Methven Springfield Water Supply

Water Safety Plan

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Water Safety Plan

Version 2.0: November 2017

Authorised by: _____

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Drinking Water Assessor

Document Control

Version No	Description	Authorised (ADC)	Approved (CHDB)	Approval Date
V1.0	Public Health Risk Management Plan 2012	Andy Guthrie (Assets Manager)	Mitesh Mudaliar	March 2012
V1.0	Water Safety Plan 2016	Andy Guthrie (Assets Manager)		Not Approved
V2.0	Water Safety Plan 2017	Andy Guthrie (Assets Manager)	Hayley Proffit	30 November 2017

Contents

1 Background

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

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

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

Methven Springfield is classified as a Rural Agricultural Drinking Water supply under the legislation and is required to be compliant with the Act by 01 July 2016. ADC submitted a Water Safety Plan for Methven Springfield in July 2016 but this was not approved. This WSP has been prepared to meet the requirements of section 69Z of the Act. This WSP has been prepared with input from ADC (Water Supply Owner) staff members and from ACL (Water Supply Operator) staff members.

1.1 Water Quality Standards and Compliance

1.1.1 Water Quality Standards

The water quality standards, which specify the maximum acceptable values (MAVs) at which the risk of disease or illness from drinking the water is negligible, will follow those set out in Section 2 of the *Drinking-water Standards for New Zealand* 2005 (2008).

1.1.2 Compliance Criteria

As per page 3 of the *Rural Agricultural Drinking-water Supply Guideline 2015*, water suppliers have the following three options available to them in order to demonstrate compliance:

1. Meet the relevant criteria for large, medium, minor, small or neighbourhood drinking-water supplies, as set out in the *Drinking-water Standards for New Zealand*, sections 4, 5, 7, 8 and 9
2. Choose to use section 10 of the *Drinking-water Standards for New Zealand* (Small water supplies, alternative criteria), and follow that water safety plan approach, or
3. Use the *Rural Agricultural Drinking-water Supply Guideline 2015* to develop and implement an approved water safety plan.

Methven Springfield Water Supply intends to follow option two - **Use Section 10 of the Drinking-water Standards for New Zealand (Small water supplies, alternative criteria) and follow that water safety plan approach** – in order to demonstrate compliance.

2 Implementation, Review and Reporting

2.1 Implementation of the Plan

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

2.2 Reviewing Plan Performance

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

The review will include an assessment of any events, non-compliances, near misses and unexpected situations that have occurred; progress against the improvement schedule; and any changes to any of the supply elements. Adjustments will be made to the plan as a result of information provided by this assessment.

2.3 Duration of the Plan

This Plan shall remain in force for a period of up to five years following approval.

2.4 Revision and Re-approval of the Plan

It is a requirement that the WSP be reviewed, revised and submitted for re-approval within five years of approval. During the five year period, the document will be kept current through the following steps:

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

2.5 Links to other Quality Systems

This Water Safety Plan will contribute improvement measures to Ashburton District Council's Activity Management Plan (AMP) for prioritisation and funding via Ashburton District Council's Long Term Plan (LTP).

3 Supply Details

Supply	
Supply Name	*Methven Springfield*
DWO Community Code	*MET002*
Supply Owner	*Ashburton District Council*
Supply Manager	*Andrew Guthrie*
Supply Operator	*Ashburton Contracting Ltd – Robin Jenkinson (NZCE Civil, R.E.A.)*
Population Served by Supply	*178 (Census 2013)*
Supply Grading	*Ed*
Source	
Source Name	*Methven/Springfield Gallery*
Source WINZ Code	*S00224*
Location	*Ashburton River Road, METHVEN/SPRINGFIELD*
Map Reference	*NZMS 260 K36: 9223-3190*
Type of Source	*Infiltration Gallery*
Depth of Bore	*N/A 150m long, 6m deep*
Consent Number	*CRC002108*
Consent Expires	*30 Jan 2041*
Treatment Plant	
Treatment Plant Name	*Methven Springfield*
Treatment Plant DWO Code	*TP00343*
Location	*Pudding Hill Road*
Map Reference	*NZTM 1486094 easting, 5169077 northing*
Treatment Processes	*Chlorine Disinfection and UV Disinfection*

