Wanaka Airport Water Supply Water Safety Plan

Final

September 2015

QUEENSTOWN LAKES DISTRICT COUNCIL

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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 Airport Water Supply. This includes taking "all practicable steps" towards compliance with DWSNZ 2005 (Revised 2008), by I July 2015. Planning for risk, in all forms, is regarded as an outcome of good asset management.

The Wanaka Airport Water Supply is registered with the Ministry of Health (MoH) with the Water Information New Zealand (WINZ) Community Code of WAN007.

A draft PHRMP was developed for Wanaka Airport in 2011. The 2011 PHRMP was based on a compliance date of June 2012 under the dates originally enacted in 2007.

This document is to be read in conjunction with the 3-Waters Asset Management Plan (AMP) and Wanaka Airport Bore Operations and Maintenance Manual. These documents can be viewed at the QLDC office.

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
New Drinking-Water Suppliers	-	1 July 2009	1 July 2012
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

1.2 The Development Process

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

A workshop was held on 2 February 2015 with key QLDC staff and network operators, to carry out a risk assessment of the Wanaka Airport Water Supply.

Those were:

QLDC Staff

- Melanie Heather, Environmental Consent Officer
- Nichola Greaves, Project Manager

Veolia Water (VW)

- Jason Thorburn, Wanaka Supervisor

Wanaka Airport

- Ralph Fegan, Operations 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

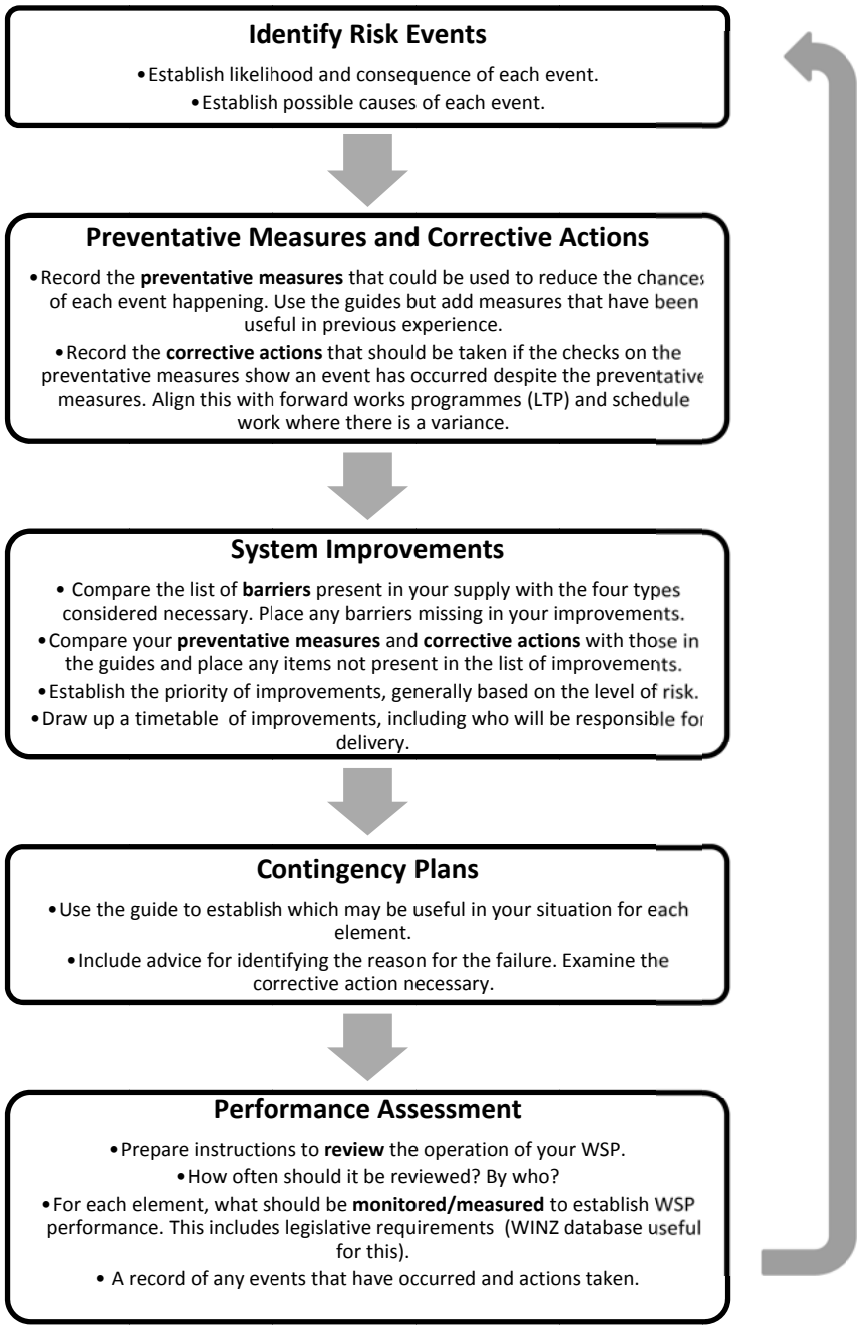
The HDWAA requires all drinking-water suppliers providing drinking-water to over 101 people to develop and implement a PHRMP, now WSP. Specifically, the purpose of this part of the Act is to protect the health and safety of people and communities by promoting adequate supplies of safe and wholesome drinking-water 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))

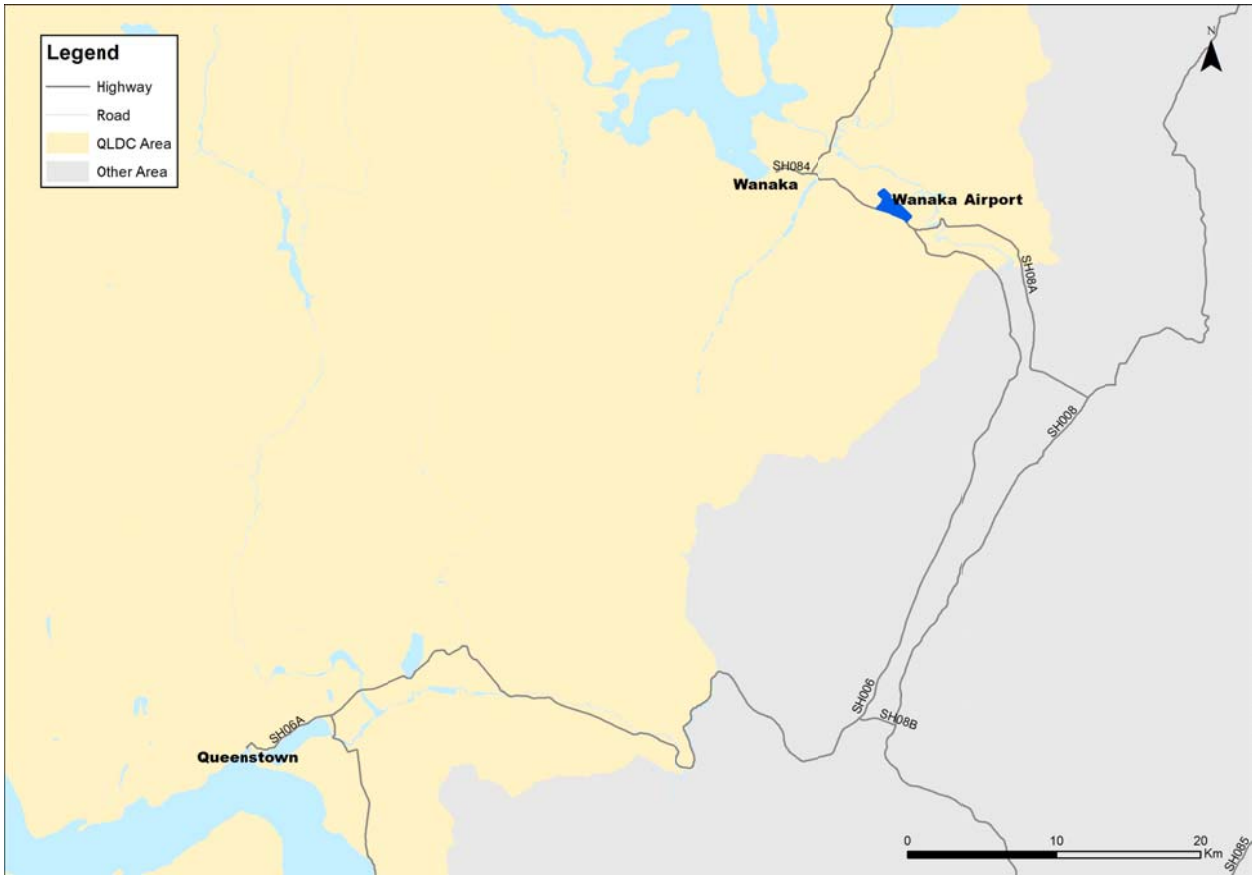


2 Description of Water Supply

2.1 Overview

The existing development at Wanaka Airport covers approximately 37 hectares of land, located 9 km to the east of Wanaka on the Wanaka-Luggate Highway.

Figure 2 Location of Wanaka Airport Water Supply



The Wanaka Airport scheme was commissioned in 1995. Raw water is abstracted from one bore located within the hangar area in Wanaka Airport, 150m from the Wanaka–Luggate Highway, about 2.9km north-west of Luggate, and 9km south east of Wanaka Township.

Water is abstracted at a maximum allowable take of 240,000 L/day. Water is pumped from a bore to one Council owned 25,000 L concrete tank. There is no water treatment.

The water is then pumped directly into reticulation that supplies:

- Approximately 12 hangars;
- Airport office building;
- A café; and
- Irrigation network along the Airport hangar area.

Potable water is delivered to an individual water storage tank at each hangar located at the airport. The Airport Café, Airport Office building, and the irrigation network along the Airport hangar area is supplied on-demand.

It is understood the existing bore can deliver up to 100,000 L/day during peak periods, with the majority of water being used for irrigation purposes. A new irrigation system is currently being

installed which will use Project Pure's treated effluent for irrigation purposes on the airside of the Airport only. This will reduce demand on the Wanaka Airport bore.

The community currently consumes 17,000 m^3/year with an average daily volume[1] of 53 m^3.

It should be noted that the recent and future developments (1 section left vacant) of the Airport will impact on the existing water and wastewater infrastructure. Investigations are underway to determine the feasibility of upgrading the water and wastewater services at the Airport, including a sewer connection to Project Pure WWTP and connecting to the Luggate Water Supply. At this time, future infrastructure upgrades or changes have not been considered in this WSP.

2.2 Catchment

Wanaka Airport is situated on a terrace above the Clutha River and is generally flat to gently rolling with little surface drainage. The land drops away to the east (towards Luggate) and north (towards the Clutha River), while the topography steepens in the upper catchment towards the Criffel Range. The catchment is approximately 212 hectares.

Median annual rainfall to the area is generally between 651 and 700mm[2]. The air temperature ranges from 5.1°C in winter (July – Sept) to 16°C in summer (Jan-March).

Soil in the catchment area and surrounding land comprises Luggate sandy loam of shallow depth (20-45cm)[3] that are undulating in nature.

The Wanaka Airport bore extracts raw water from the Wanaka Basin Cardrona Gravel Aquifer (Figure 3). The aquifer extends from Wanaka township in the northwest to Luggate in the south east and is bounded by the Clutha River/Mata-Au and Lake Wanaka to the north and the Criffel Range to the south. Although a detailed groundwater level survey has not been undertaken in the immediate vicinity of the bore site, it is inferred that groundwater flows towards the Clutha River to the north east[4]. Groundwater from the Wanaka Basin Cardrona Gravel Aquifer is mainly used for irrigation, stock water supply as well as potable supply.

The water supply bore is located in an area designated for Airport use under the Queenstown Lakes District Plan. The main surrounding land use, both up and down gradient of the water supply bore site, appears to be limited to grazing of sheep and deer.

The majority of the airport land is covered by grassed open space, a runway, and buildings used by for aviation maintenance, tourism/commercial, and domestic passenger arrival and departure terminal. Buildings occupy an area restricted to approximately 11 hectares of land directly adjacent to the road. Adjacent to the airport site is the Wanaka Toy and Transport Museum and the New Zealand Fighter Pilot Museum. This land is zoned Rural Visitor. One other commercial development in the area is the 'Have A Shot' shooting range, located immediately to the south of the Airport, across the Wanaka-Luggate Highway.

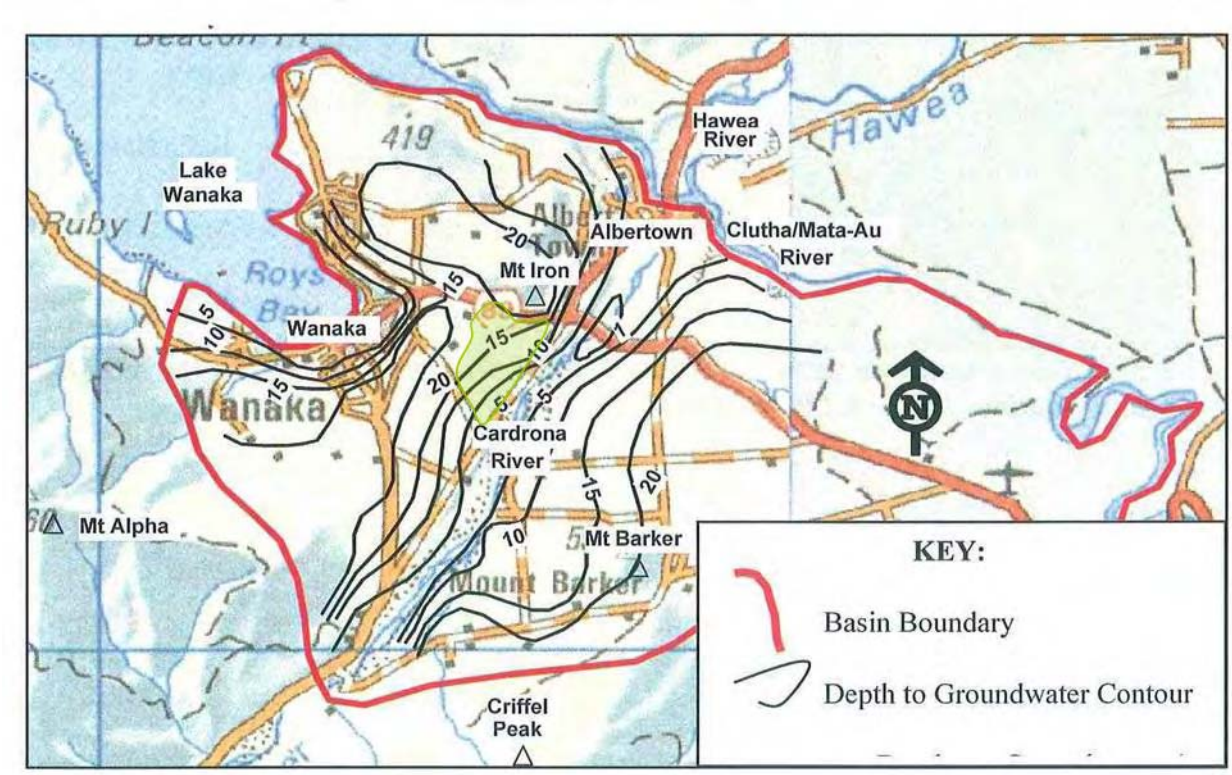
The 'Have A Shot' shooting complex comprises a shotgun and rifle range, as well as other activities such as archery. Lead contamination of land and water associated with lead shot from clay target shooting is now documented in New Zealand[5]. In addition, clay targets typically contain Polycyclic Aromatic Hydrocarbons (PAH), a carcinogenic compound, to bind the clay targets together. Research

[1] SCADA
[2] Grow Otago, Otago Regional Council
[3] Grow Otago, Otago Regional Council
[4] Otago Regional Council, 2003: Wanaka Basin Groundwater Modelling Report – Draft
[5] Environment Canterbury, 2006: Potential for PAH contamination clay target debris at shooting sites. Report No. U06/81

indicates that the PAH compounds are tightly bound within the targets and are unlikely to leach into the environment[6]. Therefore clay targets present a low risk to groundwater.

