

## Glengarry Water Supply

### Water Safety Plan

**Date: 1/3/2019**

**Revision Date: To be revised by 1 March 2024**

Supply Owner/Operator: **Glengarry Water Supply Association Inc.**

Supply Name: **Glengarry (GLE020)**

Well card: **BV24/003**

Regional Council Resource consent: **CRC598255: To take and use groundwater for domestic and firefighting water supply purposes**



Photo 1 –map showing the position of Glengarry well (BV24/0031) for supply GLE020

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## **Intent**

Whilst it is a legal requirement to have a current Water Safety Plan, the primary reason for this plan is to ensure that water coming out of any taps within the Glengarry Water Supply Association Inc. reticulation cannot make people sick.

## **Introduction**

The area serviced by this water supply is a fishing & leisure community, consisting of 71 Bach properties, situated on the South Bank of the White River at the River mouth. (Photo 1). The Glengarry Water Supply Association Inc. owns the freehold to this 12 hectare settlement, with individual Bach owners holding a licence to occupy. The water supply also services the local District Council camping ground and domain which adjoin the settlement.

The estimated population supplied ranges from 40 – 500 depending on bach and camping ground occupancy. Thus, we are classed as a “small water supply” under the New Zealand Drinking water Standards.

The settlement is managed by an elected committee who meet every 6 weeks. At the January annual general meeting of the GLENGARRRY WATER SUPPLY ASSOCIATION INC. two of the six committee members retire on rotation but the retirees may re-stand if they wish.

Several GLENGARRRY WATER SUPPLY ASSOCIATION INC. members, capable in mechanical matters, monitor and maintain the pumps & treatment equipment – most particularly Charlie Barker (a permanent resident and former committee member) and Rick Smith (a committee member who is a plumber and has significant knowledge of the historic and current workings of our system). Both men plus GLENGARRRY WATER SUPPLY ASSOCIATION INC. president (Richard Mason) were party to the preparation of this plan.

### **BACH HOLDERS MANAGEMENT COMMITTEE.**

Committee Members are elected annually but for two-year terms on an alternating basis. Accordingly, management expertise is ensured by the presence of several experienced committee members each year to assist new members in becoming accustomed to the requirements of the settlement.

## Overview

Our well was drilled sometime in the 1950s and is 8.5 metres deep. In 1996 our entire reticulation was re-piped, and the well lining was re-cased.

In 2000/2001 we implemented monthly water testing at the camp ground tap undertaken by the District Council who both collect and test our samples. From then until January 2017 we never had a transgression.

During 2015 we installed (through a third party installer) a treatment system to ensure compliance with the Drinking Water Standards for New Zealand.

As part of the installation the well lining was again re-cased.

The system comprises:

2 x 20 micron coarse filters

7 x 1 micro fine filters (upgraded from nominal to Z rated later in 2017)

2 x SPV950 UV light systems

2 x 30000L tanks

Following ongoing transgressions in 2018 a chlorine doser was installed October 2018:

1 x Chem Tech XPV peristaltic chlorine dosing pump

The systems are all electronically monitored and any failure in pressure or UV intensity is signalled generically by a flashing light on the front of the treatment shed and specifically on a light board inside the treatment shed. Each day Charlie Barker or a delegate notes on a calendar inside the shed that no lights have signalled.

The first point in the reticulation post treatment is the garage tap. It is also the first point if we bypass the treatment system thus it can be used for pre and post treatment sample collection. The campground taps, and the domain taps come off a separate feed partway along the main reticulation line and if we shock chlorinate the tanks we need to draw water through this feed by running the camp ground tap for a few minutes. If we have a significant contamination event we can flush the entire system (outside of the campground) with chlorinated water by opening our fire hydrant at the end of the reticulation line to rapidly draw the chlorinated water through.

We have retained the ability to operate outside of the treatment system as this is essential for continuity of supply in a significant power outage; and for firefighting. It is understood that if we do supply water outside of a working treatment system the boil water notices must go up and vulnerable residents should be notified. It is also understood that if when we disengage the bypass lever it is essential that it is completely shut off.

In January 2017 we had our first treatment system assessment by the DHB's Drinking Water Assessor who required us to provide additional information around the UV system, to test at a variety of sites instead of just the Campground, and to notify bach owners to protect against contamination from old pipes within their homes. We provided the information and requested

that the district council test the garage tap, campground 1, campground 2, and the domain taps on rotation. We then received notice that our system was compliant.

The week after the DWA's visit we received our first transgression report.

All testing and reviews since that time indicate the system is installed and working to specification; but, that following heavy weather we now suffer significant ground water contamination leading to the treatment system being overwhelmed and contaminated water getting through.

We have had the system reviewed by two outside agencies - Neither could see any obvious reasons for our now ongoing transgressions; however, it was suggested we review the reticulation around the campground and this has been added to our improvement schedule.

We have a regular maintenance programme in place with the filters being changed at least annually - this has just been changed to monthly for the 20 micron filters. The UV sleeves are checked and cleaned as part of the maintenance schedule and the lamps are automatically changed at 1 year or sooner if intensity diminishes and this is not resolved by sleeve cleaning.

The chlorine doser was installed in October 2018 in response to the unresolvable transgressions. It is fed by a tank which is checked daily and refilled as needed. Free Available Chlorine (FAC) is monitored at a kitchen tap within the settlement at bach 31 or bach 20 using a Siemans Wallace & Tiernan® P15 plus Photometer on long-term loan from the District Council.

Up until now training around monitoring and maintenance has been adhoc and records have not been maintained. Formalising our training activities has been added to our improvement schedule.

The regional council is now also working with us to assist in determine the source of our contamination. In addition, we have requested that we are party to all consent applications within our drinking water protection zone.

Photographs of the Bach Settlement, pumping plant, pump shed, emergency petrol driven pumping system are included in this plan.

## Summary of the barriers to contamination in this supply as at 1/03/19

Barriers to:	Actions or supply elements contributing to these barriers
Stop contamination of raw water	We cannot prevent contamination entering our groundwater outside of our area of ownership; however, we can and do protect from further contamination as the well head is adequately sealed and surrounded by a concrete apron  Each Owners are made aware of need to protect our groundwater
Remove particles from the water	Coarse filtration through two 20 micron filters followed by fine filtration through 7 x 1 micron (Z core) filters
Kill germs in the water	Fine filtration via 1 micron (nominal Z core filter) followed by disinfection via ultra-violet light  Ongoing chlorination
Prevention of recontamination after treatment	Closed storage and reticulation system  Education around importance of protecting the reticulation as it is untreated at this point unless we are full-time chlorinating  Ability to shock chlorinate at the tanks when necessary  Actions taken to avoid and remedy contamination during distribution system maintenance  Residual FAC of 0.3 - .0-5mg/l free available chlorine (FAC) at house tap in supply

**These barriers are our critical control points and all the monitoring and maintenance we undertake which is detailed in the following pages is to ensure the barriers are working and that the water remains safe.**

## Critical Control Point Process Control Summary

### Process objectives

- Provide a primary disinfection Critical Control Point to inactivate bacterial, viral and most protozoan pathogens that may have entered upstream of filtration and UV disinfection