Distribution	
Distribution Zone Name	*Methven Springfield*
Distribution Zone DWO Code	*MET002MS*
Distribution Zone Population	*178 (Census 2013) and also supplies stockwater to 7,450ha*
Regulatory Compliance	
Standards compliance assessed against	*DWSNZ (revised 2008)*
Laboratory undertaking analyses	*Ashburton District Council Laboratory (Bacteriological monitoring)* *Citilab (Chemical Monitoring)*
Secure bore water	*No (surface water supply)*
Bacterial compliance criteria used for water leaving the treatment plant	*Criterion 1*
Bacterial compliance for water leaving the treatment plant has been achieved for the last 4 quarters.	*Yes*
Protozoa log removal requirement required for the supply	*3 Log credits (Section 10)*
Protozoa treatment process	*No protozoa treatment (Non-compliant UV installed)*
Protozoa compliance for water leaving the treatment plant has been achieved for the last 4 quarters.	*No*
Compliance criteria used for water in the distribution zone.	*Criterion 6A*
Bacteria compliance for water in the distribution zone has been achieved for the last 4 quarters.	*Yes*
P2 determinands allocated to supply	*None*
Chemical compliance achieved for the last 4 quarters.	*Yes*
Cyanobacteria identified in the supply	*No*
Cyano bacterial compliance has been achieved for the last 4 quarters.	*Yes*
Identify any transgressions that have occurred in the last 4 quarters	*None*

3.1 Contact Information

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

Water Supply Operator
Ashburton Contracting ltd
PO Box 264, Ashburton
Contact: Robin Jenkinson
Phone: 03 308 4039

4 Methodology

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

4.1 System Description

The water supply has been described and a schematic diagram prepared to illustrate the key elements of the supply (section 5). Critical points and barriers to contamination are also illustrated (Sections 6 and 7).

4.2 Consultation

Version 1 of this plan was prepared in July 2016 in consultation with Ashburton District Council water supply management and operational staff and in accordance with existing documentation.

Discussions with the Water Supply Operator (Ashburton Contractor Limited) – to include both management and plant operators – have been held. Critical points, barriers to contamination, risks to the supply, preventative measures in place, and monitoring requirements were discussed at this time and the information provided has been used to inform this WSP.

The Version 2.0 WSP draft was reviewed by and discussed with Ashburton District Council (ADC) Assets Manager Andrew Guthrie and Robin Jenkinson of Ashburton Contracting Ltd (ACL) prior to completion. There have also been onsite discussions between the ADC 3 Water Engineer and ACL site operators.

4.3 Risk Assessment

A qualitative risk assessment approach has been taken following a similar approach to that outlined in Appendix 2 of "A Framework on How to Prepare and Develop Water Safety Plans for Drinking-water Supplies", Ministry of Health (2014). This allows for the prioritisation of improvement needs and the development of the Improvement Schedule.
Risk tables have been prepared to summarise:

a) What could happen that may cause drinking water to become unsafe,
b) What preventative measures are in place to prevent this from occurring and whether this is sufficient,
c) Checking the preventative measures – what to check and upon checking, what are the signs that action is needed
d) Corrective actions required.

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

The scales used have been adapted from those suggested in Appendix 2 of "A Framework on How to Prepare and Develop Water Safety Plans for Drinking-water Supplies", Ministry of Health (2014). Changes have been made to achieve a better spread of risk level outcomes, and to ensure relativity between the risks assessed for supplies of varying sizes. This is necessary as it is intended that improvement schedule items from individual supplies can be consolidated into a master list for implementation.
Table 1, Table 2 and Table 3 detail the criteria used and their definitions.

Table 1 Likelihood Scale

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

Table 2 Consequence Scale

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

Potential public health risks have been evaluated using the Likelihood and Consequence scales tabulated above (Tables 1-2) to determine a risk level from low to extreme (Table 3 below).

Table 3 Risk Level Allocation Table

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

Risk tables have been prepared to summarise:

e) What could happen that may cause drinking water to become unsafe,
f) What measures are in place to prevent this from occurring and whether this is sufficient,
g) The assessed level of risk, and
h) What could be done to eliminate, isolate or minimise the risks.

4.4 Improvement Schedule

An improvement schedule (section 9.5) has been derived from the risk tables and is prioritised according to the assessed level of public health risk associated with hazards that are not adequately controlled at present.

Funding for the improvements have either already been approved by Council and is detailed and published in the 2015 – 2025 Long Term Plan, or are included in the draft 2018-2025 Long Term Plan.