Although the quantities of lead shot in the soil at the site are unknown, there will be movement of lead from the topsoil in water draining through the soil. However, subsoil may provide some degree of retardation of lead movement. There is potential for lead to enter groundwater, although the risk of lead contamination is low considering the depth to groundwater at the site is in excess of 60m below ground[7]. It should be noted that there is potential for arsenic and antimony to be leached.

Figure 3 Wanaka Basin Aquifer Boundary



Airport wastewater is disposed of via approximately eight septic tanks. The closest septic tank to the water supply bore is 20m to the north east. In addition, two to three hangars discharge effluent to on-site holding tanks, which are serviced regularly with effluent being taken off-site for final disposal. The budget for connecting Wanaka Airport to Council's Project Pure WWTP has yet to be confirmed by Council.

Project Pure WWTP and Discharge Field lie 800m to the north of the water supply bore. It is not considered that the Wanaka Airport water supply bore is located within the effluent plume area, should the Project Pure WWTP malfunction.

Stormwater is collected via kerb and channel arrangement near the entrance to the Airfield. Stormwater from sealed access roads is directed to either two soak holes located at the intersection of Lloyd Dunn Avenue and Airport Way, or direct infiltration to ground.

[7] Rooney, C: Contamination at Shooting Ranges, www.lead.org.au.

2.3 Process Description

2.3.1 Source

The water supply for Wanaka Airport is sourced from one bore that draws groundwater from an unconfined aquifer underlying the area. Water is abstracted from one 68.23m deep 100mm diameter steel cased bore.

The borehead is located inside a concrete chamber sunk 850mm below ground level. The borehead chamber is covered against water ingress by the slightly raised concrete chamber lip and a heavy steel lid. The lid is locked. However the borehead itself is not sealed and poses a risk to contaminate entry into the bore. The borehead is not located in a flood prone area and is located at significant distance from the Clutha River, 1700m to the north - north east.

- The bore is located:
  - Approximately 10m from a chemical storage shed;
  - Approximately 150m from four underground fuel storage tanks used to refuel aircraft;
  - Directly adjacent to a gravelled carpark and Lloyd Dunn Ave, which is the access road to the Airport Hangars;
  - Approximately 150m from Wanaka-Luggate Highway;
  - A number of individual on-site septic tanks.

The current underground fuel storage tanks are due to be decommissioned in April 2015. A new fuel facility will be built airside. This will contain a 50,000L jet fuel tank and a 50,000L aviation gas fuel tank.

The borehead has backflow protection and a flowmeter. The flowmeter was installed during the 2013 upgrade and is located in a chamber beside the bore.

The borehead is not fenced to prevent access by the public or animals. However, to date there has been no known interference with the borehead and it is unlikely that stock will be within the confines of the Airport.

A Grundfos SP8A-25-3 submersible bore pump is installed in the bore, capable of pumping 2.8 litres per second. The current bore pump replaced an older pump of the same type and was installed in 2009. The current pump is reliable and no major servicing has been necessary to date.

There is no standby generator to power the pumps in case of power failure, nor is there the ability to plug in a mobile power generator. To date, most power failures are infrequent and of short duration only.

Water is pumped from the bore into a 25,000L covered concrete storage tank (reservoir) located directly adjacent to the bore. The bore and bore pump are considered to be in good condition.

The booster pump is located adjacent to the borehead and the storage tank. This pumping system, was installed in 2008. The purpose of this pump is to pressurise the reticulation network to acceptable levels to meet domestic demand. Firefighting capability is questionable. The booster pump is controlled by a pressure switch.

Raw water from the bore is analysed weekly as per the DWSNZ for pH, turbidity, E.*coli* and total coliforms. There were no E.*coli* exceedances in the 2013/14 year however there was an E.*coli* exceedance in the Airport reticulation in January 2015.

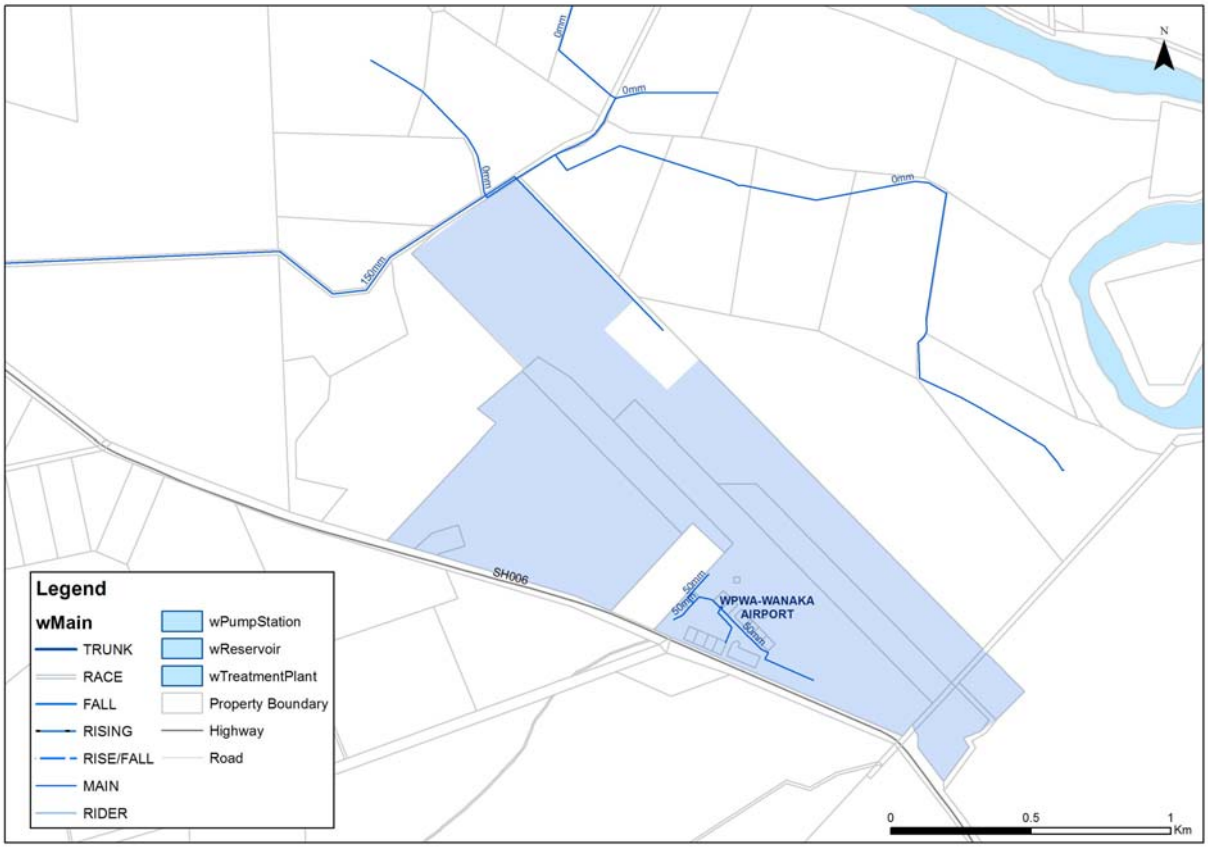
Water quality is generally very good with results of data collected between 2007 and 2010 summarised as follows:

	Total Ammonia-N	E. *Coli*	Nitrate-Nitrogen	Dissolved Reactive P	Total Nitrogen	Total P	Total Coliforms
	mg/L	cfu/100ml	mg/L	mg/L	mg/L	mg/L	cfu/100ml
Average	0.007	<1	0.599	0.006	0.65	0.0097	2.52
Maximum	0.03	<1	0.7	0.015	0.73	0.02	21
Minimum	<0.005	<1	0.04	<0.005	0.52	0.005	<1

2.3.2 Treatment

There is currently no treatment in place. Veolia Water (VW) has a mobile chlorinator to allow for emergency chlorination into the reservoir, or mains if required. However the emergency chlorinated cannot be installed without an upgrade of the pump shed.

Figure 4 Overview Map of Wanaka Airport Water Supply



2.3.3 Storage

Water is pumped from the bore to a 25,000L concrete storage tank. The storage tank was built in 1995 and is considered to be in good condition.

The reservoir level is not monitored by the SCADA system. Flows are monitored continuously by the SCADA system however there are no alarm set points.

A 30,000L plastic storage tank is also located adjacent to the borehead to provide for firefighting purposes only. It is not used to supply for potable water and is not connected to the potable water supply system.

2.3.4 Distribution

From the main storage tank, water is pumped around the Airport via alkathene pipes of approximately 50mm diameter and delivered to individually owned storage tanks located on each hangar site. The tanks on each property are 20,000L plastic tanks. Supply to individual buildings is via isolating valves on the water main to a ball-cock in each storage tank. There is one property, Wanaka Helicopters, that does not have a storage tank. There is a risk that this property does not receive water as it does not have its own onsite storage like the rest of the properties.

The Wanaka Airport distribution network was installed in approximately 1999. No major leaks or pipeline failures have been recorded since installation of the reticulation system. The reticulation is understood to be in reasonably good condition.

Irrigation pipes are connected directly to the water main, which are supplied on demand directly from the bore. It is unknown if existing connections and irrigation connections connected to the main supply have suitable backflow prevention devices installed. There is a switch located in the pump shed to turn the irrigation system on/off.

QLDC currently have 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 Airport Water Supply is owned and managed by QLDC. The daily operation and maintenance of the supply is outsourced under contract to VW. The responsibilities of VW are contained within the latest Management, Operation and Maintenance of Utilities Contract document dated 1 July 2011 and the Wanaka Airport Bore Operations and Maintenance Manual.

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

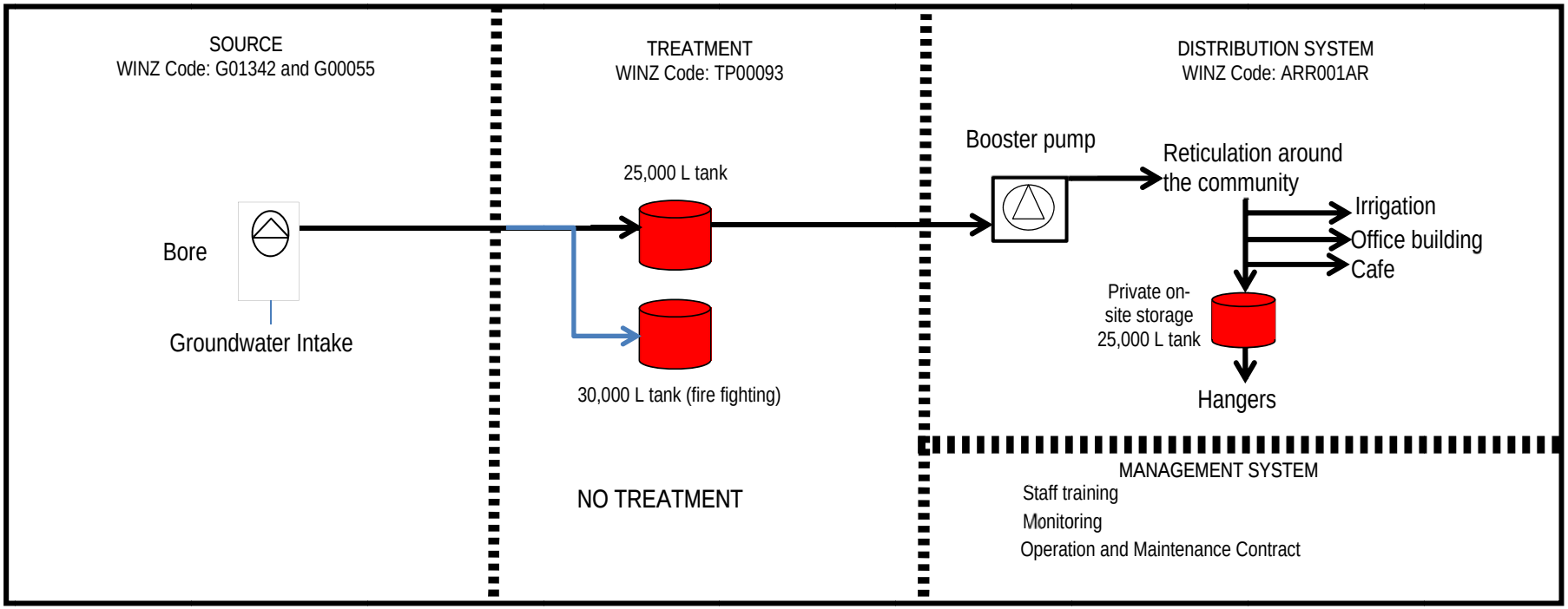
Infrastructure Management (executive)	Registered Chartered Engineer (civil)
Water Services Management	Bachelor of Engineering (civil)
Water Services Engineering & Investigation	National Certificate in Water Treatment or
	National Diploma in Drinking Water Assessors Assessment or
	National Certificate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



Borehead under steel lid, plastic firefighting storage tank & concrete storage tank (reservoir)

Borehead within concrete chamber. Borehead itself not sealed.

Plastic storage tanks like this one are located on each property for storage & firefighting.

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 Airport Water Supply to prevent contaminants reaching the public are tabulated below.

