmed or is low density stocked. Poor water quality results. Livestock and other animals within the catchments contaminate the source by direct and indirect run off.	Regional Fresh Water Plan and Clean Streams Accord encourage farmers to minimise contamination of water ways. Monitor water quality for evidence of health-significant contaminants. Significant dilution is available in the Lake to render any chemical run-off to <50% of MAV values and microbiological contamination to low levels under most circumstances.	Chief Engineer	Median E. *coli* count over 12 months > 500/100mL. Elevated levels of nitrate or nitrite in source water. Reticulated water not compliant with DWSNZ. Lack of knowledge of catchment/ recharge zone. Stock with access to source water.	Wanaka Yacht Club borefield stage 1: This will address LOS, fire-fighting capability and potentially reduce algae ingestion into reticulation. The two surface water intakes will remain. The borefield adds more resilience to the supply. UV will still be required.	6256	$320k	2015/16	Project Manager

Risks to Public Health							Preventative Measures List the measures that could be used to reduce the likelihood of each event happing. There needs to be at least one preventative measure for each cause.			Corrective Actions Actions to take if preventative measures fail.				
Ref	Process	Event	Likelihood	Consequence	Risk	Indicators / Cause	Preventative Measure	Responsibility / Delivered by	Sign that Action is Needed	Action	Project ID	Cost	Timeframe	Responsibility / Delivered by
S1.1.14	Source	Agrichemicals (including stock dip) or poisons enter source water	Unlikely	Moderate	Moderate	Agrichemicals used within the catchments' enter waterways to the lake. No chemicals likely to be transported near the lake.	Regional Fresh Water Plan and Clean Streams Accord encourage farmers to minimise contamination of water ways. Monitor water quality for evidence of health-significant contaminants. Significant dilution is available in the Lake to render any chemical run-off to <50% of MAV values and microbiological contamination to low levels under most circumstances.	Chief Engineer	Concentrations of agrichemicals > 50% of their MAV in the source water. Reticulated water not compliant with DWSNZ. Lack of knowledge of catchment/ recharge zone. Agrichemicals still being applied in a way that is likely to contaminate the source.	Wanaka Yacht Club borefield stage 1: This will address LOS, fire-fighting capability and potentially reduce algae ingestion into reticulation. The two surface water intakes will remain. The borefield adds more resilience to the supply. UV will still be required.	6256	$320k	2015/16	Project Manager
S1.1.15	Source	Contaminants washed into source water during irrigation	Unlikely	Minor	Low	Irrigation being undertaken within catchment. Heavy rain in catchment and/ high winds leads to elevated turbidity levels which enter treatment plant (note there is no treatment plant in Wanaka, chlorine dosed directly into the reservoirs).	Stormwater run-off is diluted by the lake volumes for the most part.	Chief Engineer	Farmers unaware of possible effects of irrigation. Development of algal blooms. Signs of salt migration into groundwater from the soil salinisation.					
S1.1.16	Source	Source water receives sediment and agrichemicals from forestry activities			#N/A									
S1.1.17	Source	Fertiliser enters source water during application	Unlikely	Insignificant	Low	Application of fertiliser in the catchment. Farmer unaware of the extent of the catchment. Poor fertiliser application practices.	Develop an understanding of the extent of the source catchment. Identify source protection zones. Gather information on the use of fertiliser in the source protection zone, and monitor water quality for evidence of health-significant contaminants. Where there is a high contaminant loading seek assistance from the council in reducing it. Inform farmers with property in the catchment or recharge zone of this, and the effects their activities can have on source water quality and correct fertiliser application practices.	Chief Engineer	Elevated levels of contaminants, including algae/ cyanobacteria, in source water. Treated water not compliant with DWSNZ. Poor fertiliser application practices in use.	Wanaka Yacht Club borefield stage 1: This will address LOS, fire-fighting capability and potentially reduce algae ingestion into reticulation. The two surface water intakes will remain. The borefield adds more resilience to the supply. UV will still be required.	6256	$320k	2015/16	Project Manager
S1.1.18	Source	Geothermal contaminants enter source water			#N/A									