4.5 Contingency Plans

Contingency plans have been prepared (section 10) to provide guidance in the event that control measures fail to prevent the occurrence of a risk event that may present acute risk to public health. The Water Supply Operator is responsible for implementation of the contingency plans when monitoring has identified the occurrence of a risk event.

5 Methven Springfield Water Supply - General Description

5.1 Methven Springfield Water Supply Process Diagram

Figure 1 (below) illustrates the Methven Springfield water supply from source to reticulation.

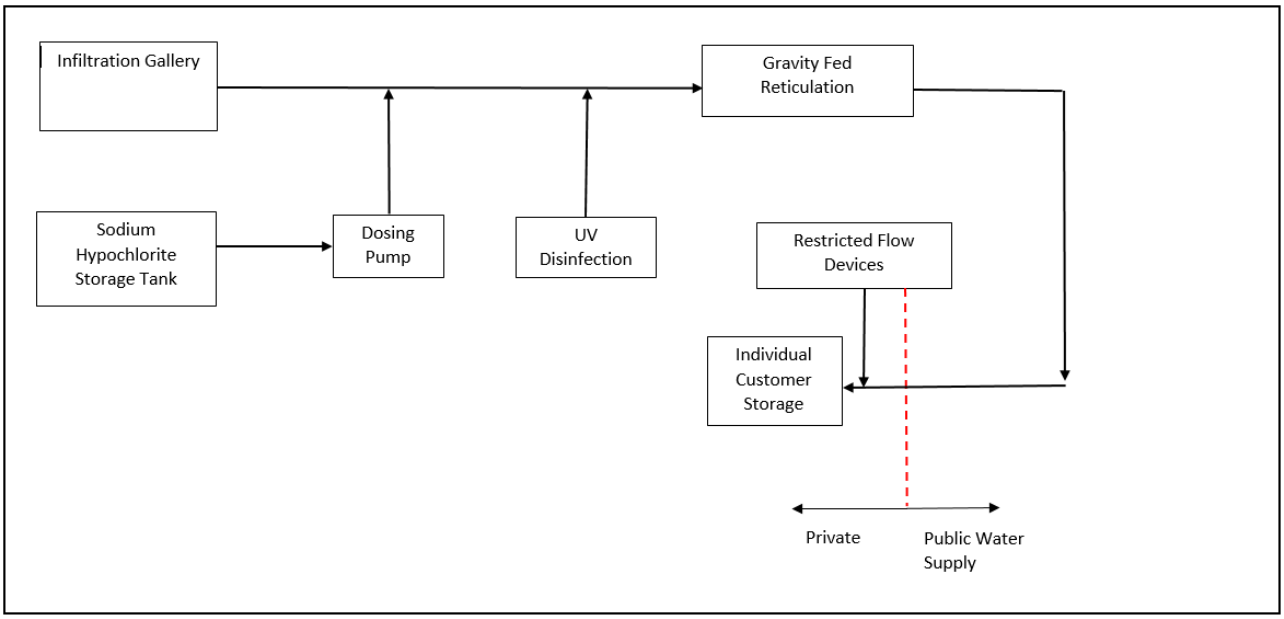


Figure 1: Methven Springfield Water Supply Process Diagram

5.2 Source

In 1981, the Methven Springfield source, which is adjacent to the confluence of the Ashburton River North Branch and Pudding Hill Stream, was constructed to provide a more adequate water supply in terms of quantity and quality for the rural areas and to replace the existing stock water races. The scheme was designed on a restricted flow regime in that all contributing landowners are provided with a finite amount of water.