Table 2 Wanaka Airport Barriers to Contamination

Barriers to:	Action or supply elements contributing to these barriers	Description	Barrier Effective?
Stop contamination of raw water	• The bores draw from a deep (>60m bgl) unconfined aquifer. • Potential contamination sources nearby (Airport fuel tanks).	• Bore draws from an unconfined aquifer and is therefore considered as using unsecure groundwater. Bore security could be achieved if Sections 4.5.2.2 and 4.5.2.3(1) are met. This will include: o 12 months of no E.*coli* detection. o The borehead must be judged to provide satisfactory protection by a person recognised as an expert. o The borehead must be sealed at the surface to prevent the ingress. o Animals must be excluded from within 5m of the borehead. o Potential sources of contamination such as septic tanks or other waste discharges must be situated sufficiently far from the bore so contamination of the groundwater cannot occur. o Age testing. • Borehead not sealed. Bore is not fenced to limit human or animal access but it does have a secure locked metal lid. Unlikely animals will be within the confines of the Airport. • 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.	• The water is naturally filtered through deep gravels. • There is no treatment for the supply including an additional filtration process for removing particles if present. • Turbidity is measured by grab sample weekly. Turbidity is generally low.	**Partially Effective**

Barriers to:	Action or supply elements contributing to these barriers	Description	Barrier Effective?
Kill bacteria/ protozoa in the water	• 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 Figure 4.1 / 4.2 of the DWSNZ 2005/08.	• Emergency chlorination can be injected into the tank but this offers limited protection against *Cryptosporidium*. • There is no disinfection by chlorine, chlorine dioxide or UV treatment (protection against protozoa).	Absent
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 incomplete. • Water carriers are not registered or checked for backflow protection.. • Backflow prevention is not consistent and checking of installed devices is not assured under current procedures. • A list of Council backflow preventers is maintained within Council's AMS.	Absent

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 Arrowtown 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 2012/13	Comments
	Criteria	Monitoring Requirements		
Bacterial Compliance				
***E. coli* Treatment Plant Monitoring**	1	Frequency = weekly Max days between samples = 13 Min days of week used = 5 Total number of samples required per year = 52	Compliant for Criteria 1	VW sample 1.5 times per week (80 samples taken in the 2013/14 monitoring year) which is compliant with DWSNZ 2005/08 Table 4.2a.
***E. coli* Distribution Zone Monitoring**	6A	Frequency = 3 per quarter Max days between samples = 45 Min days of week used = 2 Total number of samples required per year = 12	Compliant for Criteria 6A	Distribution zone sampling is compliant with weekly *E. coli*, pH and turbidity samples taken from one site in the reticulation at the remote end as required by DWSNZ 2005/08. Sampling is scheduled in WINZ 5.5. The schedule is designed to have at least 10% more samples in the quarter to help reduce the risks associated with transportation and event management. 63 samples were taken through the 2013/14 year.
Bore Water Security		Borehead must be sealed. Animals must be excluded from within 5m of the borehead. Contaminant sources and migration pathways must be addressed in the WSP.	Not Compliant	Bore draws from an unconfined aquifer and is therefore considered as using unsecure groundwater. Borehead is not sealed. Bore is not fenced to limit human or animal access but it does have a secure locked metal lid.
Protozoal Compliance				
	TBC	Dependant on log credit agreed by DWA and additional treatment process chosen.	Not Compliant	No treatment plant upgrades planned.
Cyanotoxin Compliance				
	N/A	No known algal problem has been recorded / known for this unconfined aquifer.	Not reported	Algal cells are unlikely in the groundwater.
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. There is no disinfection so no DBPs expected. If it's deemed important for future plans, can assess likely DBP formation potential through UV254 absorbance testing.

DWSNZ Monitoring Requirements			MoH Annual Survey Results 2012/13	Comments
	Criteria	Monitoring Requirements		
Chemical Compliance	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.
Radiological Compliance				
		The monitoring frequency for radiological determinands is 10 years for bore water supplies that are not considered to be equivalent to surface water. If radiological sampling of water is contemplated, the Institute of Environmental Science and Research (ESR) must be consulted. ESR will specify the sampling requirements.	Need to schedule	A radiological test of the source water needs to be scheduled within the short to medium term.
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 Airport Water Supply. There are septic tank systems within the catchment.

3.2 Water Grading

The Wanaka Airport 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 Airport 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 Airport Water Supply is "Cc" as shown in the table below. This equates to 'marginally satisfactory, low level of microbiological risk when the water leaves the treatment plant, but may not be satisfactory

chemically' for the source and treatment and 'marginally satisfactory, moderate 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 VW 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 the supply from septic tanks and water not being available due power or pump failure. 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: Not enough water available	Bore screen damaged/blocked. No history of bore screen blockage to date. Power, pump or control failure. Major pipeline or valve failure. Serious sabotage or vandalism. Catastrophic failure (due to flood, slips or earthquake). Drought depletes the groundwater. Rainfall is adequate to recharge the groundwater aquifer. Resource consent limitations. Increasing demand from Airport expansion. There is only one pump with no redundancy. The pump shed has limited space to allow for provision of another pump, a generator connection and/or treatment. There is a backup pump at the VW yard but requires a minimum of 1 day to change over pumps. There is a flowmeter to measure abstraction but only pulse measurements are taken.	Extreme	Possible	Major	Record any low flow alarm causes and corrective actions taken. Weekly visits by the operator and borehead checks. Power outages are infrequent and of short duration. Regular inspection of electrics undertaken. SCADA alarms on plant intake flow warn of pump failure. Repair pipe breaks. Record observations / corrective actions taken in an Incidents Log. The bores are located under heavy manhole cover that requires manhole key to open. Operator checks site for interference or damage. Monitor consumption figures and wastage as part of the Water Demand Management programme.	Upgrade the bore pump shed and include a generator connection. This will allow for emergency chlorination system as and when required. If the Airport expands, consideration may need to be given to upgrade the bore, find an alternate water supply and / or provide treatment. Dealt with under Emergency Management. Update Contingency Plans.	S1.1.22
Source: Source water receives septic tank discharges	Airport wastewater is disposed of via ~8 septic tanks. The closest septic tank is 20m to the north east. ~2 hangars discharge effluent to on-site holding tanks with effluent being taken off-site for final disposal. Project Pure WWTP and Disposal Field lie 800m to the north of the bore. It is not considered that the Wanaka Airport water supply bore is located within the effluent plume area. There has only been one known E.*coli* exceedance within this water supply.	High	Possible	Moderate	Obtain information about the number and location of septic tank discharges in the catchment or recharge zone. Consider treatment options or development of a new source.	Connect Airport and Luggate to Project Pure WWTP (removing the need for septic tanks). Reassess catchment risks at least five yearly in accordance with the DWSNZ.	S1.1.7
Source: Source water in contact with mineral deposits	Rock can contain naturally occurring radioactive elements. Amounts vary depending on the type of rock and location. Groundwater passing through rock can pick up some of that radioactivity.	High	Possible	Moderate	If a new bore is established, test the water for radiological parameters before commissioning. The source water is very acidic and is dosed with soda ash to correct the pH.	Allow for radiological testing of bore water every 10 years.	S1.1.19

4.3 Treatment Risks

There is no existing treatment plant and therefore the supply does not provide sufficient barriers to contamination. Any new type of treatment plant will be conditional to the cumulative log credits of the water source. There are improvements that can be made in the interim period to reduce the likelihood of risk events. These improvements are primarily around improving the operating and maintenance procedures of the treatment process.

Process and Event	Indicators / Cause	Total Risk	Likelihood	Consequence	Preventative Measure	Action	Risk Reference
Treatment: Changes in pressure from the bore suck contaminants into the water	Failure of the bore pump(s). Blockage of bore screen causing cavitation / sucking of air. There have been no historic issues with blockage of the bore screens.	Extreme	Possible	Major	Monitor bore performance either directly or using an observation bore. Schedule a preventive maintenance programme for the overhaul of pumps (best not to pull pumps often for maintenance but use diagnostics to assess pump performance). Monitor flow from the bore and system pressure.	Planned maintenance and inspections programme part of the O&M contract.	P10.3

Process and Event	Indicators / Cause	Total Risk	Likelihood	Consequence	Preventative Measure	Action	Risk Reference
Treatment: Too little water can be drawn from the bore or well to meet demand	Bore screen damaged/blocked. No history of bore screen blockage to date. Power, pump or control failure. Major pipeline (see distribution) or valve failure. Serious sabotage or vandalism. Catastrophic failure (due to flood, slips or earthquake). Increasing demand from Airport expansion. There is only one pump with no redundancy. The pump shed has limited space to allow for provision of another pump, a generator connection and/or treatment. There is a backup pump at the VW yard but requires a minimum of 1 day to change over pumps. There is a flowmeter to measure abstraction but only pulse measurements are taken.	Extreme	Possible	Major	Weekly visits by the operator and borehead checks. Power outages are infrequent and of short duration only. Regular inspection of electrics undertaken. There is no generator plug or generator. Maintain SCADA alarms on intake flow. Repair pipe breaks. The bore is located under a locked lid. Operator checks site for interference or damage.	Provide an alternative emergency supply. Implement Water Demand Management Plan. Upgrade the bore pump shed and include a generator connection. This will allow for emergency chlorination system as and when required. Maintain operating procedures to manage unplanned failure.	P1.3.6
Treatment: No flow through the trunk mains	Mains break or pump failures. There is only one pump with no redundancy as described above. There is no demand pressure yet but there is no excess capacity in the reservoir. Each site has a private firefighting supply but this may become a problem in the future as the public supply is limited.	Extreme	Likely	Major	Carry out a condition monitoring programme. Lifelines work. Back-up storage and conservation measures.	Condition assessment programme (pipe and non-pipe).	P2.4.1
Treatment: Contamination of the aquifer (the source)	No evidence of any adverse effects from the land use activities on the groundwater. Turbidity monitoring records show generally low results indicating that the source is not ordinarily affected by surface activity and wet weather events. Sudden change in water quality an advance warning of potential issues.	High	Unlikely	Major	Monitor land use in catchment through communications with district planning and community. Regional Council District Plan Rules require resource consents for any discharges and all consents are monitored. Ensure QLDC are informed by the ORC of any new discharge consent applications in the catchments' likely to affect surface water quality (NES requirement).	Upgrade the borehead security (seal) to meet DWSNZ requirements. Consider a Chemical Spill Plan specific to Airport in the event of a spillage. Wanaka Airport to action.	P1.3.5
Treatment: Contamination gets into the trunk mains	Main breaks from poor condition or installation, or a catastrophic event. Poor repairs of breaks, leaks, incidental damage, and penetration of trunk mains. There is no treatment, therefore no chlorine residual in the network. The network is in moderate condition. There are pipe failures on occasion. Many of the laterals are buried under buildings which limits the ability for operators to fix problems. Much of the reticulation does not meet current standards. No backflow on the irrigation system. There is a small check valve on the pump manifold but that's it.	High	Likely	Minor	Carry out a condition monitoring programme. Lifelines work.	Condition assessment programme. Reticulation renewals. Ensure any new pipe renewals are to current standard. Move valves when replacing to aid with restricting the network when required. Assess if backflow preventers exist at the Airport and investigate installing backflow preventers on private tanks and irrigation system if they are not present.	P2.1

4.4 Distribution Risks

The highest assessed risk relate to introduction of contaminants into the distribution system, and, backflow prevention. The installation of backflow prevention devices at the Airport 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	There is no post treatment storage. Water is pumped from the bore straight in to the tanks. No water. High water demand and excessive water leaks leads to inadequate capacity. Structural failure of the reservoir (leakage). The tank has not been cleaned recently but there are no issues. Low level alarms at reservoir not communicating to bore pump. Pump from bore fail. Falling main failure through condition failure or earthquake / catastrophic event. Sabotage and vandalism.	High	Possible	Moderate	Operator checks site monthly. Monitor flows. Log to SCADA. Inspections and planned maintenance. Records of consumer complaints (e.g. regarding low pressures or loss of supply) through the RFS database.	Repair pump using standby capability. No standby pump is available for the booster pump. Issue immediate notice of water restrictions to the community if supply is seriously interrupted for more than 4 hours. Implement Water Demand Management Plan. Budget for modelling of Wanaka Airport water supply (future demand). Condition assessment programme (pipe & non-pipe).	D1.1
Distribution: Dissolution of chemicals from construction materials	Inadequate flushing and routine maintenance. This water supply cannot be flushed without a flushing point. Poor quality materials. Inadequate maintenance or replacement of worn materials. Materials insufficiently resistant to dissolution by the water and the surrounding environment. Plumbosolvent water leaching heavy metals out of private pipes and fittings.	High	Likely	Moderate	O&M procedures. Monitoring programme and flushing programme. Mainly PVC pipework.	Public notices r.e. plumbosolvency and the need to flush taps. Issue the public notices 6 monthly. Investigate plumbosolvency testing in water as per DWSNZ. Investigate installing a flushing point in the network (install a valve at the end of the line).	D2.1.1
Distribution: Germs enter the distribution system through failed construction materials	This water supply cannot be flushed without a flushing point. 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.	High	Possible	Moderate	Establish a higher confidence in current asset condition, deterioration profiles, leakage etc. Maintain positive system pressures. Hydraulic modelling.	Planned maintenance and inspections programme part of the O&M contract. Record incidences of pipe failure and repairs undertaken in QLDC's AMS. Investigate installing a flushing point in the network (install a valve at the end of the line).	D2.1.2
Distribution: Entry of chemical contaminants through pipe materials	Biofilm development sustaining pathogens. Absorbing hydrocarbons into PE pipe. Loss of water and negative pressure could bring in contaminants.	High	Possible	Moderate	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. Record incidences of pipe failure and repairs undertaken QLDC's AMS. Monitor land uses.		D2.1.3 and .4
Distribution: Introduction of contamination by pressure fluctuations	This is possible through the irrigation system but not likely through the network due to the private tanks. Mains pressure failure. Burst or leaking mains causes water and pressure loss. Reservoir elevation ensures pressures can be met at all times in the reticulation system. Failure of bore pump. Unpredicted event such as a major fire.	High	Possible	Moderate	Condition assessment of mains in the AMP/GIS database identifies life expectancy of pipes. Council audit of hygienic pipe repair procedures and post disinfection by the contractor. Reticulation system is built to a modern standard and is well managed by VW. O&M contract requires prompt attention to leaks and bursts.	Assess if backflow preventers exist at the Airport and investigate installing backflow preventers on private tanks and irrigation system if they are not present.	D2.2.1
Distribution: Introduction of contaminating material into the distribution system	Breaks, leaks, incidental damage to mains. Affected area not correctly isolated. Unsuitable temporary bypass and/or supply bypass. Standard hygiene practices not adopted. Inadequate flushing and disinfection practices. Inappropriate materials used. Cross connections. Unsatisfactory location of water reticulation pipes. The turbidity is low. There is no chlorine in the network. Contractor staff carry out training and have the correct tickets to minimise the risk.	High	Possible	Moderate	Planned maintenance & dedicated O&M procedures on critical mains. Quality plan and training programme. Hydraulic modelling and pressure testing to identify risk areas of network. Improve asset knowledge. There may be cross connections with an irrigation system. All commercial and residential properties in Luggate have acuflos. The wastewater pumpstations have check valves, not testable RPZs.	O&M procedures. Investigate installing a flushing point in the network (install a valve at the end of the line).	D2.3.1

4.5 General Risks

General risks are those not specific to a supply process. The highest level risk is that pertaining to water quality testing procedures. These stem from the lack of information in these areas rather than evidence of incorrect data.