Risks to Public Health							Preventative Measures List the measures that could be used to reduce the likelihood of each event happing. There needs to be at least one preventative measure for each cause.			Corrective Actions Actions to take if preventative measures fail.				
Ref	Process	Event	Likelihood	Consequence	Risk	Indicators / Cause	Preventative Measure	Responsibility / Delivered by	Sign that Action is Needed	Action	Project ID	Cost	Timeframe	Responsibility / Delivered by
S1.1.19	Source	Source water in contact with mineral deposits			#N/A									
S1.1.21	Source	Source water experiences algal bloom	Almost certain	Minor	High	Conditions are suitable for algal growth: elevated nutrient level, sunshine, warmth, relatively still water. Algal bloom due to seasonal turnover and nutrient enrichment. Wanaka experiences algal problems (not toxic), primarily in the summer and on occasion in winter. The algae can settle in the reservoirs.	Visual checks and algal cell testing during the most likely months from September to April if blooms are detected.	Network Operator (VW)	Elevated levels of contaminants (nutrients and toxins) in source water. Reticulated water not compliant with DWSNZ. Complaints of symptoms consistent with toxin poisoning.	Wanaka Yacht Club borefield stage 1: potentially reduce algae ingestion into reticulation. The two surface water intakes will remain. Consider routine sampling. Consider lamella plates and a small amount chlorine dosing or a coagulant to settle out the algae.	6256	$320k	2015/16	Project Manager
S1.1.22	Source	Not enough water available	Unlikely	Moderate	Moderate	Drought - Lake Wanaka presents an unlimited water supply source for the foreseeable future. Intake screens damaged/ blocked - no fine mesh intake screens are used. Intake screens are deeper than most activity on the lake. Resource consent limits reached or exceeded - daily abstraction rates are always within the water take limits. Major pump, power, control or pipeline failure. Serious sabotage or vandalism. Excessive consumer demand and leakage.	Generator available for power cuts. Most breaks can be repaired quickly by contractor. Plant located in a less conspicuous sites so do not attract serious unwanted attention other than tagging. A comprehensive Water Demand Management Plan completed. Plant intake flow rates are continuously measured by flowmeters to SCADA. Low flow pump alarms on SCADA warn the operator. Operator visits include overall utility check including pump aural and amperage checks. ORC monitors water takes under the resource consent process.	Chief Engineer & Network Operator (Veolia)	Drop in system pressure. Customer complaints about low pressure. Consent limits exceeded. Low or no flows / no water. No inspections or maintenance records.	Use reservoir storage in the short term if sufficient. Start water conservation measures as soon as water shortage becomes likely. Invoke water restrictions under the WDMP and Water Supply by-law. Consider an emergency supply plan in the event of prolonged loss of the supply. Upgrade capacity of the supply. A 1100m^3 reservoir to be placed adjacent to the existing Western Reservoir.	4065	$320k	2015/16	Project Manager & Network Operator (Veolia)
P1.2.1	Treatment	Not enough source water available for abstraction	Unlikely	Moderate	Moderate	Drought - water levels below intake pipes. Resource consent limitations.	No history of drought in Lake Wanaka. Start water conservation measures as soon as water shortage becomes likely. Plan the development and use of the water source and the need to identify and develop new sources.		Water demand. Drop in system pressure. Customer complaints about low pressure. Resource consent limits exceeded.					

Risks to Public Health							Preventative Measures List the measures that could be used to reduce the likelihood of each event happing. There needs to be at least one preventative measure for each cause.			Corrective Actions Actions to take if preventative measures fail.				
Ref	Process	Event	Likelihood	Consequence	Risk	Indicators / Cause	Preventative Measure	Responsibility / Delivered by	Sign that Action is Needed	Action	Project ID	Cost	Timeframe	Responsibility / Delivered by
P1.2.2	Treatment	Raw water quality too poor to treat	Possible	Minor	**Moderate**	Heavy rain and high wind leading to high levels of turbidity and organic matter in water entering the plant (reservoir in this instance). Turbidity levels can affect clorine levels, the chlorine dosing is increased (via monitoring FAC levels on the outlet) during high turbidity events. Usually these events are short lived. High algal content. Seasonal turnovers typical of deep lakes and reservoirs. Water level too low so forced to take poorly oxygenated water.	Take steps to allow close down of intake when necessary. Turn off treatment. Inspect catchment for signs of erosion and slips that will potentially be on-going problems. Surveillance of water quality and temperature as warning of the need to destratify the water body or apply algicide before a bloom develops. Plan for managing seasonal turnover of water.	Chief Engineer & Network Operator (Veolia)	Increased chlorine demand, difficulty in achieving FACE in treated water. High algal counts. Taste and odour problems.	Wanaka Yacht Club borefield stage 1: This will address LOS, fire-fighting capability and potentially reduce algae ingestion into reticulation. The two surface water intakes will remain. The borefield adds more resilience to the supply. UV will still be required.	6256	$320k	2015/16	Project Manager
P1.2.3	Treatment	Contamination of the lake or reservoir	Unlikely	Moderate	**Moderate**	Contamination source in the catchment (e.g. stock). Human or boat contamination in intake area. The reservoirs are well sealed and in good condition. The water is reliably chlorinated.	Identify potential sources of contamination when new source being selected. Zone the area and restrict access by signage and physical barriers. Emergency procedures in place until contamination is contained.		No survey of potential sources of contamination undertaken. High E.*coli* counts in raw water. No system for obtaining information about land use change.					
P1.2.4	Treatment	Too little water can be drawn from the intake to meet demand	Unlikely	Moderate	**Moderate**	Clogged or damaged screens due to excessive weed growth. Blockage of intake pipe by fish/ aquatic species. Failure of the intake structure due to mechanical or structural failure. Catastrophic failure (e.g. flood, slips or earthquake-related damage). Pump and / or power failure. Vandalism/ sabotage.	O&M procedures which includes regular inspections and preventative maintenance of the intake, screens and other facility assets. Telemetric alarm for low flows.	Network Operator (Veolia)	Reduced flow and / or no water. Damage to assets. Evidence of attempts to gain access to the intake/ assets. Failure of assets. No record of maintenance programme.	Wanaka Yacht Club borefield stage 1: This will address LOS, fire-fighting capability and potentially reduce algae ingestion into reticulation. The two surface water intakes will remain. The borefield adds more resilience to the supply. UV will still be required. The hatches are locked and secure. There is no fencing surrounding the Plantation or Western reservoirs but there is no history of vandalism. No further action required.	6256	$320k	2015/16	Project Manager