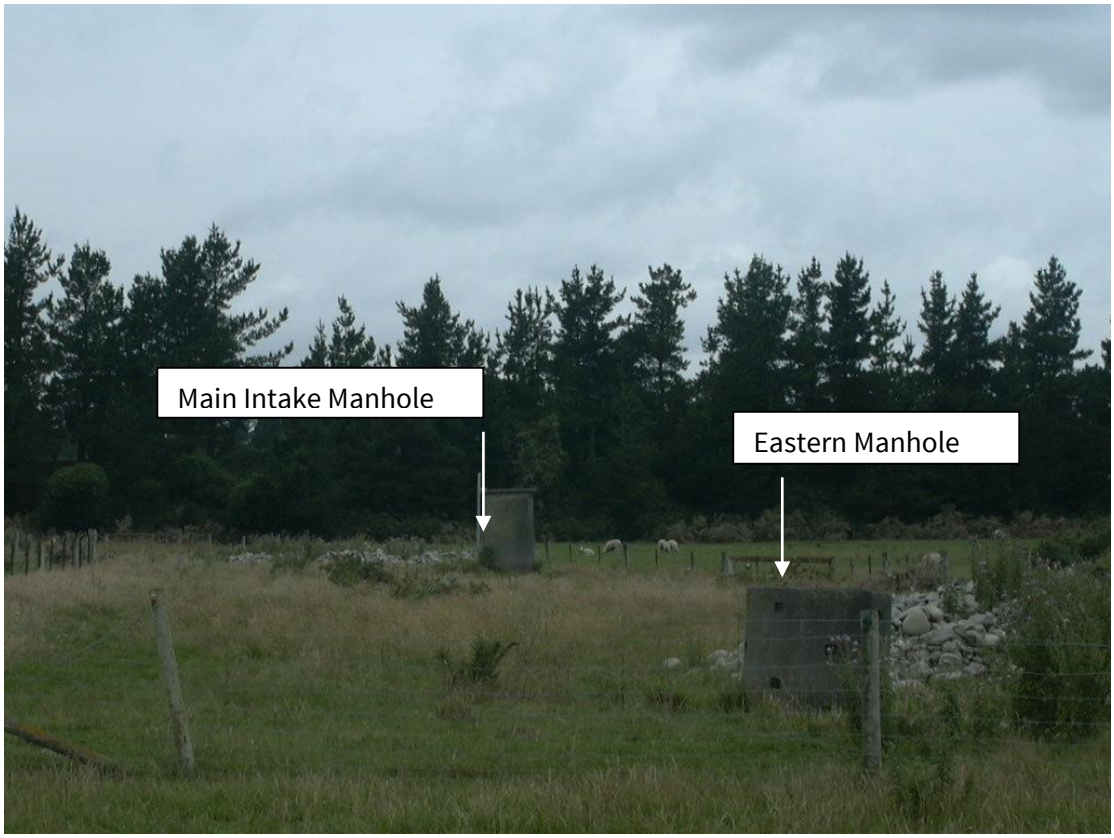
The Methven Springfield source was an infiltration gallery situated on private property off Ashburton River Road.

The gallery was constructed in 1981 and consists of a main manhole, a north lateral and a south lateral with a manhole at each end. The ground level at the main manhole is 407.8m and the top of the manhole is 1.98m above ground level. The main manhole extends 10.19m below the ground.

The western manhole is 49.4m from the main manhole and one 200mm diameter perforated Class B PVC pipe joins the two. The perforated pipe has 54 6mm holes per metre and has a level of 402.37m under the western manhole and a level of 401.91m under the main manhole.

The eastern manhole is 103.2m from the main manhole and two 200mm diameter perforated Class C PVC pipes running in parallel join the two. The perforated pipe has 54 10mm holes per metre and has a level of 403.3m under the eastern manhole and a level of 402.05m under the main manhole.

The trenches that the laterals are laid in were filled with a 50mm deep bedding layer of 25mm pea shingle before the perforated pipe was laid. Another 200-300mm of pea shingle was then placed around and on top of the pipe. The cover was finished with a 100-150mm deep layer of 6mm chip.



Photograph No 1 – Infiltration gallery, access chamber

5.3 Raw Water Trunkmain

The Raw Water Trunk Main travels 460m south from the infiltration gallery to the old chlorination shed that is also located on private property. Inside the shed is an ABB electromagnetic flowmeter with a GPRS data logger .The trunk main is 200mm dia Class B PVC pipe.

The trunk main travels south over farmland for another 2006m before turning east and crossing River Road. The trunk main then travels over farmland until it meets the Rakaia Methven Alford Forest Road (Pudding Hill Road). At this point the new treatment plant has been constructed.

There are a number of sluice valves, air valves and a washout on this line but they are not clearly identified on the ground. It would be beneficial that all appurtenances on the trunkmain are located and clearly marked. It would also be beneficial that all the air valves are exercised.

There is the ability to supplement the Methven Springfield raw water line at the Methven gallery. This is done by 'over pumping' from the Methven Gallery manhole into an up stand pipe approximately 20m away. This is required to be done when the Methven Springfield gallery is low/dry.