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. Include key staff in the WSP process and provide training before and during implementation. Carry out E. coli follow-up sampling following all transgressions. Update the O&M manual when deficiencies are found. Ensure staff are conversant with the O&M Manual for the supply.	Ensure the WINZ data is correct to reflect the current supply data. Build a water quality results database.	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	Not enough water available S1.1.22	Extreme Risk and Low Benefit-Cost	Dealt with under Emergency Management. Update Contingency Plans.	O&M contract To be confirmed	Network Operator	Budgeted in LTP
Treatment	Not enough source water available for abstraction P1.3.1	Moderate Risk and Low Benefit-Cost				
	Changes in pressure from the bore suck contaminants into the water P10.3	Extreme Risk and Low Benefit-Cost	Planned maintenance and inspections programme part of the O&M contract.	O&M contract On-going	Network Operator	Budgeted in LTP
	Too little water can be drawn from the bore or well to meet demand P1.3.6		Provide an alternative emergency supply. Implement Water Demand Management Plan. Maintain operating procedures to manage unplanned failure.	O&M contract To be confirmed	Chief Engineer & Network Operator	Budgeted in LTP
	Contamination gets into the trunk mains P2.1	High Risk and High Benefit-Cost	Condition assessment programme. Reticulation renewals. Ensure any new pipe renewals are to current standard.	O&M contract To be scheduled	Network Operator	Budgeted in LTP
	Contamination of bore/well during construction P1.3.2	Low Risk and Low Benefit-Cost	The bore was installed in 1995. This has not been an issue.	- -	Chief Engineer	-
Distribution	Introduction of contaminating material into the distribution system D2.3.1	High Risk and Med Benefit-Cost	O&M procedures.	O&M contract On-going	Network Operator	Budgeted in LTP
	Not enough water in post-treatment storage to meet demand D1.1	High Risk and Low Benefit-Cost	Repair pump using standby capability. No standby pump is available for the booster pump. Issue immediate notice of water restrictions to the community if supply is seriously interrupted for more than 4 hours. Implement Water Demand Management Plan. Condition assessment programme (pipe & non-pipe).	O&M contract To be confirmed	Network Operator	Budgeted in LTP
			Budget for modelling of Wanaka Airport water supply (future demand).	Internal To be scheduled	Chief Engineer	To be budgeted
	Dissolution of chemicals from construction materials D2.1.1		Public notices r.e. plumbosolvency and the need to flush taps. Issue the public notices 6 monthly. Investigate plumbosolvency testing in water as per DWSNZ.	Internal To be scheduled	Chief Engineer	Budgeted in LTP
	Re-suspension of sediment or biofilm within the mains by pressure fluctuations D2.2.2	Moderate Risk and Med Benefit-Cost	O&M procedures. There is a hydrant flushing programme. Cleaning / flushing carried out as required.	O&M contract To be confirmed	Network Operator	Budgeted in LTP
	Introduction of contaminating material into service reservoir D1.2	Moderate Risk and Low Benefit-Cost	District wide procedures for sealing, fencing and cleaning reservoirs are integrated into the O&M contract. Site security and damage checks by the operator monthly. Reservoir cleaned to remove any accumulated sediment when required.	O&M contract To be confirmed	Network Operator	Budgeted in LTP
	Development, or re-suspension, of sediment within tank or reservoir D1.3		O&M procedures. Reservoir cleaned to remove any accumulated sediment when required.	O&M contract To be confirmed	Network Operator	Budgeted in LTP
	Failure to maintain sufficient water pressure D2.3.4	Low Risk and Low Benefit-Cost	O&M procedures. Private tanks provide water pressure to individual properties.	O&M contract To be confirmed	Chief Engineer	To be budgeted
General	Inadequate staff training G1	Moderate Risk and High Benefit-Cost	Update WSP every 3 years.	Internal On-going	Environmental Consent Officer	Budgeted in LTP
	Incorrect water quality data used for supply management G2	High Risk and High Benefit-Cost	Ensure the WINZ data is correct to reflect the current supply data. Build a water quality results database.	O&M contract To be confirmed	Environmental Consent Officer	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?
Source	Source water receives contamination from: irrigation, fertiliser, geothermal, downholes, landfills, surface impoundments, forestry, decommissioned wells, mining, contaminated sites, livestock, sealed surfaces, waste discharged to land, domestic or industrial, agrichemicals S1.1	Low Risk and Low Benefit-Cost / Moderate Risk and Low Benefit-Cost	Improve information about the catchment and/ or recharge zone. Reassess catchment risks at least five yearly in accordance with the DWSNZ 2005/08. Determine if bore security status can be achieved.	To be scheduled To be confirmed	Chief Engineer / Environmental Consent Officer	To be budgeted
	Source water in contact with mineral deposits S1.1.19	High Risk and Med Benefit-Cost	Allow for radiological testing of bore water every 10 years.	To be budgeted To be confirmed	Environmental Consent Officer	To be budgeted
	Source water receives spillage, or leakage, arising from the storage or use of hazardous substances S1.1.6	Moderate Risk and Low Benefit-Cost	Emergency response to chemical spill events by ORC and QLDC to minimise impacts on the groundwater. Consider a Chemical Spill Plan specific to Airport in the event of a spillage.	To be scheduled To be confirmed	Wanaka Airport	To be budgeted
Treatment	No flow through the trunk mains P2.4.1	Extreme Risk and Med Benefit-Cost	Condition assessment programme (pipe and non-pipe).	To be scheduled To be confirmed	Chief Engineer	To be budgeted
	Contamination of the aquifer (the source) P1.3.5	High Risk and Mod Benefit-Cost	Upgrade the borehead security to meet DWSNZ requirements. Consider a Chemical Spill Plan specific to Airport in the event of a spillage.	O&M contract To be confirmed	Chief Engineer & Wanaka Airport	To be budgeted
	Contaminated water getting into the bore/well from the surface P1.3.4	Moderate Risk and Mod Benefit-Cost				
	Sediment containing contaminants stirred up P2.2	Low Risk and Med Benefit-Cost	O&M procedures.	O&M contract To be confirmed	Network Operator	Budgeted in LTP
Distribution	Re-suspension of contaminants in sediments in the distribution system D2.3.2	Moderate Risk and Low Benefit-Cost				
	Development of sediment or biofilm D2.3.3					
Distribution	Germs enter the distribution system through failed construction materials D2.1.2	High Risk and Low Benefit-Cost	Planned maintenance and inspections programme part of the O&M contract. Record incidences of pipe failure and repairs undertaken in QLDC's AMS.	O&M contract To be confirmed	Network Operator	Budgeted in LTP
	Entry of chemical contaminants through pipe materials D2.1.3 and .4					
	No, inadequate, faulty, or incorrectly installed backflow prevention device D2.4.2	Low Risk and High Benefit-Cost	Prohibit use of the Council mains by unregistered water carriers. Maintain an up to date register of DWCs. Council audits on Water Carriers on a random basis with emphasis on backflow protection for mains. Report any unregistered water carriers to the Medical Officer of Health and DWA. Check commercial high risk premises at least annually for backflow testing. Develop a formal policy and guidelines covering backflow protection. Check overflow lower than the inflow.	Internal To be scheduled	Chief Engineer	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 will be the piping of Wanaka Airport and Luggate wastewater to the Project Pure WWTP. 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 septic tank discharges S1.1.7	High Risk and High Benefit-Cost	Connect Wanaka Airport to Project Pure WWTP (removing the need for septic tanks).	To be budgeted	Asset Performance & Asset Planning teams	To be budgeted
	Source water receives treated effluent or untreated (leakage) from effluent ponds S1.1.10	Moderate Risk and High Benefit-Cost				
	Not enough water available S1.1.22	Extreme Risk and Low Benefit-Cost	VW have a mobile emergency chlorine treatment plant. To use this at Wanaka Airport requires the pump shed to be rebuilt/ expanded. Upgrade the bore pump shed and include a generator connection. Consider moving shed from the oxidation ponds to the Airport. If the Airport expands, consideration may need to be given to upgrade the bore, find an alternate water supply and / or provide treatment.	Internal To be confirmed	Chief Engineer	To be confirmed
Treatment	Too little water can be drawn from the bore or well to meet demand P1.3.6	Extreme Risk and High Benefit-Cost				
	Excessive formation of chlorination by-products P7.1.3.1	Low Risk and High Benefit-Cost				
	Not enough free available chlorine P7.1.1					
	Too much free available chlorine P7.1.2					
	Incorrect chemical dosing leads to poor treatment P10.2					
	Not enough source water available for abstraction P1.3.1	Moderate Risk and Low Benefit-Cost				
Treatment	Contamination gets into the trunk mains P2.1	High Risk and High Benefit-Cost	Determine final protozoa log credit removal requirement for the supply to guide any treatment upgrade design. Assess if backflow preventers exist at the Airport and investigate installing backflow preventers on private tanks and irrigation system if they are not present.	Internal & O&M contract To be scheduled	Chief Engineer & Network Operator	To be budgeted
	Contaminated water getting into the bore/well from shallower depths P1.3.3	Moderate Risk and High Benefit-Cost				
	Changes in pressure, or water hammer (pressure surges), suck contaminants into the water P10.1	Low Risk and High Benefit-Cost				
Distribution	Introduction of contamination by pressure fluctuations D2.2.1	High Risk and High Benefit-Cost				
	Water pressure in the distribution system lower than pressure in supplied premises D2.4.1	Low Risk and High Benefit-Cost				
	No, inadequate, faulty, or incorrectly installed backflow prevention device D2.4.2					

Process	Event / Risk Mitigated	Priority	Action	Cost and Timeframe	Responsibility / Delivered by	Budgeted in LTP?
Distribution	Dissolution of chemicals from construction materials D2.1.1	High Risk and Med Benefit-Cost	Investigate installing a flushing point in the network (install a valve at the end of the line).	Internal To be confirmed	Chief Engineer	To be budgeted
	Introduction of contaminating material into the distribution system D2.3.1					
	Germs enter the distribution system through failed construction materials D2.1.2	High Risk and Low Benefit-Cost				
	Entry of chemical contaminants through pipe materials D2.1.3 and .4					
	Re-suspension of contaminants in sediments in the distribution system D2.3.2	Moderate Risk and Low Benefit-Cost				
	Development of sediment or biofilm D2.3.3					

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 (VW)	Customer complaints.	RFS database	Customer	QLDC via RFS	Event
		Reporting as required by consent conditions.	CS-VUE	Environmental Consent Officer / VW	ORC	As required by consent
		Reporting incidents or operational issues.	RFS / VW email event notification	VW	Chief Engineer	Event / monthly contract meeting
		Pollution, spillage or public health risk (potential).	VW email event notification	VW	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 (VW)	Operator training review.	VW	VW	Internal	Annual
		Ensuring new staff are aware of the WSP and DWSNZ 2005/08.	-	Environmental Consent Officer / VW	Internal	New staff within I&A Department and VW
		Have roles and responsibilities / personnel changed?	VW & 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 (VW)	Completion of WINZ database to capture monitoring information with regards to water quality as required for compliance to DWSNZ 2005/08.	Lab certificates / WINZ	VW	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 Consent 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 three years.

Next Review: June 2018

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 5 Contaminated Water Contingency Plan

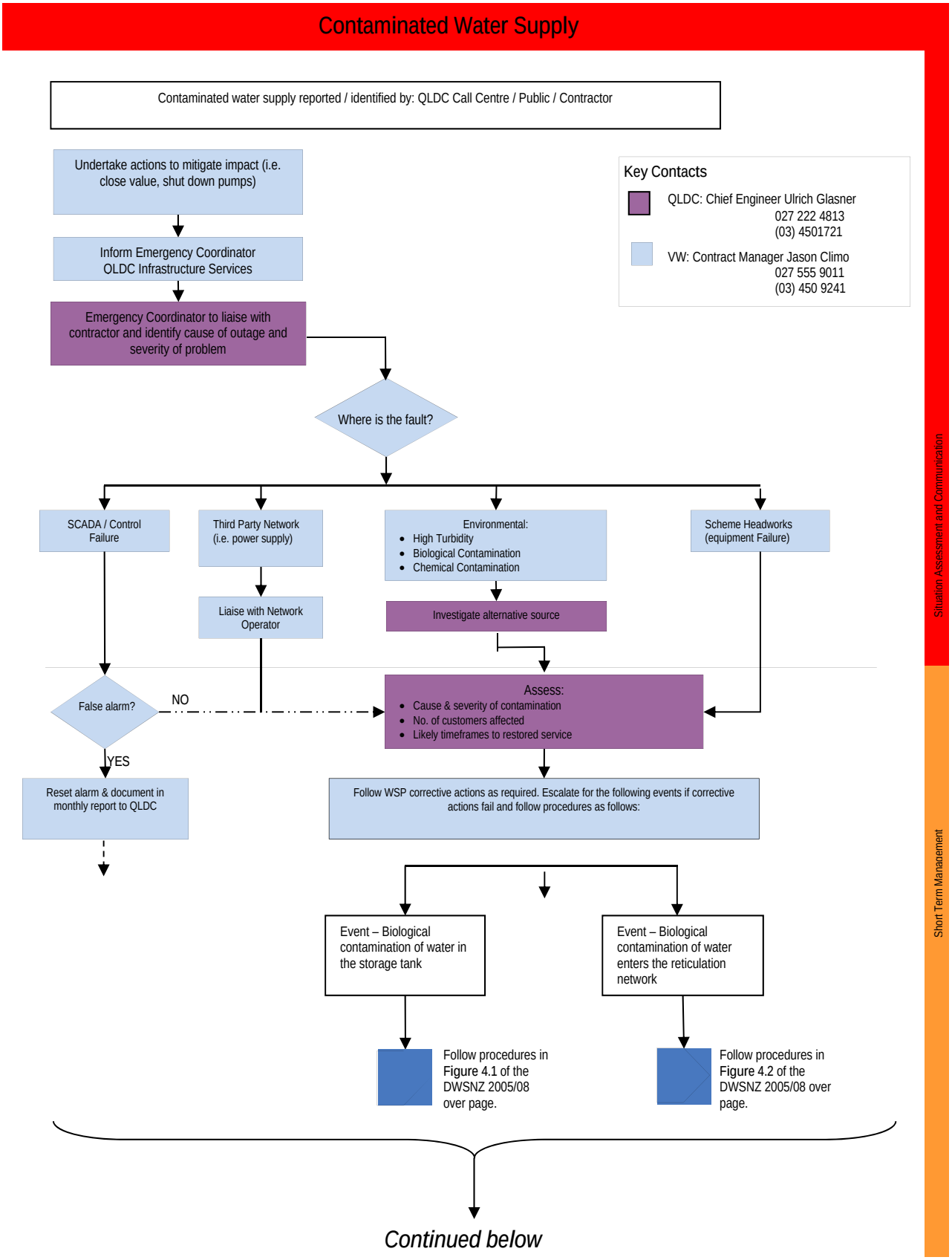


Figure 4.1: Response to *E. coli* contamination of drinking-water leaving treatment plant