Risks to Public Health						Preventative Measures List the measures that could be used to reduce the likelihood of each event happing. There needs to be at least one preventative measure for each cause.			Corrective Actions Actions to take if preventative measures fail.				
Ref	**Process**	**Event**	**Likelihood**	**Consequence**	**Risk**	**Indicators / Cause**	**Preventative Measure**	**Responsibility / Delivered by**	**Sign that Action is Needed**	**Action**	**Project ID**	**Cost**	**Timeframe**	**Responsibility / Delivered by**
P2.1	Treatment	Contamination gets into the trunk mains	Possible	Moderate	High	Mains fail between intake and treatment (reservoirs in this instance) / pumpstation. Rising main breaks from poor condition or installation, or a catastrophic event. Poor repairs of breaks, leaks, incidental damage, and penetration of trunk mains. Repairs are carried out under strict Veolia hygiene practices (i.e. chlorination).	Carry out a condition monitoring programme. Lifelines work. Leak detection programme.	Network Operator (Veolia)	Unexplained or regular mains breaks. Unexplained water loss. Unexplained contamination. Difficulty in maintaining chlorine residuals. Regular observed leaks.	Wanaka reticulation renewals. Replace existing reticulation and facility assets as identified by valuation.	4189	$6.8m	2015 - 2025	Chief Engineer & Project Manager
P2.2	Treatment	Sediment containing contaminants stirred up	Unlikely	Minor	Low	Re-suspension of sediment at the intakes. Excessive raw water turbidity causes particle breakthrough. Sediment of biofilm allowed to develop. Velocity too high. Contaminated sediments are not likely to be in the reservoirs. Generally there is no biofilm in the network due to the chlorination of the water supply.	Turbidity is monitored at the intakes and logged to SCADA. Operators check turbidity manually during plant visits weekly and record on plant log sheets. Planned maintenance and inspections programme part of O&M contract.	Network Operator (Veolia)	Abnormally high turbidity of water reaching plant & at reservoir. High E. *coli* counts. Increasing nutrient levels. Algae of health significance present & visual evidence of biological growth. Elevated chlorine demand.	Contaminated sediments are not likely to be in the reservoirs. Generally there is no biofilm in the network due to the chlorination of the water supply. No action required.	O&M contract	O&M contact	On-going	Network Operator (Veolia)
P2.4.1	Treatment	No flow through the trunk mains	Possible	Moderate	High	Mains breaks or pump failures.	Carry out a condition monitoring programme. Lifelines work. Leak detection programme.	Network Operator (Veolia)	Loss of supply at reservoir. Unexplained or regular mains breaks.	Carry out a condition monitoring programme and a leak detection programme.	O&M contract	O&M contact	On-going	Chief Engineer
P7.1.1	Treatment	Not enough free available chlorine	Unlikely	Minor	Low	Dosing malfunction. Dose controller's sensor incorrectly calibrated. These are calibrated regularly. High chlorine demand + poor dose control. Chlorine supply exhaustion. This is unlikely as there are level alarms on the chlorine tank, with an auto switchover to a standby tank. Chlorine concentration is low due to age / poor quality. FAC monitoring equipment not calibrated. Power failure.	O&M and calibration of equipment. SCADA alarm for low FAC. Standby generator. Ensure spare chlorine on-site. Ensure chlorine kept in a cool, dark place.	Network Operator (Veolia)	FAC less than 0.2mg/L. E.*coli* detected. Pump failure. Monitoring inaccuracies.	Planned maintenance and inspections programme part of O&M contract. No action required.	O&M contract	O&M contact	On-going	Network Operator (Veolia)