Photograph No 2 – Old chlorine shed on raw water trunkmain route

5.4 Water Treatment Plant

The new Methven Springfield Water Treatment Plant is located on Pudding Hill Road. This new WTP was constructed in 2002.

The WTP is contained in a small fenced area with a padlocked gate. The WTP building has a padlocked garage door. The front of the WTP building is shown in the photograph below, along with the backup generator.

At construction there was a small holding tank and booster pump installed, feeding a 25mm line to users above the mainline from the plant. This was to boost supply to higher elevations should the need arise (high downstream demand / leaks etc). it is thought that this has only ever been used once – approximately 8 years ago in 2008.

There is an outlet ABB MagMaster electromagnetic flowmeter installed. The flowmeter does not control the dosing of the chlorine.

Photograph No 3– Treatment shed with chlorine storage tank and back up generator visible.

The raw water is dosed with 13.5% sodium hypochlorite solution at a fixed dose rate before passing through a (non-validated) UV disinfection system and then to the reticulation. There is no filtration of raw water at present. Pipework allows the system to be by-passed if necessary for maintenance. Water continually runs through the plant unless it is shut down for maintenance.

Photograph No 4– Chlorine dosing pump

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

An analyser records ultraviolet transmissivity (UVT) of the water but this is not connected to telemetry and is recorded manually during inspections by the operator. The UVT analyser is calibrated when the tubes are replaced and when there is a fault with the unit or one of the tubes. SCADA is used to report power failure, high flow and UV fault to the operator by alarms. SCADA also records accumulated flow, instantaneous flow and pump run hours.

Photograph No 5 – UV unit within treatment plant

5.5 Reticulation

Water is fed directly from the treatment plant into the reticulation by gravity.

The Methven Springfield reticulation supplies an area of 7,450 hectares using 85km of pipework. The materials in the reticulation are PVC or POLY and the class of the pipe is B. The diameters of the pipes are shown in Chart 1.

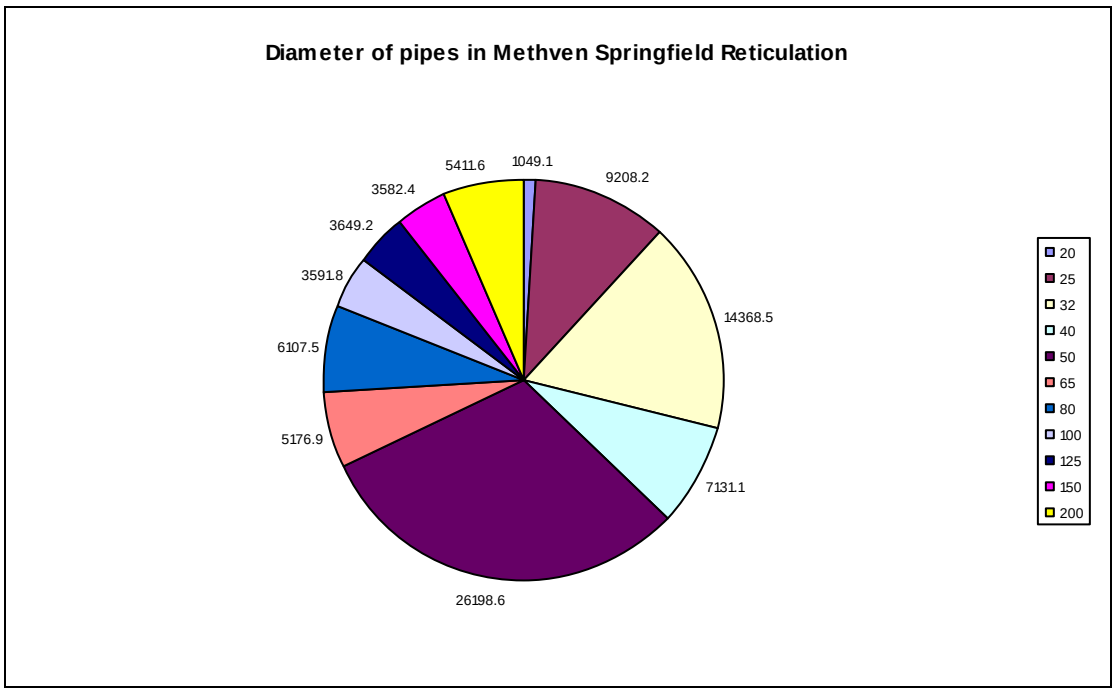


Chart 1: Diameters of pipes in Methven Springfield reticulation

The Methven Springfield reticulation has been designed as a restricted flow supply. Each consumer has the amount of water they can take restricted by the installation of a flow restrictor at the point of supply, which is normally at the storage tanks on the consumer's property.