<b>CCP 1: Operational day-to-day monitoring of control processes - Filtration</b>	
How the automatic pressure monitoring works	<p>Pressure is measured for pump 3 which pumps from well to treatment system.</p> <p>Ideal pressure: 400kPa</p> <p>Low pressure: 200kPa                      High Pressure:600kPa</p> <p>At 200kPa low pressure is signalled by a flashing light on the electronics board but does not automatically shut down the pumps</p> <p>At 600kPa high pressure is signalled by a solid light on the electronics board.</p> <p>The monitoring system also signals low tank levels and will shut down the pumps to save running the pumps if the tanks are empty.</p>
What and When	<p>Coarse cartridge filtration of 2 x 20 micron filters to remove sediment</p> <p>Fine cartridge filtration of 1 microns (nominal) to remove protozoa and fine particles</p> <p>Daily monitoring that:</p> <p>No failures have been signalled</p> <p>The treated water doesn't appear cloudy (as part of checks on the water appearance and smell)</p> <p>Weekly monitoring:</p> <p>The operator will make weekly checks on the treatment system to check that the pressure gauge for pump 3 is reading close to 400kPa when the pump is active.</p>
Where	<p>Monitoring of the treated water occurs in the reticulation at point of use</p> <p>Daily and weekly checks occur in the plant shed</p>
How	<p>Visual checks. Record and action if there are issues.</p>
Who	<p>All using the water check prior to consumption</p> <p>The operator will make a daily check to ensure the automatic monitoring system has not signalled any failures</p> <p>The operator will make weekly checks on the treatment system to check that the pressure gauge for pump 3 is reading close to 400kPa when the pump is active.</p> <p>The operator takes action if there are issues identified, which may include contacting committee members or service providers as per the maintenance</p>



	and monitoring sections of this plan
Records	Log book at the treatment plant
<b>CCP 2: Operational day-to-day monitoring of control processes – UV system</b>	
How the automatic UV system and monitoring works	<p>This unit was manufactured by Sterilight (now owned by Viqua). The model SPV950 has two reactors each containing a single sensor and a single low pressure high output lamp. This model has been Standard Validated to NSF 55 Class A and the validation certificate/report was signed and accepted by the Ministry of Health. The installer has signified that he did not alter any of the factory settings at the time of installation and that he appropriately installed the flow restrictor supplied by the manufacturer with each unit. The installation has subsequently been reviewed and confirmed as being installed to specification.</p> <p>The unit can only be effective if the incoming water meets the following specifications:</p> <ul style="list-style-type: none"> <li>• Iron: &lt; 0.3 ppm (0.3 mg/L)</li> <li>• Hardness*: &lt; 7 gpg (120 mg/L)</li> <li>• Turbidity: &lt; 1 NTU</li> <li>• Manganese: &lt; 0.05 ppm (0.05 mg/L)</li> <li>• Tannins: &lt; 0.1 ppm (0.1 mg/L)</li> </ul> <p>UV intensity (UVI) is continuously measured online (using a sensor which reads UV intensity)</p> <p>When the system is not operating correctly a visual signal is activated both within the control console (a solid light for unit 1 and a flashing light for unit 2) and as a flashing light on the exterior of the pump shed.</p> <p>Each lamp has a visual display on its accompanying ICE controller unit (see specific manufacturer’s manual in the appendix to this plan).</p> <p>For the SPV950, the unit will provide a 40 mJ/cm<sup>2</sup> dose as long as the UV intensity remains above 50%. This is measured by a sensor in each lamp unit.</p> <p>The unit will signal if UV intensity falls below 65% - UV is still effective at this level but actions must be taken as described in the maintenance schedule of this plan before intensity falls to unsafe levels (&lt;50%).</p> <p>The lamps have life of 9000 hours (365 days) and the system will signal once this time is up. The operator must then change the lamps as described in the maintenance schedule of this plan.</p>
What and when	<p>UV intensity</p> <p>Daily monitoring that:</p> <ul style="list-style-type: none"> <li>• No failures have been signalled</li> <li>• The treated water doesn’t appear cloudy (as part of checks on the water appearance and smell)</li> </ul>

	Weekly inspection of the UV lamps ICE controller readouts to ensure they are reading >65%. Yearly full water test to ensure incoming water meets the specifications described above.
Where	Daily and weekly checks occur in the plant shed Yearly monitoring of the treated water occurs in the reticulation at point of use
How	Visual checks. Record and action if there are issues.
Who	All using the water check prior to consumption The operator will make a daily check to ensure the automatic monitoring system has not signalled any failures The operator will make weekly checks on the treatment system to check that the pump pressures and the UV intensity and lamp life are operating within limits as described above. The operator takes action if there are issues identified, which may include contacting committee members or service providers as per the maintenance and monitoring sections of this plan
Records	Log book at the treatment plant
<b>Operational day-to-day monitoring of control processes – Chlorination system</b>	
How the automatic chlorine doser works	The chlorine doser sits between the UV system and the tanks. When the tank-fill pump is activated, and water is flowing through to the tanks the doser injects a pre-set amount of diluted chlorine into the water as it goes from the UV system to the storage tanks. The doser draws the chlorine from a feeder tank which contains a 1:20 dilution of concentrated chlorine (1 litre of 13.5% chlorine concentrate plus 19 litres of water). The doser is set at 50%
What and when	Doser Daily monitoring that: <ul style="list-style-type: none"> <li>• Feeder tank has adequate volume of diluted chlorine</li> <li>• Doser is on and set at 50%</li> <li>• No fault light is displayed on the doser</li> </ul> Biweekly monitoring that: <ul style="list-style-type: none"> <li>• FAC at a bach tap is between 0.3 and 0.5 mg/l.</li> </ul>
Where	Daily checks occur in the plant shed

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	Biweekly check performed in a bach by a designated tester
How	Daily visual checks. Record and action if there are issues. Biweekly test and record and notify the operator of any issues
Who	All using the water check prior to consumption The operator will make the daily check and the operator takes action if there any issues are identified, which may include contacting committee members or service providers as per the maintenance and monitoring sections of this plan
Records	Log book at the treatment plant – FAC tests recorded at the bach tested and these results are forwarded to the committee secretary for long term records and storage

#### Cartridge disinfection – Action limits

Process performance criteria at the operational monitoring point		Correction if performance criteria are not met
Action Limits	Water in the reticulation appears cloudy  Pressure is noted to be falling or rising compared with previous readings.	Refer to monitoring and maintenance schedules.
Critical Limits	water in the reticulation appears cloudy  Pressure of less than 200kPa or greater than 600kPa is noted.	Refer to monitoring and maintenance schedules.

**UV disinfection – Action limits**

Process performance criteria at the operational monitoring point		Correction if performance criteria are not met
Target range	Light indicates power is being supplied to the unit  The setting of the values range warning is based on an acceptable UV intensity at or above 65% (UV level green on screen)	Refer to monitoring and maintenance schedules.
Action Limits	UV intensity <65%	Refer to monitoring and maintenance schedules.
Critical Limits	UV intensity <50%	Refer to monitoring and maintenance schedules.

**Chlorination – Action limits**

Process performance criteria at the operational monitoring point		Correction if performance criteria are not met
Target range	At chlorinator: Lights indicates power is being supplied to the unit, unit reads 50%, feeder tank holds adequate reserves for day  FAC reading is between 0.2 and 0.5 mg/L	Refer to monitoring and maintenance schedules.
Action Limits	Chlorinator showing fault Chlorinator not showing 50% FAC <0.25 or >1.0	Refer to monitoring and maintenance schedules.
Critical Limits	FAC < 0.2 FAC >2.0	Refer to monitoring and maintenance schedules.