Risks to Public Health							Preventative Measures List the measures that could be used to reduce the likelihood of each event happing. There needs to be at least one preventative measure for each cause.			Corrective Actions Actions to take if preventative measures fail.				
Ref	**Process**	**Event**	**Likelihood**	**Consequence**	**Risk**	**Indicators / Cause**	**Preventative Measure**	**Responsibility / Delivered by**	**Sign that Action is Needed**	**Action**	**Project ID**	**Cost**	**Timeframe**	**Responsibility / Delivered by**
P7.1.2	Treatment	Too much free available chlorine	Unlikely	Minor	Low	Dosing malfunction. Dose controller's sensor incorrectly calibrated. Low chlorine demand + poor dose control. Chlorine dose strength too high. This is no longer a problem due to the automated chlorine dosing system.	O&M and calibration of equipment. Alarm system to indicate when FAC concentration is outside designated limits.	Network Operator (Veolia)	Frequent calculations errors. FAC concentration is more than 50% of its MAV.	Planned maintenance and inspections programme part of O&M contract. No action required.	O&M contract	O&M contact	On-going	Network Operator (Veolia)
P7.1.3.1	Treatment	Excessive formation of chlorination by-products	Unlikely	Minor	Low	Natural organic matter present in the water being chlorinated. There is very little organic matter in the water to cause this.	Provision of treatment processes upstream to reduce levels of organic matter in the water.		Elevated TOC or colour. Elevated disinfectant by-product formation.					
P10.1	Treatment	Changes in pressure, or water hammer (pressure surges), suck contaminants into the water	Unlikely	Insignificant	Low	Transmission pump failure due to mechanical failure or overload. No water because of pump failure due to power failure. No water because of pump failure due to flooding or other damage.	Preventive maintenance programme in place. Planned maintenance (replacement of components as per manufacturer's recommendations). Duplicate pumps for critical applications. Install devices to lessen water hammer should it occur, e.g. surge tanks, air chambers, slow-closing check valves. Standby generator.	Network Operator (Veolia)	No water. Frequent pump breakdowns. Frequency of unacceptable pressure drops in the system. Maintenance log not kept. Non-compliance with DWSNZ. Reservoir levels are difficult to maintain.					
P10.2	Treatment	Incorrect chemical dosing leads to poor treatment	Unlikely	Moderate	Moderate	Pump failure. Process pumps do not add the correct chemical dose. Process pumps supplying water to monitoring instrumentation fail. There is no chemical dosing other than chlorine. The chlorine dosing system is automated and has an alarm system.	Preventive maintenance programme in place. Planned maintenance (replacement of components as per manufacturer's recommendations). Ensure pumps are fit for purpose. Duplicate pumps for critical functions. Calibrate dosing pumps.	Network Operator (Veolia)	Difficulty maintaining a chlorine residual in the treated water. Non-compliance with DWSNZ.					

Risks to Public Health							Preventative Measures List the measures that could be used to reduce the likelihood of each event happing. There needs to be at least one preventative measure for each cause.			Corrective Actions Actions to take if preventative measures fail.				
Ref	Process	Event	Likelihood	Consequence	Risk	Indicators / Cause	Preventative Measure	Responsibility / Delivered by	Sign that Action is Needed	Action	Project ID	Cost	Timeframe	Responsibility / Delivered by
P11.1	Treatment	Treatment plant cannot produce water of satisfactory quality	Likely	Minor	High	There is no 'treatment plant' in Wanaka. Chlorine is dosed at the reservoirs. Inadequate monitoring. Inadequate security measures to prevent vandalism. Unhygienic practices (i.e. separation between water & wastewater). Events affecting the source with the result the plant cannot treat the raw water. Power failure. Lack of chemical supplies due to industrial action. There is no treatment option for dealing with fluctuating turbidity.	Have redundancy / backup at the plant (assets, fuel etc). Undertake periodic inspections and maintenance. Staff aware of WSP. Provide a lockable fence / doors / hatches. Make sure staff are trained in the correct procedures for handling the chemicals used at the treatment plant.	N/A	Microbiological or chemical determinands fail to meet the requirements of DWSNZ. Signs of the beginning of structural failure. No spare parts available. Evidence of unauthorised entry. Unexplained deterioration in water quality. Power failure.	Wanaka Yacht Club borefield stage 1: This will address LOS, fire-fighting capability and potentially reduce algae ingestion into reticulation. The two surface water intakes will remain. The borefield adds more resilience to the supply. This will include UV treatment. Consider lamella plates and a small amount chlorine dosing or a coagulant to settle out the algae.	6256	$320k	2015/16	Project Manager
P11.2	Treatment	Treatment plant cannot produce enough water			#N/A	There is no 'treatment plant'. The reservoirs are dosed with chlorine.								
D1.1	Distribution	Not enough water in post-treatment storage to meet demand	Unlikely	Major	High	Insufficient supply of raw water. Inadequate post treatment storage capacity. Insufficient treatment capacity. High water demand and excessive water leaks leads to inadequate storage capacity. Structural failure of the reservoir (leakage). Low level alarms at reservoirs not communicating to pumps. Falling main failure through condition failure or earthquake / catastrophic event.	Reservoir low level probe is linked to SCADA and initiates plant start-up. Plant flows logged to SCADA daily. Records of consumer complaints (e.g. regarding low pressures or loss of supply) through the RFS database. Pumps have a standby generator. Implement the Water Demand Management Plan and Water Supply by-law to reduce water losses. Current modelling of Western Reservoir shows Wanaka does not need another reservoir at that location (from a demand perspective) however extra storage is still deemed appropriate by the contractor at Western and on occasion at Beacon Pt. The reservoirs are in good condition.	Network Operator (Veolia)	Low level alarms at the reservoir. No water. Loss of mains pressure.	Upgrade capacity of the supply. A 1100m3 reservoir to be placed adjacent to the existing Western Reservoir.	4065	$320k	2015/16	Project Manager & Network Operator (Veolia)