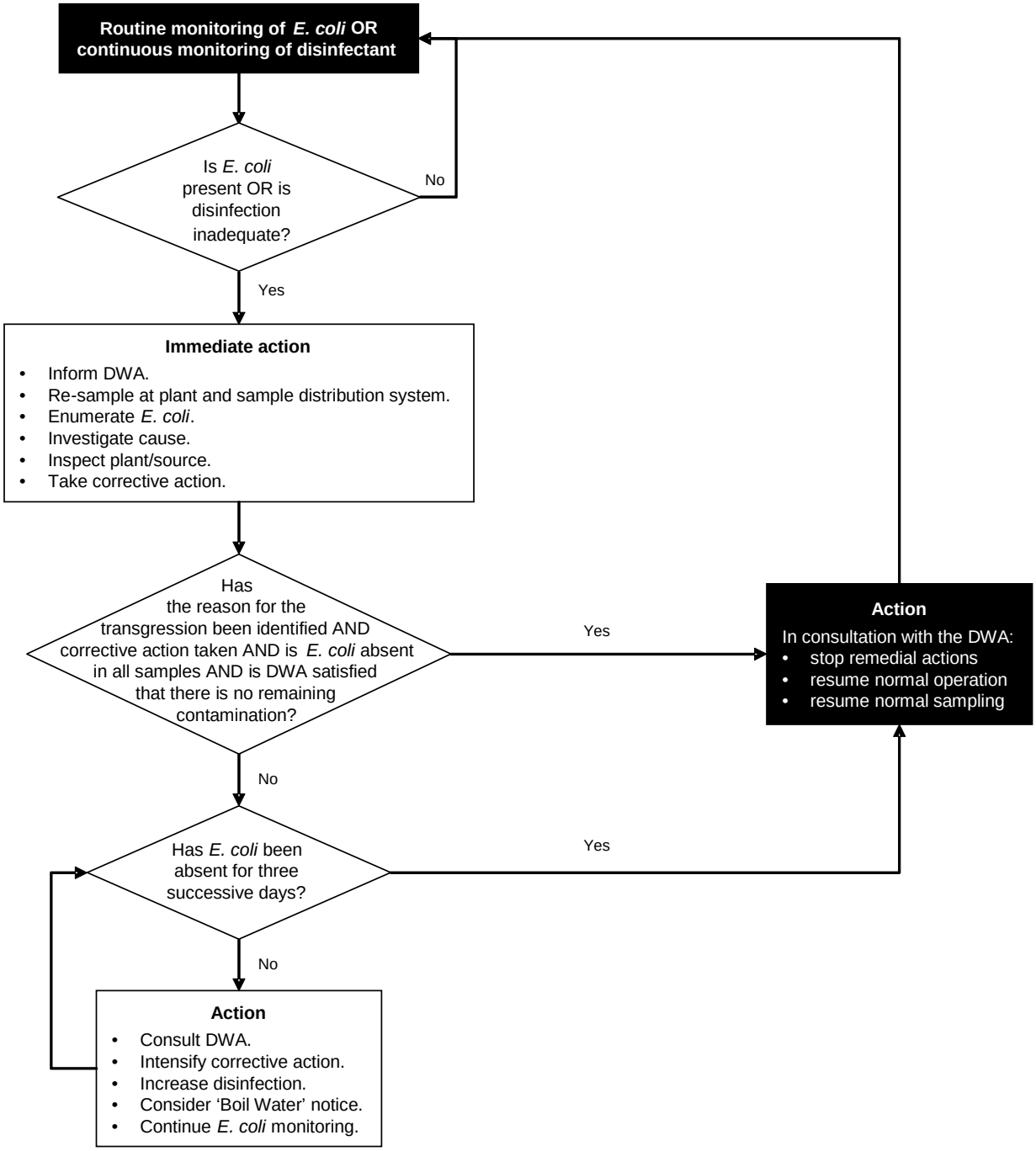
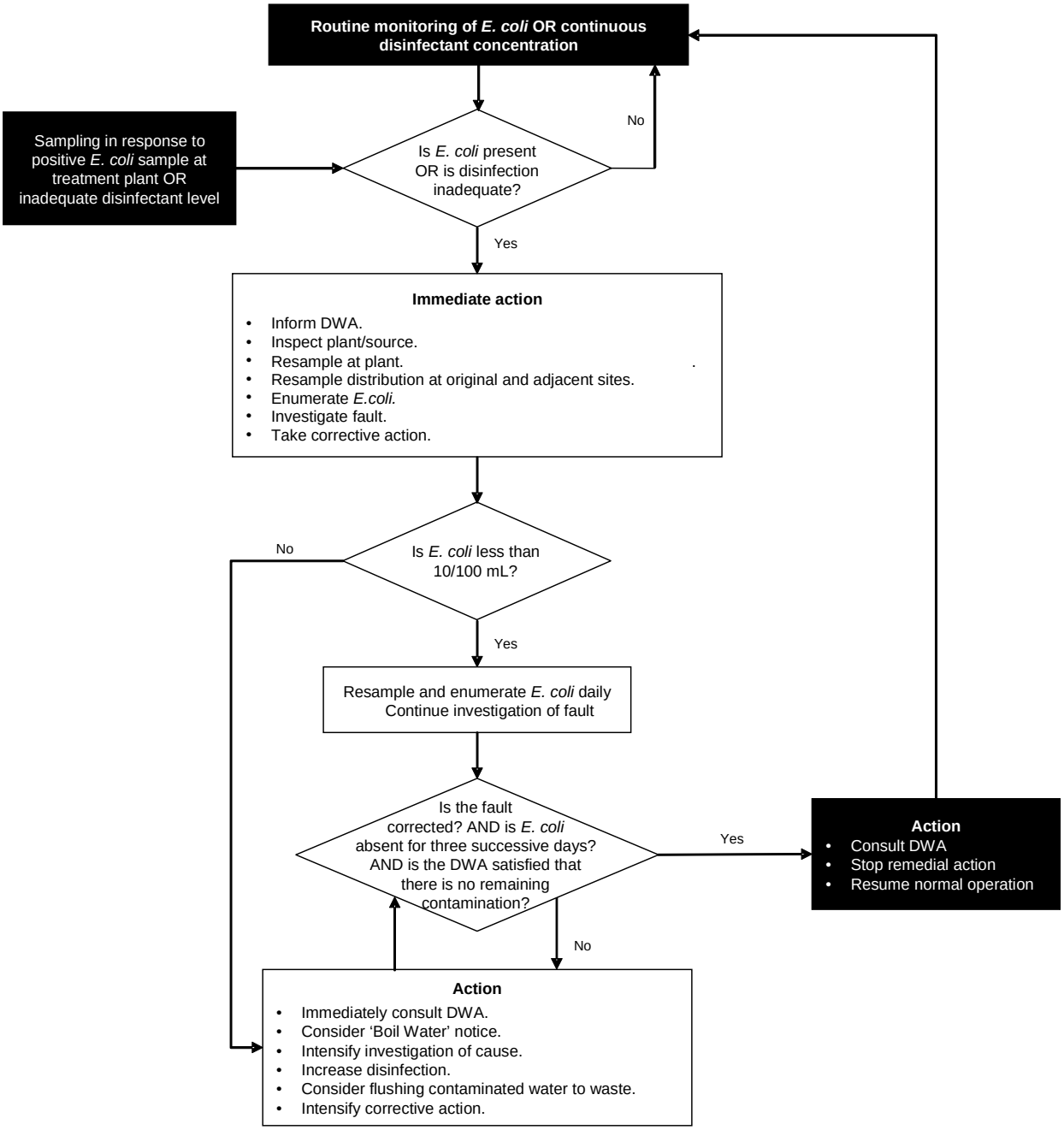


Figure 4.2: Response to *E. coli* contamination of a drinking-water supply distribution zone