**Filtration Supporting programs - as per this plan:**

1. Training and competency assessment of operator in filtration of drinking water.
2. Filter replacement when filter age is reached.
3. Checks on filters as per monitoring and maintenance schedules
4. Monthly E. coli monitoring

**UV Supporting programs - as per this plan:**

1. Training and competency assessment of operator in UV treatment of drinking water.
2. Monthly monitoring for E.coli
3. Source water quality checking for Iron, Hardness, Turbidity, Manganese, and Tannins which we know can affect the efficiency of the unit /warranty (as per UV unit manufacturers instructions) should be monitored at least annually and if there is a significant event that could change the source water quality.
4. Checks and maintenance of the UV system to be performed as per the monitoring and maintenance schedules in this plan

**Chlorination Supporting programs - as per this plan:**

1. Training and competency assessment of operator in chlorine treatment of drinking water.
2. Training and competency of FAC tester in meter use, recording and actioning results
3. Monthly monitoring for *E.coli*
4. Checks and maintenance of the chlorination system to be performed as per the monitoring and maintenance schedules in this plan

**Monitoring schedule**

<b>What we monitor</b>	<b>How we monitor</b>	<b>Who Monitors</b>	<b>How often we monitor</b>	<b>Action/contingency</b>	<b>Record</b>
Automated system monitoring	Via an on-board electronic monitoring system	System	Continuously, as long as the system is powered	System self identifies changes in pressure System self identifies changes in UV intensity which may be due to: dirty components; aging lamp and diminishing UV intensity; or water turbidity exceeding the allowable level	Failures signalled generically via the light on the treatment shed and specifically on the electronic board inside
Entire water system including the treatment plant to ensure it is operating to specification	By checking the warning lamp on front of the treatment garage is unlit.	Charlie Baker or delegate	Daily	If the warning lamp is flashing, then the electronics board inside the shed is checked - a red light denotes which part of the system is compromised. The offending area is reviewed in conjunction with the manufacturer's instructions to remedy the fault and appropriate remedial action taken.	On calendar in pump shed
Chlorine doser	Visual check of dosing system	Charlie Baker or delegate	Daily	Reset if powered off Reset to 50% if showing a different value If feeder tank has low level top up with dilution of 1 litre of 13.5% chlorine concentrate and 19 litres of water	Any actions on log at pump shed

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What we monitor	How we monitor	Who Monitors	How often we monitor	Action/contingency	Record
FAC	Using FAC test meter	Rick Smith, or delegate	biweekly	<p>If &lt; 0.25 but &gt; 0.2 test again the next day</p> <p>If &lt; 0.2 notify operator – there has been a failure in the dosing system and there is inadequate chlorine in the reticulation to be protective. Chlorine may need to be added directly to the tanks to ensure water safety.</p> <p>If &gt;1.0 test again the next day</p> <p>If &gt;2.0 notify the operator immediately. The tanks need to be partially flushed via the hydrant system and the chlorinator switched off while they refill to ensure the level of chlorine in the reticulation is not toxic to residents.</p> <p>After any actions regarding low or high levels, daily monitoring must replace biweekly monitoring until 5 consecutive acceptable results are noted</p>	<p>All results</p> <p>All actions</p>
Pressure gauge checking	By visually reading the pressure on the pump 3 gauge when the pump is active	Charlie Baker or delegate	Weekly	<p>Pressure should be close to 400kPa.</p> <p>Unexpected low pressure to be actioned by checking 20 micron filters and changing if visually dirty</p> <p>Unexpected high pressure to be actioned by checking 20 micron filters for rips/tears etc and replacing if necessary.</p>	All levels to be recorded in pump shed
UVI	By visually reading the UVI% on each ICE controller	Charlie Baker or delegate	Weekly	UVI falling to near 65% to be actioned by first checking and cleaning the quartz sleeve as per the maintenance schedule.	UVI% for each unit to be recorded in pump shed

What we monitor	How we monitor	Who Monitors	How often we monitor	Action/contingency	Record
Tanks and well head for any damage/compromising features	Visual check	Charlie Baker or delegate	Monthly	Immediate assistance sought from appropriate contact on Contacts list	On calendar in pump shed
Bacterial count	Water sample collected from within the reticulation from one of four points on rotation (Garage tap, Campground 1, Campground 2, Domain)	District Council	Monthly	<p><b>In the event of a transgression</b> – a positive test for <i>E coli</i> - District Council water test staff phone notifies Charlie Baker (03999-000), texts secretary (0274555-000) and DWA at oncallHPO@cdhb.health.nz). The secretary and Charlie Baker then communicate with a plan which the secretary on-communicates to the DWA or her team members – 03 364 1777.</p> <p>In first instance BOIL WATER NOTICE must be erected at the settlement entrance and at the Campground and vulnerable residents should be notified.</p> <p>Shock chlorination of the tanks may follow – see maintenance section for instructions.</p>	Actual report hard copies maintained by GLENGARRRY WATER SUPPLY ASSOCIATION INC. secretary. Soft copy maintained by the secretary. All transgression follow-up actions recorded by the secretary.
Nitrates	Water sample collected from within the reticulation	District Council	Three monthly	At this stage we know our nitrate levels remain very low, but we also know that if this begins to increase that our only option will be to investigate reverse osmosis filtration – drinking water assessor would then be notified	Actual report hard copies maintained by GLENGARRRY WATER SUPPLY ASSOCIATION INC. secretary. Soft copy maintained by the secretary.



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What we monitor	How we monitor	Who Monitors	How often we monitor	Action/contingency	Record
Full water chemistry	Water sample collected from within the reticulation	Secretary collects sample and submits to Hills Laboratory	Annually	<p>Any transgressions must be acted on accordingly – nil to date, but this is our independent test for turbidity, salt water intrusion, heavy metals etc.</p> <p>This is also essential information for ensuring incoming water is suitable for ongoing UV disinfection: (Iron: &lt; 0.3 mg/L; Hardness: &lt; 7 gpg (120 mg/L); Turbidity: &lt; 1 NTU; Manganese: &lt; 0.05 mg/L; Tannins: &lt; 0.1 ppm ; UV Transmittance: &gt; 75%).</p> <p>Drinking water assessor notified of any unexpected results</p>	Actual report hard copies maintained by GLENGARRRY WATER SUPPLY ASSOCIATION INC. secretary. Soft copy maintained by the secretary
Feedback from residents and visitors	They talk to us regarding water clarity, taste, their health	All of us	adhoc	<p>Any suggestion of cloudy water can indicate overwhelming groundwater contamination which would mean our treatment system may not be keeping up – immediately request ADC water test and put up BOIL WATER NOTICE and notify vulnerable residents.</p> <p>Drinking water assessor notified</p> <p>Any suggestion of salty taste can indicate saline intrusion – immediately request full water test, then flush out our system and replace with tankered water while a plan is developed and effected.</p>	<p>Person receiving report must pass on and record in pump shed.</p> <p>Secretary to maintain record of follow-up.</p>

**Maintenance Schedule**

**All maintenance work must be undertaken with strict adherence to requirements for personal health and safety whilst also ensuring that any work undertaken within the treatment and reticulation systems is done in a hygienic manner so that no contamination is introduced into the system.**

**All maintenance work must be done in strict accordance with the manufacturers’ instructions. Copies are appended to this plan.**

**All parts must be replaced like for like – substituting parts may compromise our water safety. A spare set of all parts is to be held on site.**

- 2 x 20 inch Davey Filterpure Jumbo 20 micron Polyester pleated sediment removal cartridges. Order number E20PP20J-FG
- 7 x 40 inch EZCORE01-40-YYP ZCore cyst safe EZCORE01-4
- 2 x SPV-950 UV lamps. Order number ERS950RL-HO
- Quartz sleeve - ERQS-950

**Record all maintenance on a log sheet as having been completed.**

What we maintain	How we maintain	How often we maintain
Chorine doser	1. Top up feeder tank as required with 1 litre of 13.5 % chlorine concentrate diluted with 19 litres of water	As required