There are 20 Pressure Relief Valve (PRV) stations installed throughout the reticulation. These have relief valves that typically vent to atmosphere via a discharge pipe attached to a fence. There is no back flow devices on these PRVs. All the valve stations are below ground with the majority holding water due to ground and surface water infiltration. Although PRVs have been installed to help regulate the pressure throughout the distribution, it is difficult to test the operation of the PRVS due to insufficient isolation valves pre & post valve stations.

The whole distribution network would benefit from metering of flow and pressure.

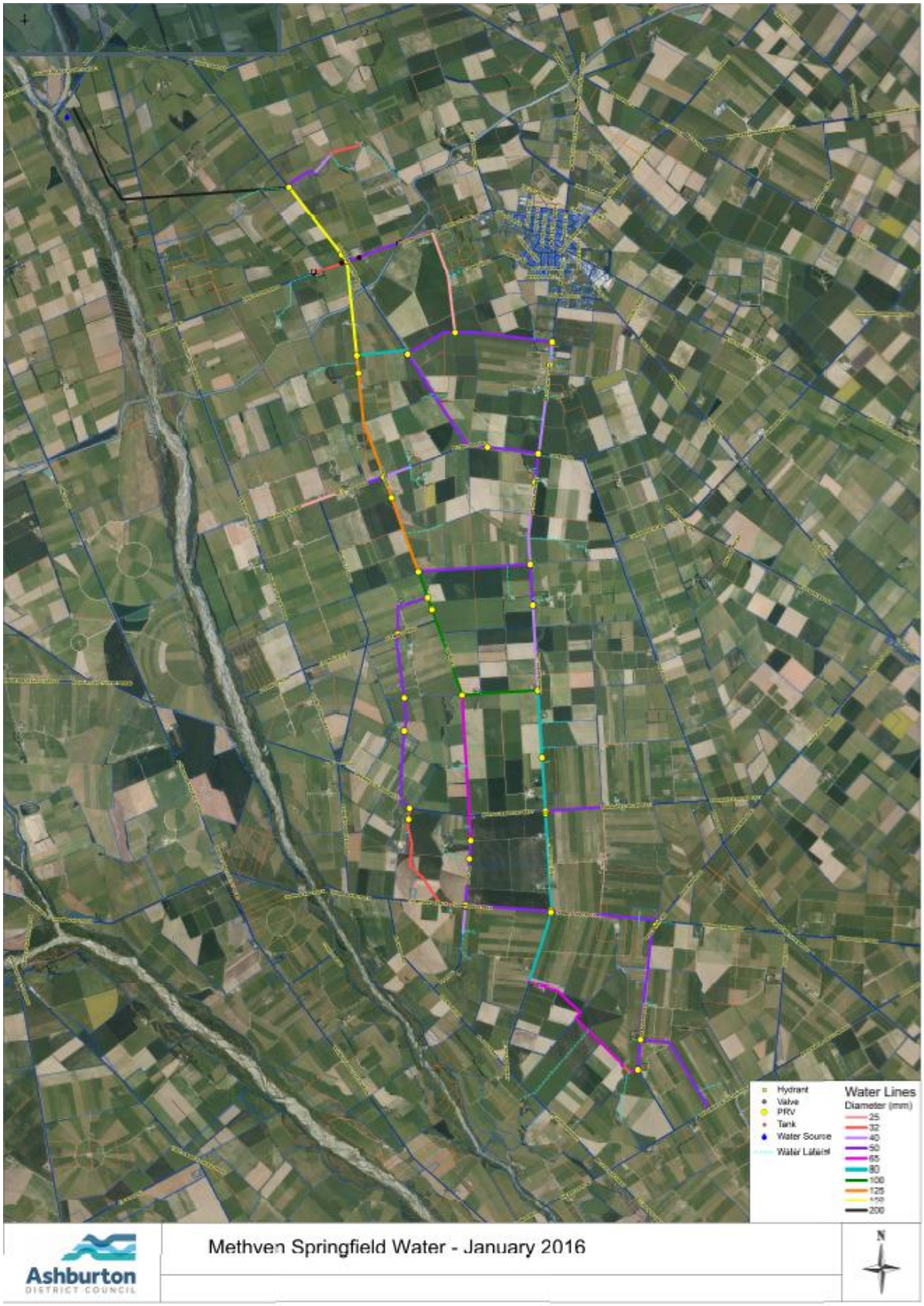


Figure 2 – Water Supply Distribution Map

5.6 Private Reservoirs

There are a number of other reservoirs used in the scheme but they are all private storage systems servicing individual properties. They are of varying capacities and their storage capacity has not been included in the overall storage capacity of the scheme. The private individuals who own these tanks have responsibility for their maintenance and upkeep, however ADC can assist with providing information and education as to how this should be done.

5.7 Monitoring and Alarms

Water quality monitoring is carried out by the Ashburton District Council Service Delivery staff in accordance with the Drinking Water Standards for New Zealand 2005 (revised 2008) (DWSNZ). Raw and treated water can be sampled at the treatment plant. The main distribution sampling point is located at an extremity of the reticulation on Braemar Lauriston Road. This is a secured sampling point.

E.coli, turbidity, free available chlorine (FAC), and pH are sampled weekly at the treatment plant and monthly in the distribution zone (Braemar Lauriston Rd). Additionally, monthly nitrate samples are taken from the treatment plant.

Methven Springfield is connected to the district wide telemetry system. SCADA is used to report site power failure, chlorine pump power failure, UV system fault, high instantaneous outflow, Pump 1 fault, SCADA battery low and site communications fail to the operator by alarms. Recently (July 2017), a raw water turbidity instrument has been installed, but is not yet fully integrated into the operations of the site (see improvements schedule).

SCADA also records outflow – accumulated today, outflow – accumulated yesterday, outflow – 7 day average, outflow – instantaneous and the outflow instantaneous set point. Figure 3 provides a screenshot of the information recorded in the SCADA system.