Contaminated Water Supply

Continued from above

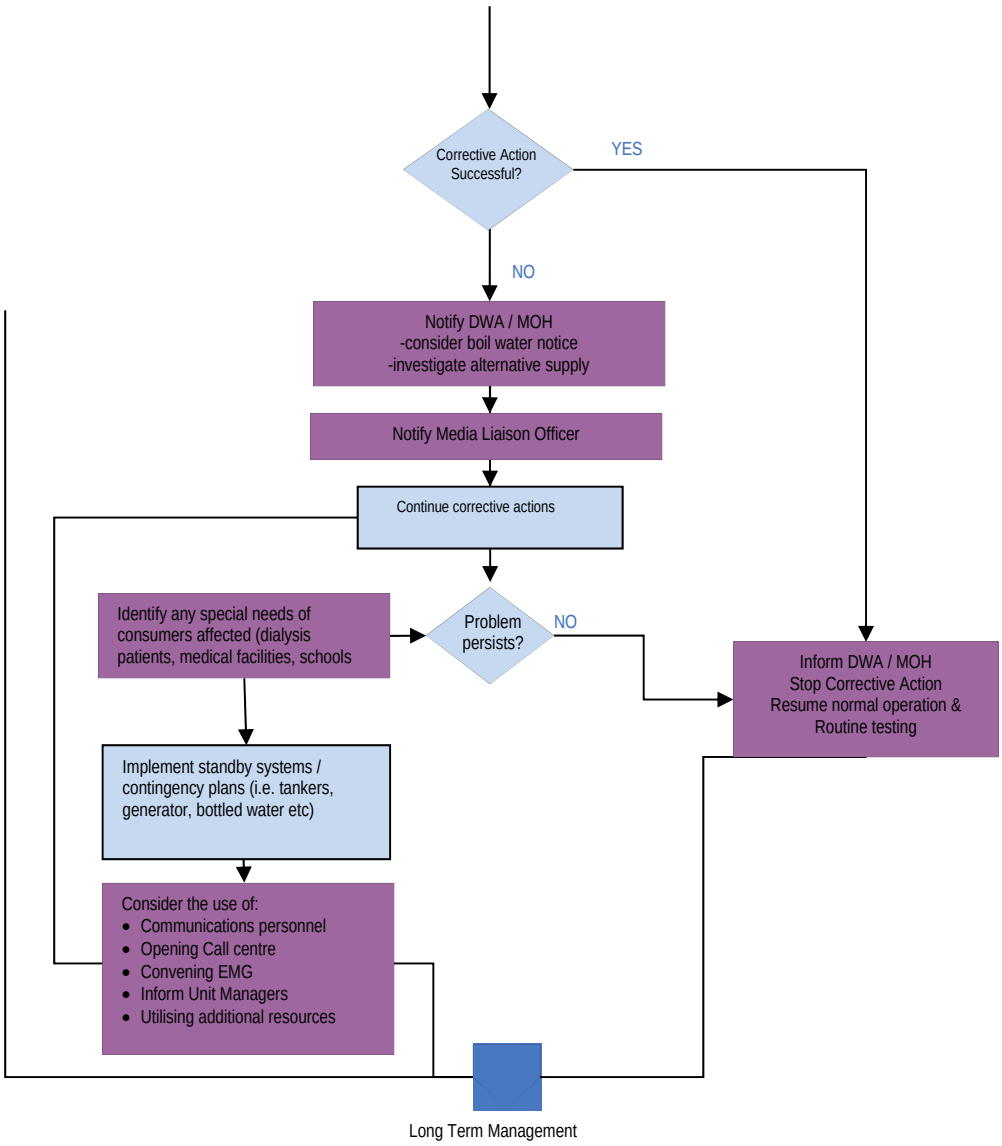


Figure 6 Loss of Water Contingency Plan

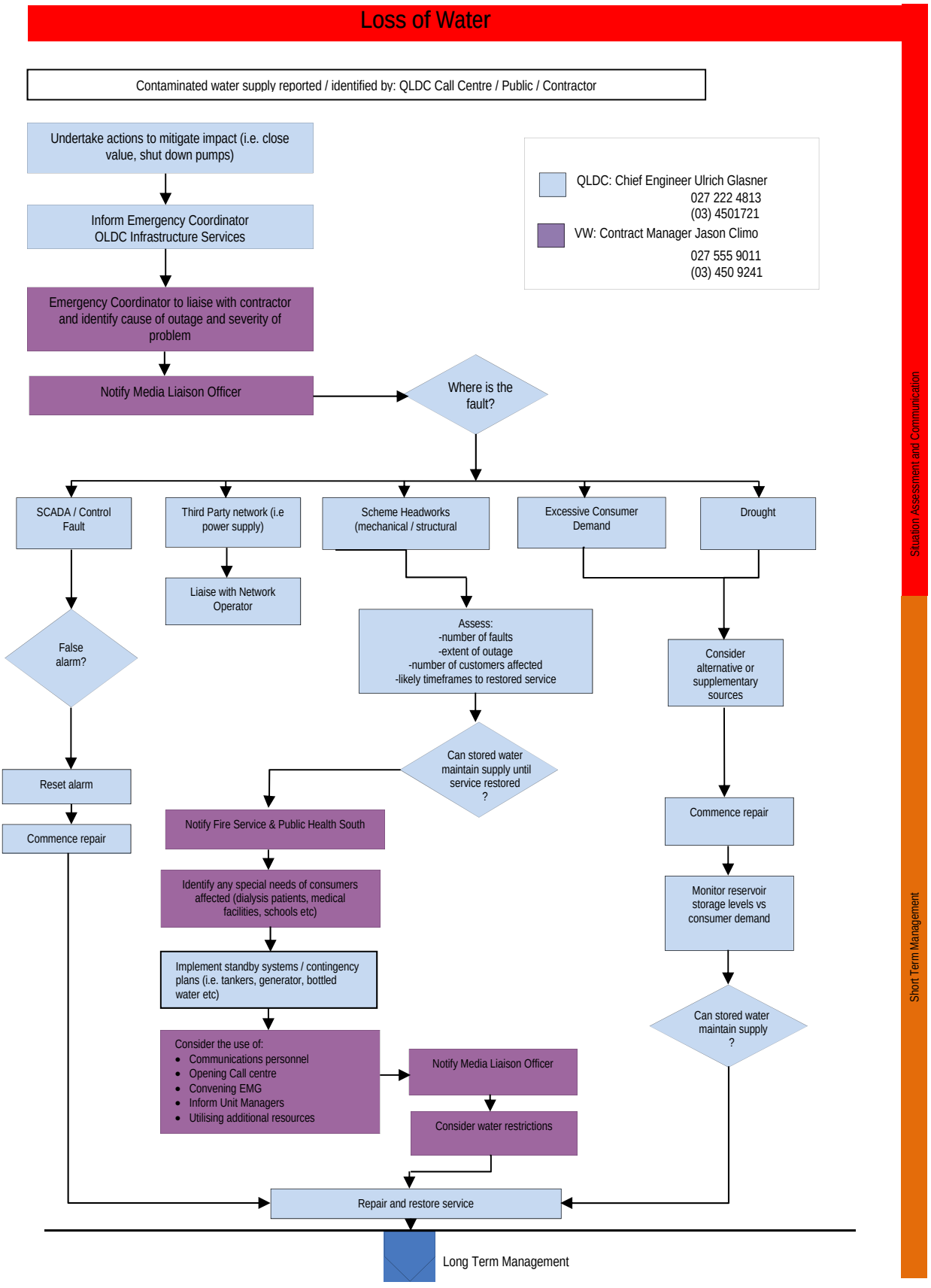
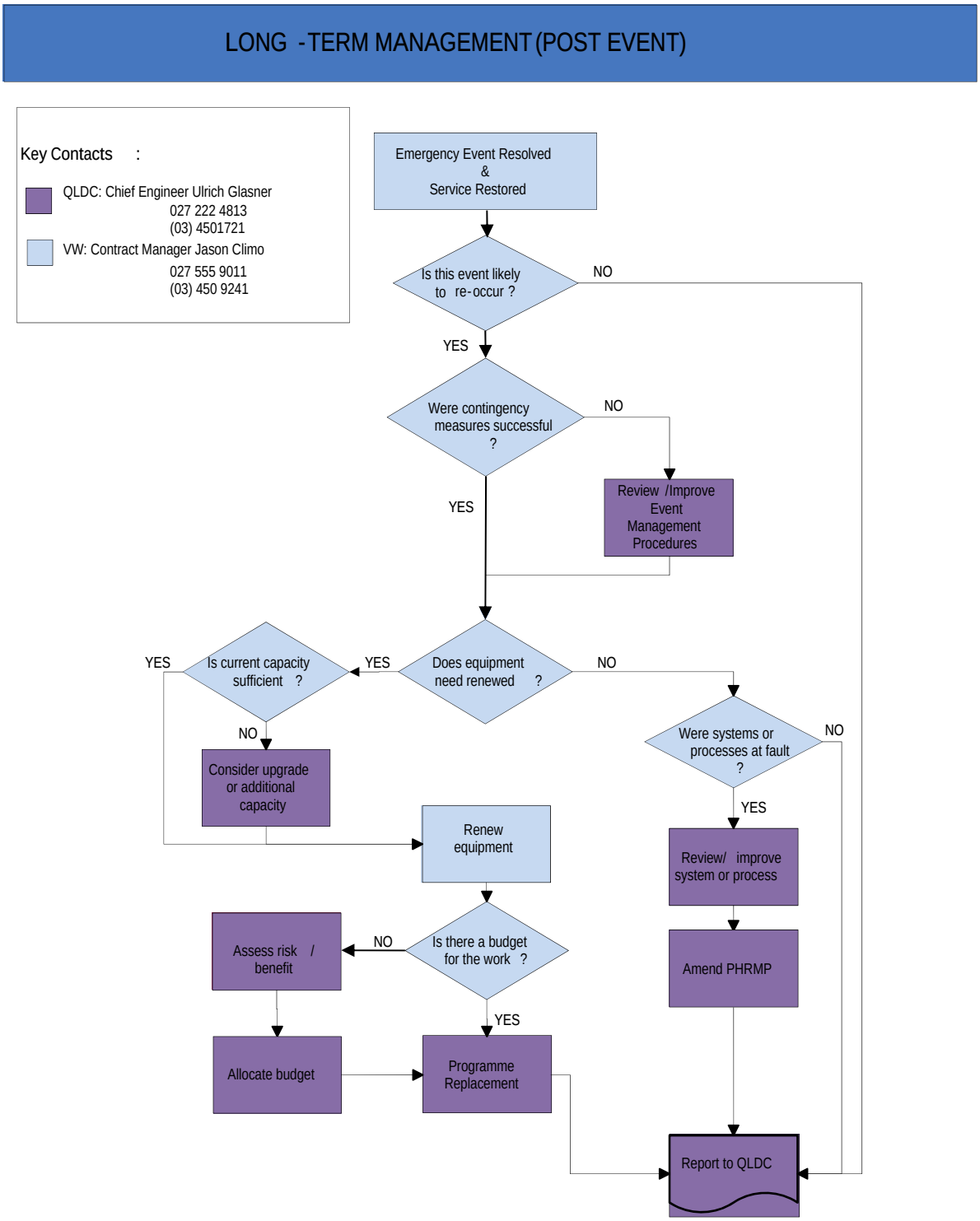


Figure 7 Long Term Management (post-event)



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	Rare	Moderate	Moderate	Poor understanding of catchment or recharge zone. Poor identification of source protection zones. No knowledge of the contaminant's existence. Private septic tanks through the airport.	Monitor water quality for evidence of health-significant contaminants. Maintain a hazards register of contaminated sites in GIS.	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 contaminated sites in the area.	Improve information about the catchment and/ or recharge zone. Reassess catchment risks at least five yearly in accordance with the DWSNZ.	Internal	To be scheduled	To be confirmed	Chief Engineer / Environmental Consent Officer
S1.1.2	Source	Source water receives discharge from domestic or industrial processes, either directly or indirectly	Rare	Moderate	Moderate	Non-permitted or permitted activities within the source protection zone. Poor understanding of catchment or recharge zone. Council plan classes activity as permitted, and hence consent conditions do not exist. Poor water quality results. Conditions of the consent are not followed. Wanaka Brewski brewery at the Airport but not seen to be a risk.	Develop an understanding of the extent of the source catchment or recharge zone. Identify source protection zones. Obtain information about non-permitted activities in the catchment or recharge zone from the Council. Ensure water supplier is informed of new discharge consent applications in the source protection zone. Consider treatment options or development of a new source. Maintain a hazards register of contaminated sites in GIS.		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.	Improve information about the catchment and/ or recharge zone. Reassess catchment risks at least five yearly in accordance with the DWSNZ.	Internal	To be scheduled	To be confirmed	
S1.1.3	Source	Source water receives discharge from mining operations	Rare	Moderate	Moderate	Non-permitted or permitted activities within the source protection zone. No mining operations in the catchment.								
S1.1.4	Source	Source water receives leachate from landfill site	Unlikely	Minor	Low	Non-permitted activity within the source protection zone. Poor understanding of catchment or recharge zone. No, or incomplete, knowledge of activities in the catchment or recharge zone. The Luggate closed landfill is downstream of the bores.	Monitor water quality for evidence of health-significant contaminants. Maintain a hazards register of contaminated sites in GIS.		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.	Improve information about the catchment and/ or recharge zone. Reassess catchment risks at least five yearly in accordance with the DWSNZ.	Internal	To be scheduled	To be confirmed	
S1.1.5	Source	Source water receives waste originally discharged to land	Unlikely	Moderate	Moderate	Non-permitted or permitted activities within the source protection zone. Project Pure WWTP and Discharge Field lie 800m to the north of the bore. It is not considered that the Wanaka Airport water supply bore is located within the effluent plume area. Irrigation of Project Pure treated effluent on to the grass runway is planned for 2015.	Develop an understanding of the extent of the source catchment or recharge zone. 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 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.	Improve information about the catchment and/ or recharge zone. Reassess catchment risks at least five yearly in accordance with the DWSNZ.	Internal	To be scheduled	To be confirmed	Chief Engineer / Environmental Consent Officer

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	Unlikely	Moderate	Moderate	Non-permitted or permitted activities within the source protection zone. Accidental spillage of wastes or chemicals during handling or transport. There are no known overflow paths over or near the bore site. Aviation gas storage tanks onsite. New tanks being installed airside in 2015. This will mitigate the risk of leakage from the old tanks.	No chemicals likely to be transported near to the bores. Develop an understanding of the extent of the source catchment or recharge zone. 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 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. Lack of knowledge of catchment/ recharge zone, and sources of contamination in the area.	Emergency response to chemical spill events by ORC and QLDC to minimise impacts on the groundwater. Consider a Chemical Spill Plan specific to Airport in the event of a spillage.	Wanaka Airport	To be scheduled	To be confirmed	Chief Engineer / Environmental Consent Officer
S1.1.7	Source	Source water receives septic tank discharges	Possible	Moderate	High	Airport wastewater is disposed of via approx. eight septic tanks. The closest septic tank is 20m to the north east. In addition, two to three hangars discharge effluent to on-site holding tanks with effluent being taken off-site for final disposal. Project Pure WWTP and Discharge Field lie 800m to the north of the bore. It is not considered that the Wanaka Airport water supply bore is located within the effluent plume area. There has only been one known E.coli exceedance within this water supply.	Obtain information about the number and location of septic tank discharges in the catchment or recharge zone. Consider treatment options or development of a new source.	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. No information to allow establishment of satisfactory separation between bores and tanks.	Connect Airport and Luggate to Project Pure WWTP (removing the need for septic tanks). Reassess catchment risks at least five yearly in accordance with the DWSNZ.	QLDC Asset Planning & Asset Perf. teams	To be budgeted	To be budgeted	Wanaka Airport
S1.1.8	Source	Source water receives run-off from urban or sealed surfaces	Likely	Insignificant	Moderate	Urban or industrial area within source protection zone. Poor understanding of catchment or recharge zone. 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 airport hard standing is increasing, this includes a runway, roads and sealed carparks.	Groundwater protection zone in the immediate area of the bores using stormwater reticulation.	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/ recharge zone, and sources of contamination in the area.	Improve information about the catchment and/ or recharge zone. Reassess catchment risks at least five yearly in accordance with the DWSNZ.	Internal	To be scheduled	To be confirmed	Chief Engineer / Environmental Consent Officer
S1.1.9	Source	Source water receives material from surface impoundments (waste ponds or lagoons) either treated discharge or leakage	Unlikely	Minor	Low	There are no surface impoundments.	Refer to S1.1.2.	Chief Engineer	Refer to S.1.1.2.	Improve information about the catchment and/ or recharge zone. Reassess catchment risks at least five yearly in accordance with the DWSNZ.	Internal	To be scheduled	To be confirmed	

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
S1.1.10	Source	Source water receives treated effluent or untreated (leakage) from effluent ponds	Unlikely	Moderate	Moderate	Project Pure WWTP and Discharge Field lie 800m to the north of the bore. It is not considered that the Wanaka Airport water supply bore is located within the effluent plume area. The effluent is also filtered and UV treated prior to disposal to land. Irrigation of Project Pure treated effluent on to the grass runway is planned for 2015.	Develop an understanding of the extent of the source catchment or recharge zone. 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 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.	Connect Airport and Luggate to Project Pure WWTP (removing the need for septic tanks). Reassess catchment risks at least five yearly in accordance with the DWSNZ.	QLDC Asset Planning & Asset Perf. teams	To be budgeted	To be budgeted	Wanaka Airport
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.					QLDC Asset Planning & Asset Perf. teams	To be budgeted	To be budgeted	
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.					QLDC Asset Planning & Asset Perf. teams	To be budgeted	To be budgeted	
S1.1.13	Source	Source water receives faecal matter from livestock or feral animals	Unlikely	Moderate	Moderate	No intensive farming activity in the catchment to cause significant contamination events near to the bore site. Animals within source protection zone. Poor understanding of catchment or recharge zone. Poor water quality results.	Check for presence of E.coli in treated water samples as per DWSNZ 2005/08. Monitor water quality (groundwater) for evidence of health-significant contaminants.	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.	Improve information about the catchment and/ or recharge zone. Reassess catchment risks at least five yearly in accordance with the DWSNZ.	Internal	To be scheduled	To be confirmed	Chief Engineer / Environmental Consent Officer
S1.1.14	Source	Agrichemicals (including stock dip) or poisons enter source water	Unlikely	Moderate	Moderate	Agrichemicals or pesticides used within catchment enter the groundwater. No chemicals likely to be transported near to the bores.	Strict controls on pesticide application under ERMA and MoH supervision. Monitor for chemical determinands for impact of land use activities on water.	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.	Improve information about the catchment and/ or recharge zone. Reassess catchment risks at least five yearly in accordance with the DWSNZ 2005/08. Emergency response to chemical spill events by ORC and QLDC to minimise impacts on the groundwater.	Internal & Wanaka Airport	To be scheduled	To be confirmed	
S1.1.15	Source	Contaminants washed into source water during irrigation	Unlikely	Minor	Low	Irrigation being undertaken within source protection zone.	Treatment process is chlorinated.	Chief Engineer	Median E. coli count over 12 months > 500/100mL. Elevated levels of contaminants in source water. Reticulated water not compliant with DWSNZ. Farmers unaware of possible effects of irrigation. Development of algal blooms. Signs of salt migration into groundwater from the soil salinisation.	Improve information about the catchment and/ or recharge zone. Reassess catchment risks at least five yearly in accordance with the DWSNZ 2005/08.	Internal	To be scheduled	To be confirmed	