20 micron filters - replace	<ol style="list-style-type: none"> <li>1. Change 20 micro filters x 2 and disinfect the filter pots by adding 250ml chlorine concentrate (13.5%) to each pot after the new filter has being placed and before reconnecting to the system.</li> <li>2. Run the system with the UV units on bypass until the chlorine has been pumped through from the filter pots and then switch off the UV bypass. (minimises breakdown of chlorine to harmful by-products due to exposure to UV light).</li> </ol>	Monthly
UV lamp quartz sleeves x 2 - clean	<ol style="list-style-type: none"> <li>1. Turn off power to UV lamps</li> <li>2. Remove quartz sleeve</li> <li>3. Wipe the quartz sleeve with a clean, soft cloth soaked in white vinegar</li> <li>4. Ensure no smears on the sleeve before repositioning</li> <li>5. Restart system</li> </ol>	3 Monthly
Reticulation flow	Every three months we flush through the fire hydrant system to ensure the pumps are all working to expectation and that no stale water is left sitting in the system (as can happen if baches have been unoccupied for long periods).	
1 micron filters	<ol style="list-style-type: none"> <li>1. Change 1 micro filters x 7 and disinfect the filter pot by adding 250ml chlorine concentrate (13.5%) to the pot after the new filters have being placed and before reconnecting to the system.</li> <li>2. Run the system with the UV units on bypass until the chlorine has been pumped through from the filter pot and then switch off the UV bypass. (minimises breakdown of chlorine to harmful by-products due to exposure to UV light).</li> </ol>	Annually

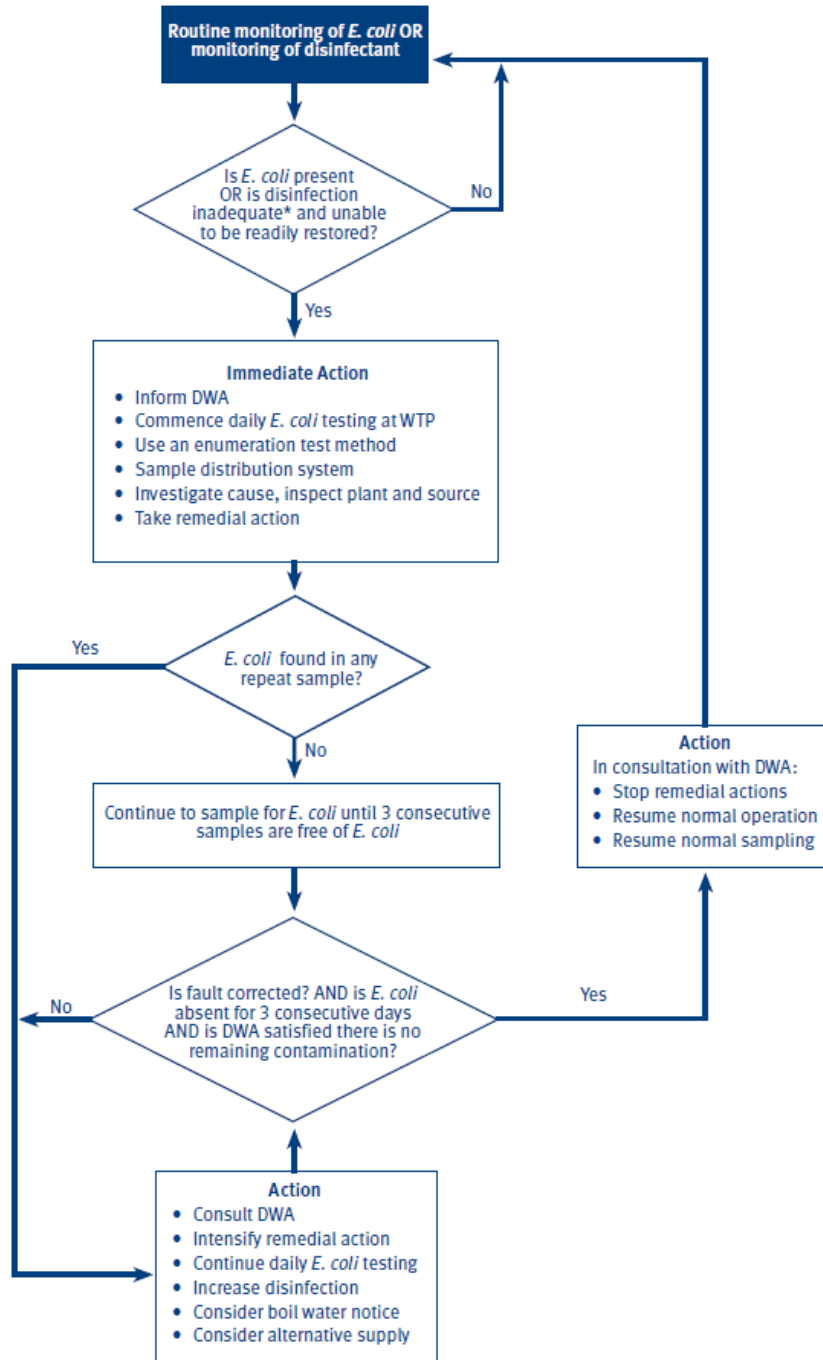
UV lamps	<ol style="list-style-type: none"> <li>1. Turn off power to UV lamps</li> <li>2. Remove each lamp and carefully discard</li> <li>3. Replace with new lamps taking care to not touch the glass surface of the lamp</li> <li>4. Restart system counter to 365 days by depressing (and holding) the push button switch (approximately 2-3 seconds until you hear a “long-beep”). Once you hear the beep, let go of the switch and the counter will be reset.</li> </ol>	
Quartz sleeves - replace	Replace the quartz sleeves on the UV lamps (due 2020)	Every 4 years
Tank chlorination	<p>To shock chlorinate the tanks in the event of a chlorine dosing failure</p> <ol style="list-style-type: none"> <li>1. Turn off the reticulation supply</li> <li>2. Allow the tanks to fill to capacity</li> <li>3. Turn off the inlet pump</li> <li>4. For safety: wear gloves, do not work alone, and work with one tank at a time.</li> <li>5. Add 500ml 13.5% chlorine concentrate to each full 30,000 litre tank this is the equivalent of approximately 2.25ppm. Ensure the lid is properly refastened</li> <li>6. Allow the tanks to sit for at least half an hour before turning on the reticulation</li> <li>7. Run the campground taps for at least one minute to draw the chlorinated water through that off-shoot from the reticulation</li> <li>8. If the problem is not resolved, then repeat this process every <b>5</b> days</li> </ol>	As required
Reticulation chlorination	<ol style="list-style-type: none"> <li>1. This is now covered by our chlorination system</li> </ol>	

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Erecting Boil Water Notices	Two signs are held in the treatment shed. They are erected when required by our monitoring; one at the entrance to the settlement and one at the Campground toilet block When erecting the boil water notices every effort should be made to personally notify vulnerable residents.	As required
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**Response to a transgression in drinking-water leaving the treatment plant**  
 (extracted from NZ Drinking Standards 4.1)

from NZ  
 Water  
 Figure



## Contingency plans

‘Needs Urgent Attention’ from the risk assessment worksheets.	IMPROVEMENT SCHEDULE/REMEDY	Until remedied, how will you know when this is actually causing deterioration towards unsafe drinking-water?	What contingency management plan is in place until the cause is removed or reduced or remedied? Who needs to know and how quickly? Who can help?
<p>Contaminated shallow aquifer water from surface activities in the recharge zone reaches the well at <b>greater</b> than log 4 level contamination, eg. milking shed effluent, septic tank, grazing stock, fertiliser application and intensive irrigation</p> <p><b>Or</b></p> <p>Significant aquifer contamination event overwhelming treatment system via increased turbidity and/or sediment and/or microbial contamination.</p>	<p>We cannot remedy the cause if it is from outside of our settlement we can only manage the consequence</p> <p>Ongoing monitoring of system should show pressure changes if the filters become unexpectedly clogged, prompting both a filter change and a call to regional council and the Public health Unit to notify them of this change in ground water state.</p> <p>However, we now know this level of contamination can occur without signalling a treatment system failure.</p>	<p>Positive test results from monthly bacterial monitoring</p> <p>Discoloured 20 micron filters</p>	<p>Monthly change of 20 micron filters</p> <p>Ongoing chlorination post treatment is the only effective way of ensuring drinking water safety in this setting and is now in place</p> <p>every effort should be made to personally notify vulnerable residents.</p> <p>Needs urgent attention if checks, tests or significant illness indicates the possibility of break-through contamination</p> <p>A boil water notice must be issued should break-through contamination be detected or suspected, the drinking water assessor notified, and follow-up testing requested. At the same time the entire treatment system must be reviewed from well to tap to attempt to determine the contamination source and then effect remedy as soon as possible</p> <p>When erecting the boil water notices</p>

Supply Name: Glengarry Water Supply  
 Supply Owner/Operator: Glengarry Water Supply Association Inc.