Risks to Public Health							Preventative Measures List the measures that could be used to reduce the likelihood of each event happing. There needs to be at least one preventative measure for each cause.			Corrective Actions Actions to take if preventative measures fail.				
Ref	**Process**	**Event**	**Likelihood**	**Consequence**	**Risk**	**Indicators / Cause**	**Preventative Measure**	**Responsibility / Delivered by**	**Sign that Action is Needed**	**Action**	**Project ID**	**Cost**	**Timeframe**	**Responsibility / Delivered by**
D1.2	Distribution	Introduction of contaminating material into service reservoir	Unlikely	Moderate	**Moderate**	Access by animals/birds. Sabotage or vandalism. Human access for sampling, etc.	District wide procedures for sealing, fencing and cleaning reservoirs are integrated into the O&M contract. Limit access to roof. Site security checks by the operator.	Network Operator (Veolia)	Taste and odour complaints. Visual inspection / evidence of contamination identified / entry of animals or birds.	The hatches are locked and secure. There is no fencing surrounding the Plantation or Western reservoirs but there is no history of vandalism. No further action required.	O&M contract	O&M contact	On-going	Network Operator (Veolia)
D1.3	Distribution	Development, or re-suspension, of sediment within tank or reservoir	Likely	Minor	**High**	Sediment/ slime accumulation and release due to rapid fill and poor cleaning. High rainfall events bring turbid water into the reservoir.	Chlorine residual provides protection against bacterial contaminants. Reservoir is in good condition and well-sealed against outside influence.	Network Operator (Veolia)	Visible slime/ sediment. Customers complain of slime/ sediment. FAC residual concentration < 0.2 mg/L. E. *coli* detected. Turbidity > 0.2 NTU. Regular cleaning required.	Cleaning reservoirs is not on the programmed maintenance schedule. Reservoirs are currently cleaned on a case by case basis. The reservoirs have never been cleaned due to the difficult nature of it. Western reservoir can be taken offline to be cleaned but Beacon Pt can't. Potable water divers could be used, and it would be best to do this in winter. Investigate need to clean the reservoirs and if it should be added to programmed maintenance schedule.	O&M contract	O&M contact	To be confirmed	Chief Engineer
D1.4	Distribution	Chlorine contact time too short	Rare	Minor	**Low**	Storage tank too small. Short circuiting.	High chlorine residual provides protection against bacterial contaminants.	Network Operator (Veolia)	E. *coli* detected despite adequate FAC residual concentration. Unexplained fluctuations in water quality.	Generator at reservoir sites provides redundancy. No action required.	O&M contract	O&M contact	On-going	Network Operator (Veolia)
D2.1.1	Distribution	Dissolution of chemicals from construction materials	Rare	Minor	**Low**	Inadequate flushing and routine maintenance. Poor quality materials. Inadequate maintenance or replacement of worn materials. Materials insufficiently resistant to dissolution by the water and the surrounding environment. The pipes are mainly made of PVC with the old part of town being predominantly made of AC.	Any new reservoirs or source need to have a procedure to manage this risk. Monitoring programme and flushing programme.	Network Operator (Veolia)	Customer complaints. Pipe deterioration or failure. High unaccounted for water use.	Issue the public notices (plumbosolvency and the need to flush taps) every 6 months. Investigate plumbosolvency testing in water as per DWSNZ 2005/08, S8.2.1.4.	Internal	To be confirmed		Chief Engineer