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
S1.1.16	Source	Source water receives sediment and agrichemicals from forestry activities	Rare	Minor	Low	Poor forestry management practices. This is not applicable, there is no commercial forestry within the catchment.	This is not applicable, there is no commercial forestry within the catchment.	Chief Engineer	Median E. coli count over 12 months > 500/100mL. Elevated levels of contaminants (including turbidity) in source water. Treated water not compliant with DWSNZ. Unsatisfactory practices still being used in the management of the forest.	Improve information about the catchment and/ or recharge zone. Reassess catchment risks at least five yearly in accordance with the DWSNZ.	Internal	To be scheduled	To be confirmed	
S1.1.17	Source	Fertiliser enters source water during application	Unlikely	Minor	Low	Application of fertiliser in the catchment or recharge zone. Farmer unaware of the extent of the catchment or recharge zone. Poor fertiliser application practices. No intensive farming activity in the catchment to cause significant contamination events near to the bore site.	Develop an understanding of the extent of the source catchment or recharge zone. Gather information on the use of fertiliser in the source protection zone, and monitor water quality for evidence of health-significant contaminants. Inform farmers with property in the catchment or recharge zone of this, and the effects their activities can have on source water quality. Inform farmers of 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.	Improve information about the catchment and/ or recharge zone. Reassess catchment risks at least five yearly in accordance with the DWSNZ.	Internal	To be scheduled	To be confirmed	Chief Engineer / Environmental Consent Officer
S1.1.18	Source	Geothermal contaminants enter source water	Rare	Insignificant	Low	Geothermal activity in the source water catchment or recharge zone. Poor understanding of the catchment or recharge zone when the source was selected. No, or limited, water quality monitoring undertaken when selecting the source. Lack of information regarding the geology, and geothermal nature of the area.	Before selecting a source in an area that may be subject to geothermal activity, undertake a monitoring programme for possible geothermal contaminants. From this determine whether they constitute a risk to public health, and if so, select another source. Extended monitoring may be required to determine whether their concentrations are changing with time.	Chief Engineer	Concentrations of geothermal contaminants are more than 50% of their MAV in the source water. Reticulated water not compliant with DWSNZ. New source developed with geothermal contaminant problems.	Improve information about the catchment and/ or recharge zone. Reassess catchment risks at least five yearly in accordance with the DWSNZ.	Internal	To be scheduled	To be confirmed	Chief Engineer / Environmental Consent Officer
S1.1.19	Source	Source water in contact with mineral deposits	Possible	Moderate	High	Rock can contain naturally occurring radioactive elements. Amounts vary depending on the type of rock and location. Groundwater passing through rock can pick up some of that radioactivity.	If a new bore is established, test the water for radiological parameters before commissioning. The source water is very acidic and is dosed with soda ash to correct the pH.	Chief Engineer	Health-significant determinands > 50% of their MAV in the source water. Reticulated water not compliant with (note heavy metals due to corrosion are excluded) DWSNZ. New source developed with contaminant problems associated with minerals.	Allow for radiological testing of bore water every 10 years.	Internal	To be budgeted	To be confirmed	Chief Engineer / Environmental Consent Officer
S1.1.20	Source	Source water intruded by saline water	Rare	Insignificant	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	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**
S1.1.21	Source	Source water experiences algal bloom	Rare	Insignificant	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
S1.1.22	Source	Not enough water available	Possible	Major	Extreme	Bore screen damaged/blocked. No history of bore screen blockage to date. Power, pump or control failure. Major pipeline (see distribution) or valve failure. Serious sabotage or vandalism. Catastrophic failure (due to flood, slips or earthquake). Drought depletes the groundwater. Rainfall is adequate to recharge the groundwater aquifer. Resource consent limitations. Increasing demand from Airport expansion. There is only one pump with no redundancy. The pump shed has limited space to allow for provision of another pump, a generator connection and/or treatment. There is a backup pump at the VW yard but requires a minimum of 1 day to change over pumps. There is a flowmeter to measure abstraction but only pulse measurements are taken.	Record any low flow alarm causes and corrective actions taken. Weekly visits by the operator and borehead checks. Power outages are infrequent and of short duration. Regular inspection of electrics undertaken. SCADA alarms on plant intake flow warn of pump failure. Repair pipe breaks. Record observations / corrective actions taken in an Incidents Log. The bores are located under heavy manhole cover that requires manhole key to open. Operator checks site for interference or damage. Monitor consumption figures and wastage as part of the Water Demand Management programme.	Network Operator (VW)	Drop in system pressure. Customer complaints about low pressure. Consent limits exceeded. Low or no flows / no water. No inspections or maintenance records.	Upgrade the bore pump shed and include a generator connection. Dealt with under Emergency Management. Update Contingency Plans.	Internal	To be budgeted	To be confirmed	Chief Engineer
P1.3.1	Treatment	Not enough source water available for abstraction	Unlikely	Moderate	Moderate	Drought depletes the groundwater. Rainfall is adequate to recharge the groundwater aquifer. Resource consent limitations.	Rainfall is adequate to recharge the groundwater aquifer. Record any low flow alarm causes and corrective actions taken. O&M procedures.							
P1.3.2	Treatment	Contamination of bore/well during construction	Rare	Insignificant	Low	Cross contamination by drilling equipment. Residual substances used in drilling releasing health significant determinands.	Ensure that drills are cleaned and disinfected before drilling starts. Follow requirements of the NZDS. Ensure bore is well flushed before being put into use.	Chief Engineer	Development of nuisance organisms such as iron bacteria. Evidence of NZDS not having been followed. Concentrations of chemical determinands more than 50% of their MAV. Flushing not undertaken.	The bore was installed in 1995. This has not been an issue.	-	-	-	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
P1.3.3	Treatment	Contaminated water getting into the bore/well from shallower depths	Unlikely	Moderate	Moderate	Upstream waste discharges into the groundwater. No evidence of any adverse effects from the land use activities on the groundwater. Turbidity monitoring records show generally low results indicating that the source is not ordinarily affected by surface activity and wet weather events. Turbidity does increase the longer the pumps pump water for. Poor joints, cracks or corrosion, in the bore casing. Drawdown bringing contaminants from shallower regions of the aquifer.	Select appropriate casing material from knowledge of the water chemistry. Ensure bore construction follows the NZDS. Treatment plant switches off. Rely on storage and manage demand. Water conservation measures / procedures if prolonged. Regional Council District Plan Rules require resource consents for any discharges.	Network Operator (VW)	High E. coli counts. Evidence of NZDS not having been followed. Inappropriate casing material selected. No system for backflow prevention. Turbidity.	Ensure QLDC are informed by the ORC of any new discharge consent applications in the catchments' likely to affect surface water quality (NES requirement). Determine final protozoa log credit removal requirement for the supply to guide any treatment upgrade design. Assess if backflow preventers exist at the Airport and investigate installing backflow preventers on private tanks and irrigation system if they are not present.	Internal & O&M contract	Internal & O&M contract	To be scheduled	Chief Engineer & Network Operator
P1.3.4	Treatment	Contaminated water getting into the bore/well from the surface	Unlikely	Moderate	Moderate	Heavy rain in catchment leads to groundwater contamination. Surface water enters the bore through the poorly sealed borehead. Sudden change in water quality an advance warning of potential issues. The lids were improved at the bore in 2012 however the bore is not completely sealed.	Operator site checks including bore installation checks for damage.	Network Operator (VW)	Check mircobiological quality. Chemical determinands possible at shallower depths (e.g. nitrate, manganese).	Upgrade (seal) the borehead security to meet DWSNZ requirements. Consider a Chemical Spill Plan specific to Airport in the event of a spillage.	Internal & Wanaka Airport	Internal & O&M contract	To be scheduled	Chief Engineer & Wanaka Airport
P1.3.5	Treatment	Contamination of the aquifer (the source)	Unlikely	Major	High	No evidence of any adverse effects from the land use activities on the groundwater. Turbidity monitoring records show generally low results indicating that the source is not ordinarily affected by surface activity and wet weather events. Sudden change in water quality an advance warning of potential issues.	Monitor land use in catchment through communications with district planning and community. Regional Council District Plan Rules require resource consents for any discharges and all consents are monitored. Ensure QLDC are informed by the ORC of any new discharge consent applications in the catchments' likely to affect surface water quality (NES requirement).	Chief Engineer	No survey of potential sources of contamination undertaken. No aquifer tests carried out. No system for obtaining information about changing land use in place. Tests to demonstrate security do not meet the requirements of DWSNZ. Changes in turbidity and/or colour of water with weather conditions.					
P1.3.6	Treatment	Too little water can be drawn from the bore or well to meet demand	Possible	Major	Extreme	Bore screen damaged/blocked. No history of bore screen blockage to date. Power, pump or control failure. Major pipeline (see distribution) or valve failure. Serious sabotage or vandalism. Catastrophic failure (due to flood, slips or earthquake). Increasing demand from Airport expansion. There is only one pump with no redundancy. The pump shed has limited space to allow for provision of another pump, a generator connection and/or treatment. There is a backup pump at the VW yard but requires a minimum of 1 day to change over pumps. There is a flowmeter to measure abstraction but only pulse measurements are taken.	Weekly visits by the operator and borehead checks. Power outages are infrequent and of short duration only. Regular inspection of electrics undertaken. There is no generator plug or generator. Maintain SCADA alarms on intake flow. Repair pipe breaks. The bore is located under a locked lid. Operator checks site for interference or damage.	Network Operator (VW)	Low or no flows / no water. No inspections or maintenance records. RFS / customer complaints.	Provide an alternative emergency supply. Implement Water Demand Management Plan. Upgrade the bore pump shed and include a generator connection. Maintain operating procedures to manage unplanned failure.	Internal & O&M contract	O&M contract	To be scheduled	Chief Engineer & Network Operator

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	Likely	Minor	High	Main breaks from poor condition or installation, or a catastrophic event. Poor repairs of breaks, leaks, incidental damage, and penetration of trunk mains. There is no treatment, therefore no chlorine residual in the network. The network is in moderate condition. There are pipe failures on occasion. Many of the laterals are buried under buildings which limits the ability for operators to fix problems. Much of the reticulation does not meet current standards. No backflow on the irrigation system. There is a small check valve on the pump manifold but that's it.	Carry out a condition monitoring programme. Lifelines work.	Network Operator (VW)	Unexplained or regular mains breaks. Unexplained water loss. Unexplained contamination. Difficulty in maintaining chlorine residuals. Regular observed leaks. Loss of supply at reservoir.	Condition assessment programme. Reticulation renewals. If a new wastewater main is installed to transfer wastewater to Project Pure, consider installing a new water main at the same time. Ensure any new pipe renewals are to current standard. Move valves when replacing to aid with restricting the network when required. Assess if backflow preventers exist at the Airport and investigate installing backflow preventers on private tanks and irrigation system if they are not present.	Internal, & O&M contract	O&M contract	To be scheduled	QLDC, Wanaka Airport
P2.2	Treatment	Sediment containing contaminants stirred up	Unlikely	Minor	Low	Sediment or biofilm allowed to develop. Re-suspension of sediments at the pump intake. Raw water turbidity is generally low and <1NTU. There is no treatment and therefore no residual chlorine to address this.	Turbidity sampled as per the DWSNZ weekly.	Network Operator (VW)	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.	O&M procedures.	O&M contract	O&M contract	O&M contract	Network Operator
P2.3.1	Treatment	Contaminants get into open channel conduits and break-pressure tanks	Rare	Insignificant	Low	The pump shed contains two pressure vessels. One was recently replaced. This event is not seen to be an issue.	N/A	N/A	N/A	N/A	-	-	-	-
P2.4.1	Treatment	No flow through the trunk mains	Likely	Major	Extreme	Mains break or pump failures. There is only one pump with no redundancy. The pump shed has limited space to allow for provision of another pump, a generator connection and/or treatment. There is a backup pump at the VW yard but requires a minimum of 1 day to change over pumps. There is a flowmeter to measure abstraction but only pulse measurements are taken. There is no backup or spare pump in storage for the pressure booster pump. There is no demand pressure yet but there is no excess capacity in the reservoir. Each site has a private firefighting supply but this may become a problem in the future as the public supply is limited.	Carry out a condition monitoring programme. Lifelines work. Back-up storage and conservation measures.	Network Operator (VW)	Loss of supply at reservoir. See P10's and distribution.	Condition assessment programme (pipe and non-pipe).	To be budgeted	To be scheduled	To be confirmed	Chief Engineer

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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
P7.1.1	Treatment	Not enough free available chlorine	Rare	Insignificant	Low	There is no permanent chlorination. Chlorination is only carried out in emergency situations where chlorine is manually injected into the tank. The use of the VW mobile emergency chlorinator use is restricted and would require the pump shed to be rebuilt/ expanded.	Routine maintenance of dose-controller and dosing pump. Regular manual checks on calibration of sensor. Replacement of controller if suspect. Alarm system to warn if FAC concentration incorrect.	Network Operator (VW)	FAC concentration < 0.2mg/L. E. coli or coliforms detected in 100 mL sample of water leaving the treatment plant. Frequent repairs recorded. Maintenance log not signed off.	VW building a mobile emergency chlorine treatment plant. To use this at Wanaka Airport requires the pump shed to be rebuilt/ expanded. Move spare shed from ponds.	Internal	To be confirmed	To be confirmed	Chief Engineer
P7.1.2	Treatment	Too much free available chlorine	Rare	Insignificant	Low	There is no permanent chlorination. Chlorination is only carried out in emergency situations where chlorine is manually injected into the tank. The use of the VW mobile emergency chlorinator use is restricted and would require the pump shed to be rebuilt/ expanded.	Replacement of controller if suspect. Alarm system to warn if FAC concentration incorrect. Routine maintenance of dose-controller and dosing pump. Regular manual checks on calibration of sensor.	Network Operator (VW)	FAC concentration is more than 50% of its MAV. Maintenance log shows frequent maintenance needed. Maintenance log not signed off.					
P7.1.3.1	Treatment	Excessive formation of chlorination by-products	Rare	Insignificant	Low				Chlorine consumption high. Customer complaints, turbidity. Elevated disinfection by-product formation.					
P8.1.1	Treatment	pH level too high	Unlikely	Minor	Low	Chemical spill or overuse in the catchment. Incorrect calibration of pH probe. Natural raw water pH variations.	ORC rules prohibit the use of toxic chemicals near waterways and to protect groundwater. There are now online continous monitoring pH and turbidity meters. pH meters are calibrated weekly and serviced yearly under contract.	Network Operator (VW)	pH level more than 8.5. Frequent repair needed. Problems with chlorination effectiveness (when used). Poor continuity of power supply. Chemical use record not maintained. Concentrations of health-significant chemical determinands more than 50% of their MAV.	Shut off the supply if a serious pH problem is suspected during plant visits i.e. pH above 9.	O&M contract	O&M contract	O&M contract	Network Operator
P8.1.2	Treatment	pH level too low	Unlikely	Minor	Low	Chemical spill or overuse in the catchment. Incorrect calibration of pH probe. Natural raw water pH variations.	ORC rules prohibit the use of toxic chemicals near waterways and to protect groundwater.	Network Operator (VW)	The same causes, preventive measures, checks and corrective actions as noted in P8.1.1.1–P8.1.1.8 are appropriate here. Note, however, that the minimum pH should be no less than 7.0, and that problems with disinfection efficiency are not linked to low pH levels. Further, there is one additional preventive measure required when pH adjustment is by contact with calcite or a dolomitic material (eg, Akdolit).	Shut off the supply if a serious pH problem is suspected during plant visits.	O&M contract	O&M contract	O&M contract	Network Operator
P8.1.3	Treatment	Germs introduced during aeration	Rare	Insignificant	Low	N/A, there is no aeration.	N/A	N/A	N/A	N/A	-	-	-	-