<b>'Needs Urgent Attention' from the risk assessment worksheets.</b>	<b>IMPROVEMENT SCHEDULE/REMEDY</b>	<b>Until remedied, how will you know when this is actually causing deterioration towards unsafe drinking-water?</b>	<b>What contingency management plan is in place until the cause is removed or reduced or remedied? Who needs to know and how quickly? Who can help?</b>
<p>Well pumps, mechanical or electric power failure prevents any water being delivered to Community. This occurred 2006 during a significant snowstorm.</p>	<p>Petrol powered back up pump in place with permanent residents trained in its use</p>	<p>Self-evident</p>	<p>Should we need to operate outside of the treatment system the boil water notices must be erected.</p> <p>Pump failure referred to Smith Brothers Engineers Ltd for urgent repair. Should all pumps fail we will have approximately 1 day's water in storage at peak use. If the problem is not remedied within 24 hours, then inhabitants will be advised to use bottled water in the first instance and adjacent river water as a last resort.</p> <p>We understand that use of untreated river water could lead to significant illness. Residents would be advised of the absolute necessity of boiling river water before drinking or using it for washing.</p> <p>Drinking water assessor to be notified and professional help sought if necessary.</p> <p>When erecting the boil water notices every effort should be made to personally notify vulnerable residents.</p>
<p>Complacence that we have a treatment system and therefore are no longer at any risk.</p>	<p>Ongoing treatment system monitoring and maintenance as per this plan.</p>	<p>Monthly monitoring is undertaken for break-through bacterial contamination</p>	<p>A boil water notice must be issued should break-through contamination be detected or suspected, the drinking water assessor notified, and follow-up testing requested. At the same time the entire treatment system must be reviewed from well to tap to attempt to determine the contamination source and then effect remedy as soon as possible</p> <p>When erecting the boil water notices every effort should be made to personally notify vulnerable residents.</p>



Supply Name: Glengarry Water Supply  
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<b>'Needs Urgent Attention' from the risk assessment worksheets.</b>	<b>IMPROVEMENT SCHEDULE/REMEDY</b>	<b>Until remedied, how will you know when this is actually causing deterioration towards unsafe drinking-water?</b>	<b>What contingency management plan is in place until the cause is removed or reduced or remedied? Who needs to know and how quickly? Who can help?</b>
Inadequate UV light intensity to achieve antimicrobial effect	Regular sleeve cleaning and lamp changing as per the maintenance schedule	A failure is indicated by the automatic monitoring system	<p>Should the penetrating light intensity fall below 65% a signal is triggered, and the sleeves must be checked and cleaned as per page 7 of the Sterilight owners' manual.</p> <p>If the maintenance fails to solve the problem the water's turbidity must be tested as the UV system will not work at a turbidity of &gt;1 NTU.</p> <p>Our chlorination system should protect our water in the event of UV failure.</p>
Inadequate or excessive chlorination of supply	Daily checking of doser Biweekly FAC monitoring	FAC too low or too high	<p>FAC &lt; 0.25 but &gt; 0.2 test again the next day</p> <p>FAC &lt; 0.2 notify operator – there has been a failure in the dosing system and there is inadequate chlorine in the reticulation to be protective. Chlorine may need to be added directly to the tanks to ensure water safety (see maintenance schedule).</p> <p>FAC &gt; 1.0 test again the next day</p> <p>FAC &gt; 2.0 notify the operator immediately. The tanks need to be partially flushed via the hydrant system and the chlorinator switched off while they refill to ensure the level of chlorine in the reticulation is not toxic to residents.</p> <p>After any actions regarding low or high levels, daily monitoring must replace biweekly monitoring until 5 consecutive acceptable results are noted</p>

Supply Name: Glengarry Water Supply  
 Supply Owner/Operator: Glengarry Water Supply Association Inc.

<b>'Needs Urgent Attention' from the risk assessment worksheets.</b>	<b>IMPROVEMENT SCHEDULE/REMEDY</b>	<b>Until remedied, how will you know when this is actually causing deterioration towards unsafe drinking-water?</b>	<b>What contingency management plan is in place until the cause is removed or reduced or remedied? Who needs to know and how quickly? Who can help?</b>
Power supply failure	A long term power failure such as experienced in 2006 would render the treatment system inoperable. Water can still be drawn directly from well to reticulation via the petrol driven pump, but the treatment system will be inoperable		<p>The boil water notices must be erected at the entrance to the settlement and at the Campground at any time water is being distributed without first going through the treatment system.</p> <p>Drinking water assessor notified</p> <p>When erecting the boil water notices every effort should be made to personally notify vulnerable residents</p>
Water in the distribution system becomes contaminated but goes undetected because E. coli tests are carried out once per month.	A sample is tested monthly from the reticulation system.	<p>High incidence of illness in the community.</p> <p>Water tastes, looks or smells funny.</p>	<p>Our chlorination system should protect our water even in the event of contamination entering the reticulation.</p> <p>Boil water notices erected</p> <p>Drinking water assessor notified.</p> <p>Tanks may require additional chlorination as per Maintenance Schedule</p> <p>When erecting the boil water notices every effort should be made to personally notify vulnerable residents</p>

‘Needs Urgent Attention’ from the risk assessment worksheets.	IMPROVEMENT SCHEDULE/REMEDY	Until remedied, how will you know when this is actually causing deterioration towards unsafe drinking-water?	What contingency management plan is in place until the cause is removed or reduced or remedied? Who needs to know and how quickly? Who can help?
Severe weather, or environmental event causing well-head, pump or reticulation damage, eg. Flood, snow, landslide, earthquake.	Beyond our control	No water available Or/ Water tastes, smells, or looks abnormal. Treatment system clearly not working or visibly damaged Monthly monitoring detects E. coli High incidence of enteric illness in the community.	Should an earthquake be experienced that damaged the water intake, pumps or distribution, then community members will be advised via door to door communication and a notice at the entrance to the settlement to use boiled/treated river water if water tankers are not available from emergency services. Notify Drinking water assessor
Well is situated just a few metres from seashore & irrigation abstraction from other existing wells and/or future irrigation consents could allow an infiltration of saline into well.	This is in a groundwater red zone and therefore no further irrigation wells <b>should</b> be drilled in our vicinity. Sodium Chloride tests are currently included in the annual full chemical screen performed on our water and to-date all results indicate intrusion has not occurred despite significant earth movement and king tides during this time.		We are unable to judge this threat, but the danger has been identified and will continue to be monitored. Residents will report if they ever notice water tastes salty. If this were to occur, we would need to test immediately and then flush out our system and replace with tankered water while a plan is developed and effected.