Risks to Public Health							Preventative Measures List the measures that could be used to reduce the likelihood of each event happing. There needs to be at least one preventative measure for each cause.			Corrective Actions Actions to take if preventative measures fail.				
Ref	**Process**	**Event**	**Likelihood**	**Consequence**	**Risk**	**Indicators / Cause**	**Preventative Measure**	**Responsibility / Delivered by**	**Sign that Action is Needed**	**Action**	**Project ID**	**Cost**	**Timeframe**	**Responsibility / Delivered by**
D2.1.2	Distribution	Germs enter the distribution system through failed construction materials	Unlikely	Moderate	**Moderate**	Deterioration of distribution system through material or installation failure modes. This could lead to ingress of micro-organisms when system pressures fluctuate and go negative. Biofilm development sustaining pathogens. However chlorine residual in the network assists with preventing contamination.	The network is in good condition. Establish a higher confidence in current asset condition, deterioration profiles, leakage etc. Record incidences of pipe failure and repairs undertaken in Hansen. Maintain positive system pressures. Hydraulic modelling. Planned maintenance and inspections programme part of the O&M contract.	Network Operator (Veolia)	Customer complaints. Pipe failures, particularly in high pressure areas.	Condition assessment programme.	O&M contract	O&M contract	On-going	Chief Engineer & Network Operator (Veolia)
D2.1.3 and .4	Distribution	Entry of chemical contaminants through pipe materials	Unlikely	Moderate	**Moderate**	Inappropriate materials in use. Loss of water and negative pressure could bring in contaminants. The pipes are mainly made of PVC with the old part of town being predominantly made of AC.	Increase the awareness of this risk through procedures. Product selection in certain areas where the risk of absorbtion into PE pipes is high. Monitor leakage and asset condition. The network is in good condition. Record incidences of pipe failure and repairs undertaken in Hansen.	Network Operator (Veolia)	Customer complaints. Concentrations of chemical contaminants are more than 50% of their MAV. Mains failure. Increased deterioration on assessed mains.	Condition assessment programme.	O&M contract	O&M contract	On-going	Chief Engineer & Network Operator (Veolia)
D2.2.1	Distribution	Introduction of contamination by pressure fluctuations	Possible	Moderate	**High**	High demand causing low pressure areas and backflow risk. Burst or leaking mains causes water and pressure loss. Unpredicted events such as a major fire. There is very little backflow prevention in the network with the exception of new sub-divisions. Algae in the water supply is making backflow prevention devices less effective.	Emergency water restrictions. Condition assessment of assets. Record incidences of pipe failure and repairs undertaken in Hansen. Veolia monitors pressure via network flowmeters and pressure transducers. Pressure readings are linked to SCADA and can be viewed via the ASPEX GUI.	Network Operator (Veolia)	Mains failure. Pressure fluctuations. E.*coli* detection.	Carry out water modelling to identify potential problem pressure areas. A water pressure field survey is planned from December 2015. This information will feed in to re-building the water models. Leak detection programme.	To be budgeted	To be budgeted	To be scheduled	Chief Engineer

Risks to Public Health							Preventative Measures List the measures that could be used to reduce the likelihood of each event happing. There needs to be at least one preventative measure for each cause.			Corrective Actions Actions to take if preventative measures fail.				
Ref	Process	Event	Likelihood	Consequence	Risk	Indicators / Cause	Preventative Measure	Responsibility / Delivered by	Sign that Action is Needed	Action	Project ID	Cost	Timeframe	Responsibility / Delivered by
D2.2.2	Distribution	Re-suspension of sediment or biofilm within the mains by pressure fluctuations	Unlikely	Minor	Low	Sediment or biofilm allowed to develop. Significant fluctuations in reticulation pressure. There are few pressure fluctations and biofilm in the network (due to chlorine residual).	Pipe scouring and jetting programme records kept. Prompt attention by Veola to discoloured water complaints via the RFS customer service at Council. Public notices re plumbosolvency and the need to flush taps. VW monitors pressure via network flowmeters and pressure transducers. Pressure readings are linked to SCADA and can be viewed via the ASPEX GUI.	Network Operator (Veolia)	Customer complaints about pressure and quality. Concentrations of chemical contaminants > 50% of MAV.	Generally there is no biofilm in the network due to the chlorination of the water supply. No action required.	O&M contract	O&M contract	On-going	Network Operator
D2.3.1	Distribution	Introduction of contaminating material into the distribution system	Possible	Moderate	High	Breaks, leaks, incidental damage to mains. System pressure drop. Standard hygiene practices not adopted. Inadequate flushing and disinfection practices. Flow direction in affected area unknown or uncontrollable. Inappropriate materials used. Cross connections are not seen to be an issue in Wanaka. Unsatisfactory location of water reticulation pipes. There is no enforcement of unauthorised water takes. Water carts often take water for dust suppression.	Planned maintenance & inspections programme part of the O&M contract. Quality plan and training programme. Hydraulic modelling and pressure testing to identify risk areas of network. Improve asset knowledge.	Network Operator (Veolia)	Customer complaints about pressure and quality. E.*coli* detected. Failure to meet the requirements of DWSNZ 2005/08.	Sunrise Bay pond is fed by the reticulation. This has been identified as a risk. Turn off and cap.	O&M contract	O&M contact	2015/16	Network Operator (Veolia)
D2.3.2	Distribution	Re-suspension of contaminants in sediments in the distribution system			#N/A									
D2.3.3	Distribution	Development of sediment or biofilm	Unlikely	Minor	Low	Inadequate cleaning programme. Poor microbiological water quality leaving the treatment plant and into the network. Poor repair practices allowing colonisation. Water flows too low resulting in the decay of chlorine and microbiological colonisation of surfaces. There is little biofilm in the network (due to chlorine residual).	Prompt attention by Veolia to discoloured water complaints. Public notices re plumbosolvency and the need to flush taps.	Network Operator (Veolia)	Customer complaints about pressure and quality. Failure to meet the requirements of DWSNZ 2005/08.	No action required. Very little biofilm build-up due to chlorine residual.	To be budgeted	To be budgeted	To be scheduled	Chief Engineer