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P10.1	Treatment	Changes in pressure, or water hammer (pressure surges), suck contaminants into the water	Unlikely	Minor	Low	Pump failure at bores causing pressure surge and water hammer. Transmission pump failure due to mechanical failure or overload. Water hammer can cause pipe failure and contaminants being sucked into the water by backflow. Water hammer is unlikely in this supply as it is flat and based on the discahrge in to the QLDC and private tanks.	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.	Network Operator (VW)	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.	Assess if backflow preventers exist at the Airport and investigate installing backflow preventers on private tanks and irrigation system if they are not present.	Internal & O&M contract	To be scheduled	To be confirmed	Network Operator
P10.2	Treatment	Incorrect chemical dosing leads to poor treatment	Rare	Minor	Low	There is no dosing.	O&M procedures part of the O&M contract.	Network Operator (VW)	Difficulty maintaining a chlorine residual in the treated water. Non-compliance with DWSNZ.	VW building a mobile emergency chlorine treatment plant. To use this at Wanaka Airport requires the pump shed to be rebuilt/ expanded. Move spare shed from ponds.	Internal	To be confirmed	To be confirmed	Network Operator
P10.3	Treatment	Changes in pressure from the bore suck contaminants into the water	Possible	Major	Extreme	Failure of the bore pump(s). Blockage of bore screen causing cavitation / sucking of air. There have been no historic issues with blockage of the bore screens.	Monitor bore performance either directly or using an observation bore. Schedule a preventive maintenance programme for the overhaul of pumps (best not to pull pumps often for maintenance but use diagnostics to assess pump performance). Monitor flow from the bore and system pressure.	Network Operator (VW)	Low bore levels. Bore pumps stop. Reduced, or no, flow from bore(s). Reduced pressure in distribution zone fed directly from the bore. Non-compliance with DWSNZ. No maintenance log kept.	Planned maintenance and inspections programme part of the O&M contract.	O&M contract	O&M contract	On-going	Network Operator
P11.1	Treatment	Treatment plant cannot produce water of satisfactory quality	Rare	Insignificant	Low	No treatment.	No treatment.	Chief Engineer	No treatment.	There is no treatment.	Internal	To be scheduled	To be confirmed	Chief Engineer
P11.2	Treatment	Treatment plant cannot produce enough water	Rare	Insignificant	Low	No treatment.	No treatment.	Chief Engineer	No treatment.	There is no treatment.	Internal	To be scheduled	To be confirmed	Chief Engineer
D1.1	Distribution	Not enough water in post-treatment storage to meet demand	Possible	Moderate	High	There is no post treatment storage. Water is pumped from the bore straight in to the tanks. High water demand and excessive water leaks leads to inadequate capacity. Structural failure of the reservoir (leakage). Condition of the reservoir is good. The tank has not been cleaned recently but there are no issues. Pump from bore fail. Falling main failure through condition failure or earthquake / catastrophic event. Sabotage and vandalism.	Operator checks site monthly. Monitor flows. Log to SCADA. Inspections and planned maintenance. Records of consumer complaints (e.g. regarding low pressures or loss of supply) through the RFS database.	Network Operator (VW)	Low level alarms at the reservoir. No water. Bore failure alarms. Loss of mains pressure. Loss of pressure and flow with no alarm indication.	Repair pump using standby capability. No standby pump is available for the booster pump. Issue immediate notice of water restrictions to the community if supply is seriously interrupted for more than 4 hours. Implement Water Demand Management Plan. Budget for modelling of Wanaka Airport water supply (future demand). Condition assessment programme (pipe & non-pipe).	Internal & O&M contract	O&M contract	To be scheduled	Network Operator

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D1.2	Distribution	Introduction of contaminating material into service reservoir	Unlikely	Moderate	Moderate	Contamination of water in reservoir/s passes into the reticulation system. Contamination enters the roof or inspection covers; access by animals/birds, human access for sampling, etc. Sabotage or vandalism. The QLDC reservoir tank lid is unlocked. There is no fence surrounding the small pump shed.	District wide procedures for sealing, fencing and cleaning reservoirs. Limit access to roof. No history of vandalism. Low turbidity water leaves very little reservoir sediments.	Network Operator (VW)	Taste and odour complaints. Visual inspection / evidence of contamination identified / entry of animals or birds.	District wide procedures for sealing, fencing and cleaning reservoirs are integrated into the O&M contract. Site security and damage checks by the operator monthly. Reservoir cleaned to remove any accumulated sediment when required.	O&M contract	O&M contract	To be scheduled	Network Operator
D1.3	Distribution	Development, or re-suspension, of sediment within tank or reservoir	Unlikely	Moderate	Moderate	Sediment/ slime accumulation and release due to rapid fill and poor cleaning. The QLDC reservoir tank lid is unlocked. There is no fence surrounding the small pump shed.Condition of the reservoir is unknown. They have not been cleaned recently but there are no issues.	O&M procedures. Reticulation pH and turbidity taken manually weekly by Watercare. Clean reservoir to remove accumulated sediment when required (regular cleaning programme). Avoid high flow from bores. Bores are cascading controls up and down.	Network Operator (VW)	Visible slime/ sediment. Customers complain of slime/ sediment. FAC residual concentration < 0.2 mg/L. E. coli or coliforms detected in 100mL of water. Turbidity > 0.2 NTU (turbidity leaving reservoir high yet low at source). Regular cleaning required.	O&M procedures. Reservoir cleaned to remove any accumulated sediment when required.	O&M contract	O&M contract	To be scheduled	Network Operator
D1.4	Distribution	Chlorine contact time too short	Rare	Insignificant	Low	N/A, only emergency chlorination treatment.	FAC is monitored at the treatment plant and in the distribution system. E.coli levels are tested to DWS and no signs of need to change frequency.	Network Operator (VW)	E. coli or coliforms detected in 100mL of water despite adequate FAC residual concentration. Unexplained fluctuations in water quality.	There is no treatment.				Chief Engineer
D2.1.1	Distribution	Dissolution of chemicals from construction materials	Likely	Moderate	High	This water supply cannot be flushed without a flushing point. 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. Plumbosolvent water leaching heavy metals out of private pipes and fittings.	O&M procedures. Monitoring programme and flushing programme. Mainly PVC pipework.	Network Operator (VW)	Customer complaints. Pipe deterioration or failure. Testing of supplies to target problem (at property and at reservoir).	Public notices r.e. plumbosolvency and the need to flush taps. Issue the public notices 6 monthly. Investigate plumbosolvency testing in water as per DWSNZ. Investigate installing a flushing point in the network. Install a valve at the end of the line.	Internal & Wanaka Airport	To be budgeted	To be confirmed	Chief Engineer
D2.1.2	Distribution	Germs enter the distribution system through failed construction materials	Possible	Moderate	High	This water supply cannot be flushed without a flushing point. 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.	Establish a higher confidence in current asset condition, deterioration profiles, leakage etc. Maintain positive system pressures. Hydraulic modelling.	Network Operator (VW)	Customer complaints. Pipe failures, particularly in high pressure areas.	Planned maintenance and inspections programme part of the O&M contract. Record incidences of pipe failure and repairs undertaken in QLDC's AMS. Investigate installing a flushing point in the network. Install a valve at the end of the line.	Internal & Wanaka Airport	O&M contract	To be scheduled	QLDC, Wanaka Airport

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D2.1.3 and .4	Distribution	Entry of chemical contaminants through pipe materials	Possible	Moderate	High	Biofilm development sustaining pathogens. Absorbing hydrocarbons into PE pipe. Loss of water and negative pressure could bring in contaminants. (see D 2.1.2)	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. Record incidences of pipe failure and repairs undertaken QLDC's AMS. Monitor land uses.	Network Operator (VW)	Customer complaints. Concentrations of chemical contaminants are more than 50% of their MAV. Mains failure. Increased deterioration on assessed mains.	Planned maintenance and inspections programme part of the O&M contract. Record incidences of pipe failure and repairs undertaken in QLDC's AMS. Investigate installing a flushing point in the network. Install a valve at the end of the line.	Internal & Wanaka Airport	O&M contract	To be scheduled	QLDC, Wanaka Airport
D2.2.1	Distribution	Introduction of contamination by pressure fluctuations	Possible	Moderate	High	This is possible through the irrigation system but not likely through the network due to the private tanks. Mains pressure failure. Burst or leaking mains causes water and pressure loss. Reservoir elevation ensures pressures can be met at all times in the reticulation system. Failure of bore pump. Unpredicted event such as a major fire.	Condition assessment of mains in the AMP/GIS database identifies life expectancy of pipes. Council audit of hygienic pipe repair procedures and post disinfection by the contractor. Reticulation system is built to a modern standard and is well managed by VW. O&M contract requires prompt attention to leaks and bursts.	Network Operator (VW)	Mains failure (see D2.3.1). Pressure fluctuations. Bore failure, power failure, incorrect operations / work procedures. High instantaneous demand.	Assess if backflow preventers exist at the Airport and investigate installing backflow preventers on private tanks and irrigation system if they are not present.	Internal & O&M contract	To be scheduled	To be confirmed	Network Operator
D2.2.2	Distribution	Re-suspension of sediment or biofilm within the mains by pressure fluctuations	Possible	Minor	Moderate	Sediment or biofilm allowed to develop but this is not an issue in Luggate. Significant fluctuations in reticulation pressure.	Mains flushing procedures and schedule. Planned maintenance.	Network Operator (VW)	Customer complaints about pressure and quality. Concentrations of chemical contaminants > 50% of MAV.	O&M procedures. There is a hydrant flushing programme. Cleaning / flushing carried out as required.	O&M contract	O&M contract	To be scheduled	Network Operator
D2.3.1	Distribution	Introduction of contaminating material into the distribution system	Possible	Moderate	High	Breaks, leaks, incidental damage to mains. Affected area not correctly isolated. Unsuitable temporary bypass and/or supply bypass. Standard hygiene practices not adopted. Inadequate flushing and disinfection practices. Inappropriate materials used. Cross connections. Unsatisfactory location of water reticulation pipes. The turbidity is low. There is no chlorine in the network. Contractor staff carry out training and have the correct tickets to minimise the risk.	Planned maintenance & dedicated O&M procedures on critical mains. Quality plan and training programme. Hydraulic modelling and pressure testing to identify risk areas of network. Improve asset knowledge. There may be cross connections with an irrigation system. All commercial and residential properties in Luggate have acuflos. The wastewater pumpstations have check valves, not testable RPZs.	Network Operator (VW)	Customer complaints about pressure and quality.	O&M procedures. Investigate installing a flushing point in the network. Install a valve at the end of the line.	Internal & Wanaka Airport	O&M contract	To be scheduled	QLDC, Wanaka Airport
D2.3.2	Distribution	Re-suspension of contaminants in sediments in the distribution system	Possible	Minor	Moderate	Sediment or biofilm allowed to develop. Significant fluctuations in reticulation pressure. Flushing, scouring (due to operational procedures).	Mains flushing procedures and schedule. Planned maintenance. Quality plan and training programme. Hydraulic modelling and pressure testing to identify risk areas of network.	Network Operator (VW)	Customer complaints about pressure and quality. Concentrations of chemical contaminants are more than 50% of their MAV.	O&M procedures. Investigate installing a flushing point in the network. Install a valve at the end of the line.	Internal & Wanaka Airport	O&M contract	To be scheduled	QLDC, Wanaka Airport

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D2.3.3	Distribution	Development of sediment or biofilm	Possible	Minor	Moderate	Poor chemical water quality leaving the treatment plant. Development of biofilm and resuspension of sediment. There is nothing to suggest that biofilm is an issue. Nothing was detected when the new bypass line was installed in 2013.	Much of this precipitation will be contained within the reservoir. QLDC to consider pipe scouring and cleaning programme under the O&M contract. RFS system records on water quality complaints.	Network Operator (VW)	Customer complaints about pressure and quality.	O&M procedures. Investigate installing a flushing point in the network. Install a valve at the end of the line.	Internal & Wanaka Airport	O&M contract	To be scheduled	QLDC, Wanaka Airport
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. Private tanks to supply own pressure.	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 (VW)	Customer complaints about pressure and quality. Low pressure and low flow.	O&M procedures. Private tanks provide water pressure to individual properties.	To be budgeted	To be budgeted	To be confirmed	Chief Engineer
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. Each premises has its own tank.	Risk reduced through accuflow meters, risk remains at high risk land user (industrial).	Network Operator (VW)	Unexplained fluctuations in chemical and microbiological water quality. E. coli or coliforms detected in 100mL water sample. Concentrations of targeted chemical determinands are more than 50% of their MAV.	Assess if backflow preventers exist at the Airport and investigate installing backflow preventers on private tanks and irrigation system if they are not present.	Internal & O&M contract	To be scheduled	To be confirmed	Network Operator
D2.4.2	Distribution	No, inadequate, faulty, or incorrectly installed backflow prevention device	Unlikely	Minor	Low	Council policy (in Bylaw) on backflow prevention requires existing at-risk commercial consumers to have back flow preventers installed. Controls on taking of water from Council hydrants. Pressure in the reticulation is generally maintained at 300 kPa. Water Carriers introduce contaminants while filling up tankers. There are no known backflows in the network.	Appropriate install methods and selection of devices for water connection (land use). Appropriately qualified staff doing installs. Good knowledge of new consents for land use. Council policy (in Bylaw) on backflow prevention requires existing at-risk commercial consumers to have back flow preventers installed. Controls on taking of water from Council hydrants. Pressure in the reticulation is generally maintained at 300 kPa. Adherence to the MoH Guidelines for the Safe Delivery of Drinking Water and Compliance with S11 DWSNZ 2005 Tankered Drinking water compliance criteria.	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.	Prohibit use of the Council mains by unregistered water carriers. Maintain an up to date register of DWC's. Council audits on Water Carriers on a random basis with emphasis on backflow protection for mains. Report any unregistered water carriers to the Medical Officer of Health and DWA. Check commercial high risk premises at least annually for backflow testing. Develop a formal policy and guidelines covering backflow protection. Assess if backflow preventers exist at the Airport and investigate installing backflow preventers on private tanks and irrigation system if they are not present. Check overflow lower than inflow.	Internal & Wanaka Airport	To be scheduled	To be confirmed	QLDC & Wanaka Airport
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 (VW) / Chief Engineer	Training levels inadequate for water grading (DWS). Inspection of qualifications / certificates or defining levels of competency for each operator / supervisor (minimum qualifications).	Update WSP every 3 years.	Internal & O&M contract	Internal & O&M contract	On-going	Environmental Consent Officer

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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. Include key staff in the WSP process and provide training before and during implementation. Carry out E. coli follow-up sampling following all transgressions. Update the O&M manual when deficiencies are found. Ensure staff are conversant with the O&M Manual for the supply.	Network Operator (VW) / Chief Engineer	Auditing of procedures highlights failures.	Ensure the WINZ data is correct to reflect the current supply data. Build a water quality results database.	Internal	Internal	To be confirmed	Environmental Consent Officer