## Flow chart of water source and treatment system

<p><b>Catchment and Intake.</b></p> <p>The intake is a shallow well, with a sealed well head &amp; casing (casing and foot valve renewed 2015), with a depth of about 8.5 metres (measured 2012). The well head is surrounded by a concrete apron.</p> <p>The well is located immediately adjacent to a modern garage building which houses the pumps and treatment system as well as firefighting equipment and emergency supplies. The building is in excellent repair and secure.</p> <p>The site is secure against vandalism.</p>
↓
<p><b>Treatment:</b></p>
<p>Water is pumped from the well (well head photo 2) via Pump 3 to the treatment plant located in the adjacent garage (Photos 5 - 13).</p> <p>The treatment system (commissioning completed 2016) comprises:</p> <ul style="list-style-type: none"> <li>• two 20 inch, 20 micron polyester pleated “Filterpure” sediment filters</li> <li>• one “Filterpure” FP7X40 filter housing with seven x 40 inch EZCORE01-40-YYP ZCore cyst safe filters</li> <li>• Two Viqua Sterilight SPV-950 UV reactors with HO lamps, each with a Platinum ICE controller. Certification of this unit as operating within the standard: NSF/ANSI 55-2002 Class A (NSF and ANSI 2002b) to deliver at least 40 mJ/cm<sup>2</sup> validated reduction equivalent dose at the UVT and turbidity present has been confirmed with Viqua and is demonstrated via a statement on the units themselves.*</li> <li>• one neutraliser pH correction filter – not currently connected to system</li> <li>• an electronic monitoring system which highlights any fault in the treatment system via a red light on the diagnostics board (specifically showing the fault location) inside the treatment room and via a warning light on the exterior front of the treatment garage.</li> <li>• Chem-Tech XP series Chlorine doser and feeder tank</li> </ul> <p>*Complies with requirements shown in Table 10.1, The Drinking-water Standards for New Zealand 2005 (Revised 2008) chapter 10 Small Water Supplies, Alternative Compliance Criteria</p>
↓

**Storage and Distribution:**

Post treatment storage is in two 30000L tanks behind the treatment garage (photo 3).

It is estimated that the tanks will give approximately one day's domestic use at peak times – and around one hour's firefighting time - which is important to us given our distance from local volunteer brigades

The connections at the tanks are protected by a custom made cage (photo 4).

Water is pumped from the tanks, via a high pressure system (pump 1), into 90 mm polyethylene mains, 600 mm underground, to the 71 Baches.

Pumps are computerised, powered by three phase electric motors, adequate petrol powered backup facilities are available on site for short term power outages.

Standard fire hydrants are included in the main line. Pump 2's sole role is to supplement reticulation flow in the event of high need – such as in a fire.

Back flow prevention devices are not considered necessary due to high pressure delivery in main line. However non return valves are fitted at the source.

The main line reticulation follows the road verges. The full reticulation map is on the wall of the treatment shed and has been submitted with a previous plan.

**Testing:**

Biweekly FAC testing in a bach in the reticulation

Potable water testing for FAC, coliforms and *E coli* is undertaken monthly within the distribution network by the District Council – who both collect and analyse the samples.

Nitrate testing collected by the District Council on a quarterly basis and forwarded to another testing facility.

If bacterial results are outside acceptable limits the drinking water assessor must be notified immediately, and boil water notice erected (see Monitoring).

## Risk assessment worksheets backgrounding all the preceding schedules

### Catchment and Intake

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)	Is this under control?	If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.
1. Contaminated shallow aquifer water from surface activities in the recharge zone reaches the well at less than log 4 level contamination, eg. Milking shed effluent, septic tank, grazing stock, fertiliser application and intensive irrigation.	Yes – Control has been effected by the 2016 implementation of our treatment plan.  To the best of our ability we monitor and submit on consent applications within our water protection zone.	.
2. The bypass lever which allows us to draw from well to reticulation in the event of fire or power failure is not fully shut off	Yes, all who use this system have been instructed in the absolute need to ensure this is properly shut off to ensure contaminated groundwater can not mix with treated tank water when the reticulation pump is activated.  Should water mixing occur the ongoing chlorination should be protective	

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)	Is this under control?	If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.
<p>3. Contaminated shallow aquifer water from surface activities in the recharge zone reaches the well of <b>greater</b> than log 4 level contamination, eg. Milking shed effluent, septic tank, grazing stock, fertiliser application and intensive irrigation</p>	<p>No – breakthrough contamination may occur despite treatment</p>	<p><b>URGENT</b> – see Plans to Manage Section</p>
<p>4. Contamination at well head from surface leaching and run off down the outside of the casing.</p>	<p>Yes. Well head &amp; casing sealed from outside contamination. Hardware in good condition and intake position secure from stock etc.  Further control has been effected by our treatment system</p>	
<p>5. Severe flooding from the River. – May affect turbidity of bore and increase risk of contamination.</p>	<p>Yes. Historically river levels have not affected well conditions &amp; flood protections are in place to protect community area from water build up.</p>	
<p>6. Not enough water can be drawn from the well to meet demand because the aquifer is low on water.</p>	<p>Yes. Recent droughts have seen many wells in the area running low; however, our well has consistently been able to fully meet demands.</p>	
<p>7. Resource consent to take water restricts amount that can be taken.</p>	<p>Yes. Demand can and has always been satisfactorily met but should restrictions be imposed we have documented ways of managing</p>	

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)	Is this under control?	If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.
<p>8. Well is situated just a few metres from seashore &amp; irrigation abstraction from other existing wells and/or future irrigation consents could allow an infiltration of saline into well.</p>	<p>No. However this is in a groundwater red zone and therefore no further irrigation wells <b>should</b> be drilled in our vicinity.</p> <p>Sodium Chloride tests are currently included in the annual full chemical screen performed on our water and to-date all results indicate intrusion has not occurred despite significant earth movement and king tides during</p>	<p>We are unable to judge this threat, but the danger has been identified and will continue to be monitored.</p>
<p>9. Well pumps, mechanical or electric power failure prevents any water being delivered to Community. This occurred 2006 during a significant snowstorm. Property is surrounded by intensive dairying area &amp; mains power restoration can be delayed due to demand on Lines Company.</p>	<p>Yes. Pumps require substantial three phase electric power.</p> <p>Pumps are now covered by both uninterrupted power supplies and an automatic system reset to protect entire system from <b>short term</b> power outages.</p> <p>For long term outages (such as in 2006) a back-up petrol pump is available (see photo 5) and several people have been trained in its use.</p>	<p>Should we need to operate outside of the treatment system the boil water notices must be erected - <b>URGENT</b></p> <p>Should all pumps fail inhabitants will use the adjacent river water and would advised to boil it as use of untreated river water could lead to significant illness, Health.</p> <p>Authorities to be alerted &amp; professional help sought if necessary.</p> <p>When erecting the boil water notices every effort should be made to personally notify vulnerable residents</p>



**Treatment**

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)	Is this under control?	If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.
<p>10. Complacency that we have a treatment system and therefore are no longer at any risk.</p>	<p>Yes – on going treatment system monitoring and maintenance as per Operating and maintenance procedures for the Glengarry water supply treatment system</p> <p>Monthly monitoring is undertaken for break-through bacterial contamination.</p>	<p>Needs urgent attention only if checks, tests or significant illness indicates the possibility of break-through contamination.-see 10 below.</p>
<p>11. Significant aquifer contamination event overwhelming treatment system via increased turbidity and/or sediment and/or microbial contamination.</p>	<p>NO – on going monitoring of system should show pressure changes if the filters become unexpectedly clogged, prompting both a filter change and a call to the regional council and the Drinking Water assessor to notify them of this change in ground water state.</p> <p>However, we now know that breakthrough contamination can occur without triggering any signals in our system and that the 20 micron filters maybe also be visibly dirty and not signal a pressure change.</p>	<p>Needs <b>URGENT</b> attention should break-through contamination be suspected or confirmed.</p>
<p>12. Inadequate UV light intensity to achieve antimicrobial effect</p>	<p>Yes – Platinum ICE controllers on each lamp which signal if there is inadequate UV light penetrating the sleeve.</p> <p>Ongoing monitoring and maintenance as per this plan</p>	<p><b>URGENT</b></p>

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)	Is this under control?	If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.
13. Incorrect parts inserted or correct parts incorrectly inserted (filters/lamps/sleeve)	Yes. Ordering and maintenance undertaken as per Operating and maintenance procedures for the Glengarry Water supply Water treatment system by people skilled in the use of the system.	
14. Filter cartridge failure due to rupture	Yes. This would be detected due to change in pressure and appropriate steps undertaken to remedy as per Operating and maintenance procedures for the Glengarry Water Supply Water treatment system	
15. Contamination introduced at time of system maintenance	Yes. Maintenance undertaken by skilled people Each time the filters are changed the filter pots are to be chlorinated as per maintenance schedule	
16. Power supply failure.	No – a long term power supply failure as seen in 2006 would render the treatment system inoperable.	<b>URGENT</b>
17. The SPV-950 has been discontinued by Viqua – can parts and replacement lamps still be purchased?	Yes. Personal communication with the supplier, confirms ongoing plentiful stocks of all parts including replacement lamps will be available out to 10 years from now.	