Risks to Public Health							Preventative Measures List the measures that could be used to reduce the likelihood of each event happing. There needs to be at least one preventative measure for each cause.			Corrective Actions Actions to take if preventative measures fail.				
Ref	**Process**	**Event**	**Likelihood**	**Consequence**	**Risk**	**Indicators / Cause**	**Preventative Measure**	**Responsibility / Delivered by**	**Sign that Action is Needed**	**Action**	**Project ID**	**Cost**	**Timeframe**	**Responsibility / Delivered by**
D2.3.4	Distribution	Failure to maintain sufficient water pressure	Unlikely	Minor	Low	Insufficient water available from the source, treatment plant or post treatment reservoir. Leaks in the reticulation network. Transmission pump failure. Water pressure level of service generally met apart from a couple of areas such as Mt Aspiring Rd.	See Guides regarding abstraction of water from sources (P1 series), pre-treatment storage (P3), design and construction of the treatment plant (P11) and post-treatment storage (D1).	Network Operator (Veolia)	Customer complaints about pressure and quality. Low pressure and low flow.	This is not much of a problem. No action required.	O&M contract	O&M contact	On-going	Network Operator (Veolia)
D2.4.1	Distribution	Water pressure in the distribution system lower than pressure in supplied premises	Unlikely	Minor	Low	A pressure drop in the reticulated system. An elevated pressure in the premise(s) supplied as compared to the reticulated system. Backflow risk. Question raised over whether or not there is a chance the booster system would feed back into the network.	Installation of backflow preventers. Risk reduced through accuflow meters, risk remains at high risk land user (industrial).	Network Operator / Chief Engineer	Unexplained fluctuations in chemical and microbiological water quality. E. *coli* or coliforms detected. Concentrations of targeted chemical determinands are more than 50% of their MAV.	This is not much of a problem. No action required.	O&M contract	O&M contact	On-going	Network Operator (Veolia)
D2.4.2	Distribution	No, inadequate, faulty, or incorrectly installed backflow prevention device	Possible	Moderate	High	No, or faulty, backflow devices installed. Water Carriers introduce contaminants while filling up tankers. An illegal cross connection. All wastewater pumpstation washdowns have backflow prevention, either acuflows or non-return valves.	Council policy (in Bylaw) on backflow prevention requires existing at-risk commercial consumers to have backflow preventers installed. Pressure in the retic is generally maintained at 300 kPa. Controls on taking of water from Council hydrants. Compliance with S11 DWSNZ 2005 Tankered Drinking water compliance criteria. Check reticulation pressures under high demand in known vulnerable areas. Veolia test network BFPs annually but it is up to property owners to test private ones under the WOF requirements.	Chief Engineer	Auditing of work highlights failure. No indicator of land use changes through consenting processes. No policy in place to provide mandate for monitoring.	Identify backflow risk in the District. Talk to the Building inspectors about process for checking commercial premises for backflow testing (WOF).	Internal	Internal	2016/17	Manager - Strategy & Performance / Environmental Consents Officer
G1	General	Inadequate staff training	Unlikely	Moderate	Moderate	Failure of staff to follow QLDC QA procedures. Inadequate staff training in correct procedures.	Training programme in place and monitored (training attendance and levels). Regular staff training for new staff in particular in correct methods by VW. Regular refresher and induction training for new staff.	Network Operator / Chief Engineer	Training programme in place and monitored (training attendance and levels). Regular staff training for new staff in particular in correct methods by VW. Regular refresher and induction training for new staff.	Continue with a training needs assessment and training recording system for staff. Train all staff to National Diploma or National Certificate levels as detailed in the WSP.	Internal & O&M contract	Internal & O&M contract	On-going	Network Operator / Chief Engineer

Risks to Public Health						Preventative Measures List the measures that could be used to reduce the likelihood of each event happing. There needs to be at least one preventative measure for each cause.			Corrective Actions Actions to take if preventative measures fail.				
Ref	Process	Event	Likelihood	Consequence	Risk	Indicators / Cause	Preventative Measure	Responsibility / Delivered by	Sign that Action is Needed	Action	Project ID	Cost	Timeframe	Responsibility / Delivered by
G2	General	Incorrect water quality data used for supply management	Possible	Moderate	High	Delay in obtaining test results from lab. SCADA failure – no data received. Water Safety Plan not properly understood and followed by staff or not reviewed on schedule. Failure of staff to follow the analytical method and other related quality assurance procedures. Inappropriate/ incorrect sampling and / or calibration. Inadequate or incorrect monitoring records. Failure of staff to follow the analytical method and other related quality assurance procedures. Use of a non-MoH-approved laboratory.	Training programme in place and monitored. Regular monthly audit of Contractor performance under the O&M contract to ensure the required 'Levels of Service' are met. Only an MoH approved laboratory is used, (Watercare), and alert notices for non-compliant test results. SCADA monitors continuously and alarms are raised. Include key staff in the WSP process and provide training before and during implementation. WSP reviewed as per the WSP schedule. Advise the lab of any incorrect or erroneous results. Carry out E. coli follow-up sampling following all transgressions. Update the O&M manual when deficiencies are found.	Network Operator (Veolia) / Chief Engineer	Auditing of procedures highlights failures.	Build lab results database that will house all water quality and environmental data.	To be confirmed		2015/16	Environmental Consents Officer

8.2 Catchment Risk Categorisation

The following text is a direct extract from the Ministry of Health "Guidelines for Drinking-water Quality Management for New Zealand, 2013."

"There are two approaches for determining the protozoal risk categorisation of surface waters, see DWSNZ sections 5.2.1.1 and 5.2.1.2, and both require a five-yearly review, see section 8.2.6.

a) **Catchment risk category approach (Guidelines section 8.2.3)**

This is the default option for supplies serving a population up to 10,000, and is based on assessing the perceived risk related to the surface water catchment categories as defined in DWSNZ Table 5.1a. Should a water supplier consider the assignation of the log credit requirement to be inappropriate, any appeal must be supported by data obtained by monitoring *Cryptosporidium* (see b).

b) **Measurement of *Cryptosporidium* oocysts approach (Guidelines section 8.2.4)**

This is the default option for supplies serving a population over 10,000, and is based on matching the mean oocyst concentration with the log credit categories in Table 5.1b of the DWSNZ. Should the water supplier consider this approach to have led to an inappropriate log credit requirement, the log requirement based on the perceived risk related to the surface water catchment categories as defined in section 5.2.1.1 and Table 5.1a may be adopted.

Note that all water suppliers conduct catchment assessments as part of their water safety plan process, and this is an ongoing process. Catchment assessments are intended to consider all aspects that may impact on the quality of the raw water and the security of the supply. Information from the initial catchment assessment will have been used in the selection of the water treatment plant site and design. Protozoal risk categorisation only considers those activities that may affect the number of *Cryptosporidium* oocysts.

To achieve a balance between accuracy and costs, the monitoring programme must comprise at least 26 samples collected over a 12-month period at approximately equal time intervals to attempt to ensure representative samples and minimise seasonal bias. The samples must be tested quantitatively for *Giardia* cysts and *Cryptosporidium* oocysts. Subject to laboratory and delivery services, samples should be taken to cover every day of the week and must cover at least Monday to Friday three times during the sampling programme; this has been discussed further in Chapter 17: Monitoring, section 17.2. The results from the monitoring programme must be reported to the DWA who will assign the log credit requirement.

The DWA must be informed of the year's monitoring plan before it starts, and any changes to it must be agreed with the DWA before the changes are made. This is to avoid samples being taken intentionally at times when the concentrations of oocysts in the raw water are expected to be low.

The sampling location must meet a number of criteria (see DWSNZ section 5.2.2). These are designed to ensure that the samples are representative of the water quality entering the first treatment process for which log credits will be claimed. If water taken from the source at the point of abstraction does not undergo any changes in quality before treatment, then the untreated water may be obtained from this location. Where water is drawn from multiple sources, samples must be taken from the combined flow.

To assist in understanding the relationships between catchment activities and Cryptosporidium oocysts levels, it would be helpful to collate the following additional information when samples are collected:

1 weather conditions, or the operation of irrigation systems, in the catchment or recharge zone on the day the sample was collected and on each of the two previous days

2 for surface waters, the turbidity, a description of the source water quality (visual appearance) and how this compared with the water quality during fine weather, and river flow/river height

3 for all sources, the date and time of sampling

4 which sources are in use at the time of sampling if the treatment plant is fed from multiple sources

5 other factors that might influence the level of raw water contamination, such as irregular or seasonal land-use activities, and precedent weather.

The words "*The protozoa monitoring programme must be repeated at least five-yearly intervals*" can be interpreted more reasonably as:

The protozoa monitoring programme must be repeated in response to:

- **a change in catchment activities that indicates a likely increase in oocyst numbers; or**
- **an intention by the water supplier to employ a protozoal treatment with a reduced protozoal log removal rating; or**
- **an outbreak of waterborne protozoal infection linked to the water supply that is not explained by a lapse in protozoal treatment."**

QLDC is following option b) measurement of *Cryptosporidium* oocysts approach for assessing catchment risk / protozoal risk.