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)	Is this under control?	If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.
18. The chlorine doser fails in some way	Daily checks at doser and of FAC in supply	Should FAC be too low or too high urgent attention is needed

**Storage and Distribution**

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)	Is this under control?	If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.
19. Breaks, leaks or damage to pipes allowing contaminants to enter mains	<p>Yes, skilled artificer, who was involved with initial water mains installation, is available to quickly effect any repairs necessary.</p> <p>Backup person available if required.</p> <p>Our ongoing chlorination should overcome any contamination which enters the reticulation</p>	Yes if overwhelming contamination enters reticulation

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)	Is this under control?	If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.
20. Contamination enters the water during repairs to the distribution system.	Our ongoing chlorination should overcome any contamination which enters the reticulation	
21. Illegal connection to water supply - especially where backflow of contaminated water is possible.	Yes, supply demand is monitored. No notable change in supply demand.	
22. Backflow from consumer's household water storage facilities into reticulation.	Yes, some consumers have on-site storage facilities the status of which is unknown. The reticulation has non-return valves on point of entry to well and delivery site of pumps.  An inspection/survey of consumers to ascertain type and status of on-site storage was undertaken 2010 and was deemed satisfactory	
23. Dead ends in mains – water sitting for extended periods at ends of supply lines.	Yes, managed by implementing a regular programme of flushing through fire hydrants <b>and the campground tap line as this is also a dead end</b>	
24. Water storage insufficient to supply settlement	Yes, there have not been issues with this to date. Refer to point 5.	

Supply Name: Glengarry Water Supply  
 Supply Owner/Operator: Glengarry Water Supply Association Inc.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)	Is this under control?	If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.
25. Contamination introduced via insecure tank seals	<p>Yes. Tanks were adequately sealed at time of installation (2015).</p> <p>Protective caging has been placed around the pipe connections to discourage vandalism and animal damage – see Photo 4.</p> <p>Ongoing review of tanks seals are undertaken monthly to ensure integrity– see maintenance schedule.</p>	

**Other**

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)	Is this under control?	If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.
26. Water in the distribution system becomes contaminated but goes undetected because <i>E coli</i> tests are carried out only once per month.	Can now only be assured by full time chlorination.	If at any time contamination of the water is suspected or confirmed = <b>URGENT</b>
27. Incorrect actions when taking water samples for testing causes the sample to become contaminated.	Yes. District Council sampling officer is trained as to how to take samples from the reticulation main line and works with us should we need to have a pre-treatment sample collected.	
28. Severe weather, or environmental events causes well-head, pump or reticulation damage, e.g. flood, snow, landslide, earthquake.	Yes, with respect to well head damage or flood. Also, yes regarding landslide as there are no apparent earth works, risen areas or banks that could provide a danger in this respect. No. earthquakes - cannot provide for or control this	Needs <b>URGENT</b> attention for any event which compromises the integrity of the system.



Photo 2 Wellhead

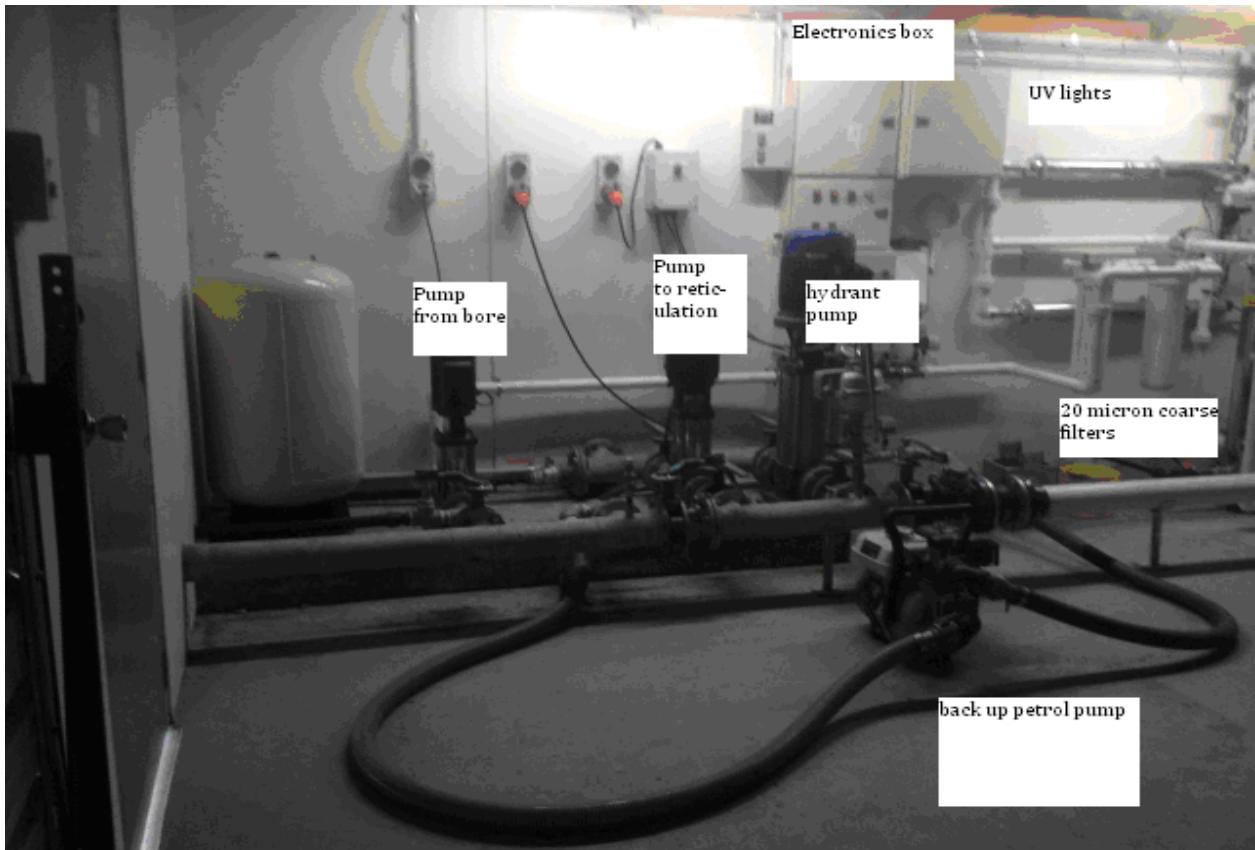
Photo 3 Tank location in relation to treatment system garage

Photo 4 pipe protection between tanks



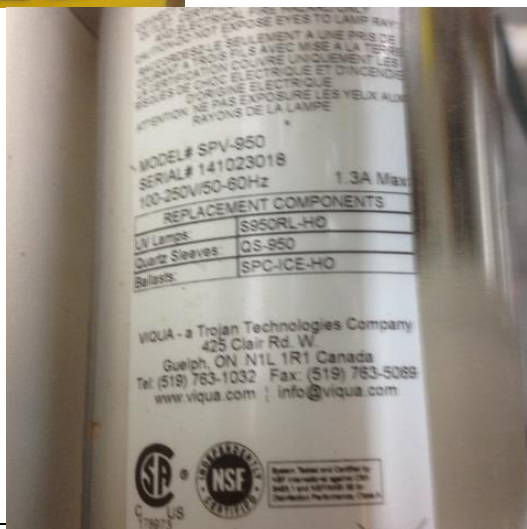
Supply Name: Glengarry Water Supply

Photos 5 and 6: actual treatment system





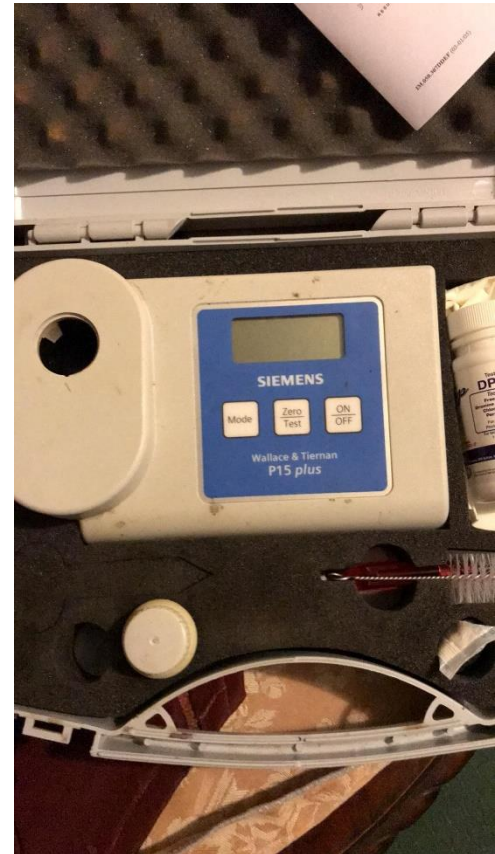
Photos 7 – 12, components of system



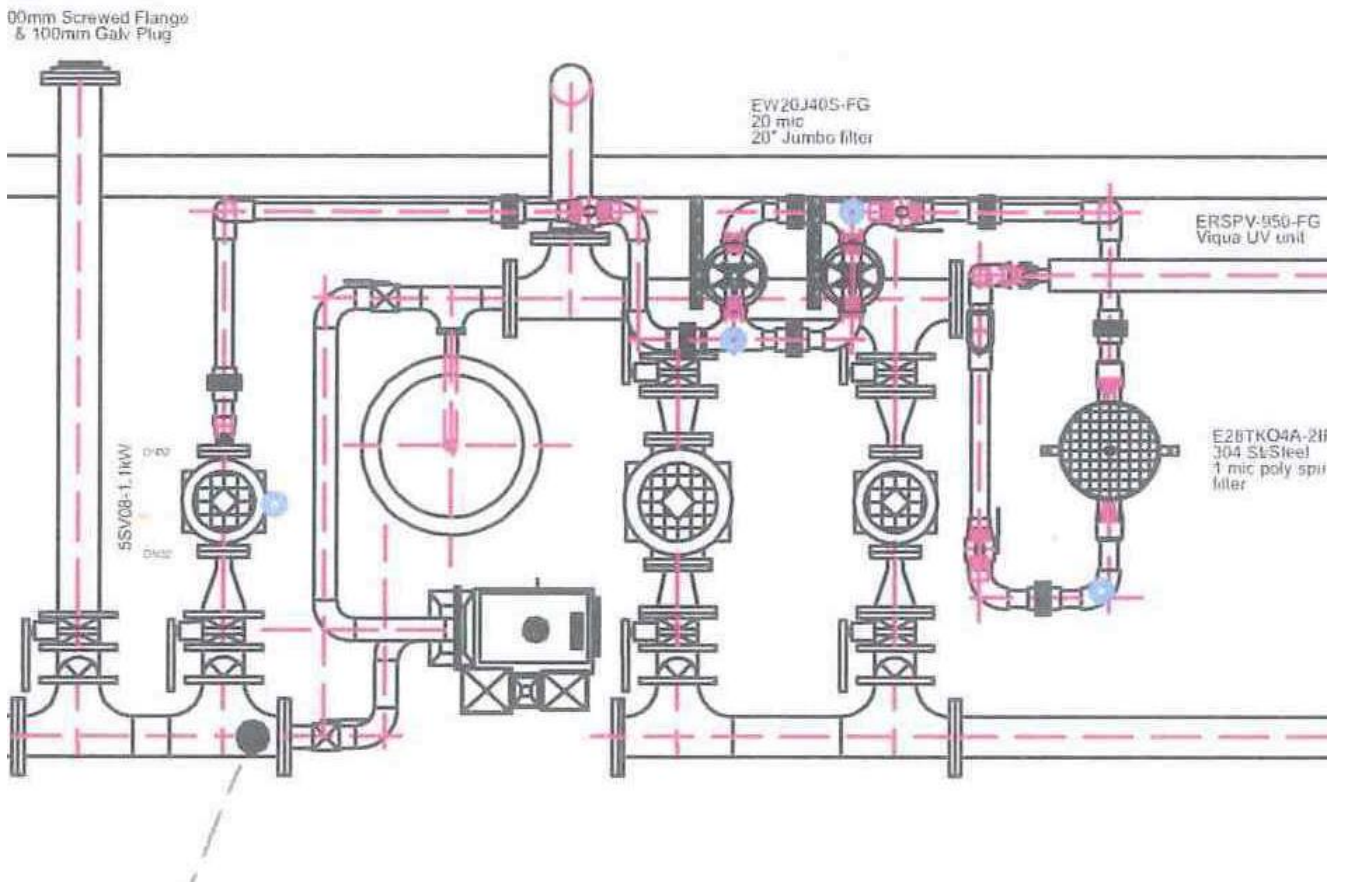


chlorine doser

FAC meter



Original plan on which the current system is based.



Boil water notice – Two held and erected at entrance and Campground when necessary



## Improvement Schedule

					Costs			
	Improvement needed	Level of risk (see Risk Information Table)	Health priority	Time frame	Time input required	Equipment and any installation costs (estimated)	Overall priority for making the improvement	Comments
1	Install chlorinator and commence ongoing chlorination	Extreme	Top	By October 2018	Moderate	\$3000	Top	Done.
2	Introduce regular monitoring of the chlorine residual (FAC)	High	High	At time of chlorinator install	Low	To be confirmed	High	Done
3	Create a register of vulnerable residents and determine a way of directly communicating boil water requirements to them	High	High	By October 2018	moderate	Nil	High	Ongoing

Supply Name: Glengarry Water Supply

4	Update documentation to include chlorinator and its ongoing maintenance			At time of chlorinator install	Low – moderate		High	Done
5	Train volunteers who carry out monitoring and maintenance work and record this training.	High	High	By October 2018	Low – moderate	\$0	High	Ongoing
6	Continue working with regional council and other territorial local authorities to determine source of contamination			Ongoing	moderate			Ongoing
7	Review pipework around campground			By November 2018	low			Ongoing
8	Upgrade campground pipework where necessary			By February 2019	moderate	To be confirmed		Ongoing
9	Ongoing review of this water safety plan			Annually				The water safety plan will be reviewed each December between the formal review cycles and discussed at each year's January committee meeting (and any other committee meeting in between should the need arise).

## **Appendices**

**Manufacturers specifications and instructions relating to 20 micron filters**

**Manufacturers specifications and instructions relating to 1 micron filters**

**Manufacturers specifications and instructions relating to SPV 950 UV treatment system**

**Manufacturers specifications and instructions relating to Chem-Tech XP chorine**

**Manufacturers specifications and instructions relating to Siemans FAC meter**

**Chapter 10 Drinking water standards for NZ 2005 (revised 2008) – Small water supplies alternative compliance criteria**

**Background paper on GLENGARRRY WATER SUPPLY ASSOCIATION INC. water supply and catchment 2018**