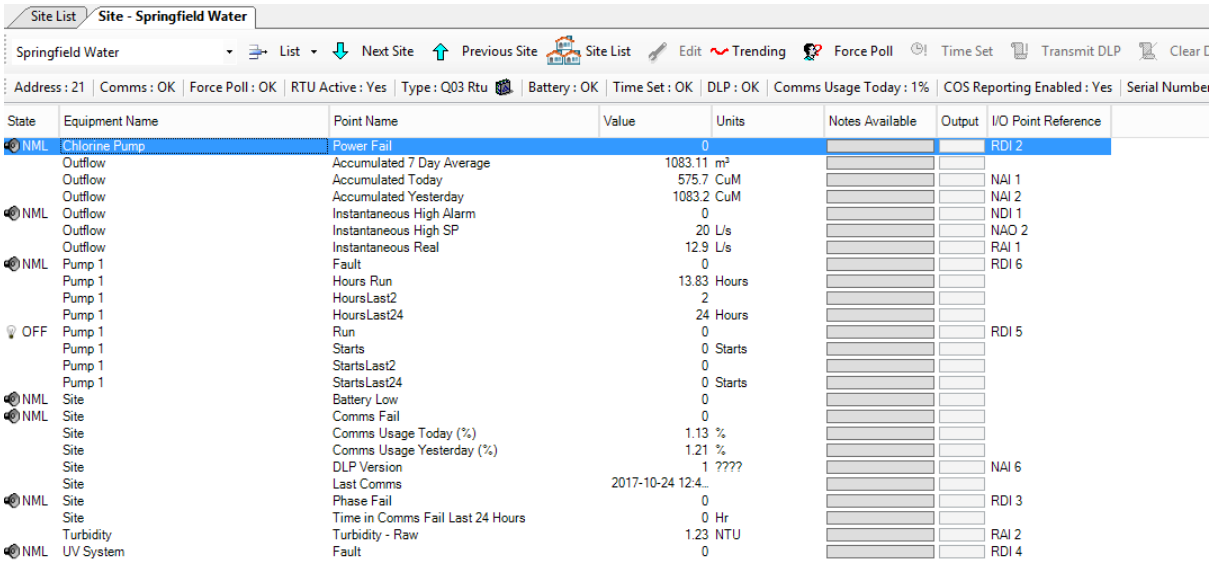


Figure 3: Methven Springfield Water Supply Telemetry Screenshot

5.8 Maintenance and Administration

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

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

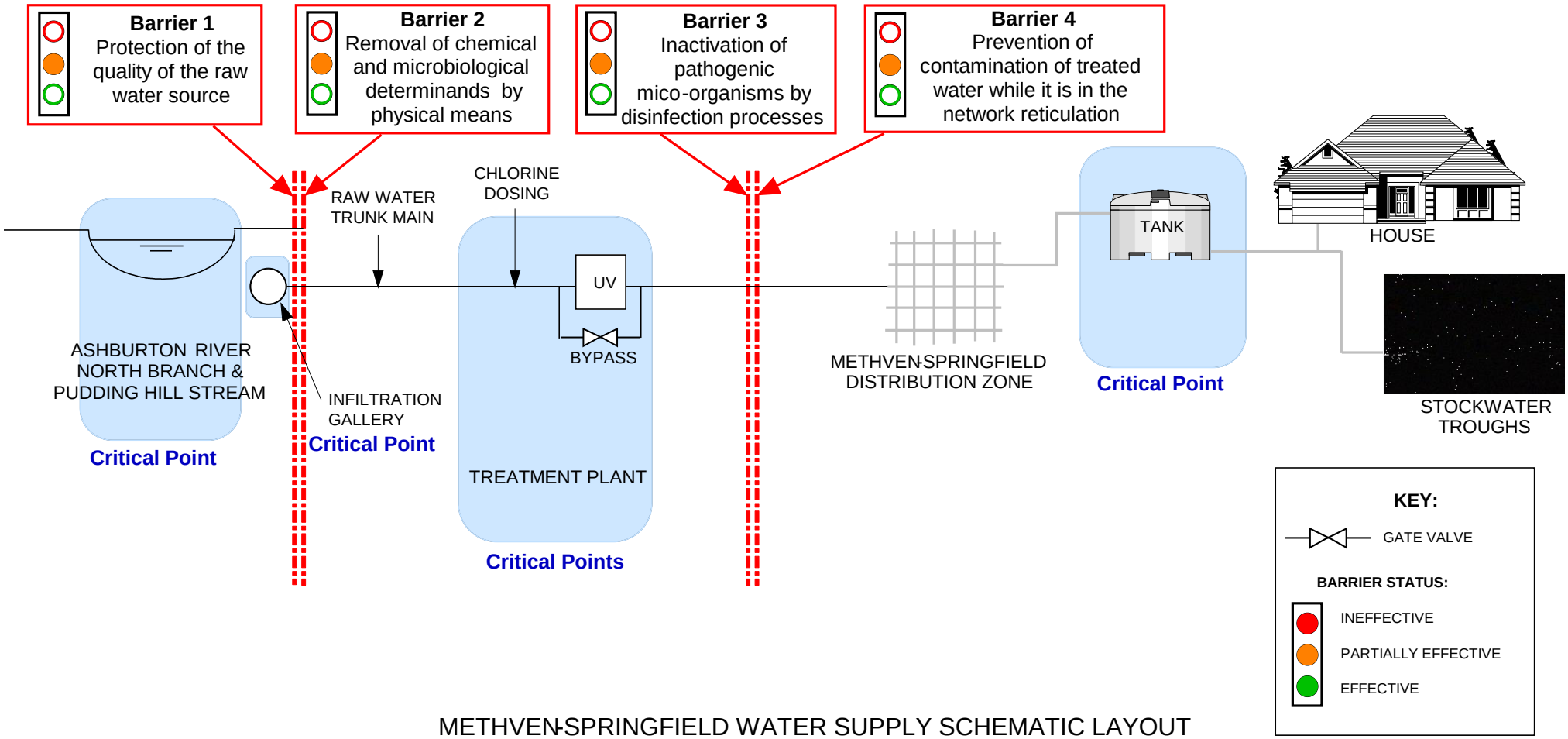
6 Critical Points for Hazard Management

Figure 4 (over the page) presents a schematic of the water supply from source to consumer. Critical points, where hazards can be eliminated, minimised or isolated are indicated in blue. Barriers to contamination are indicated in red.

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

Critical Point	**Description**
Catchment	*Possible point for microbiological and protozoal contamination (unprotected surface water)*
Intake	*Intake failure means eventual loss of supply*
Chlorine dosing	*Possible failure of chlorine dosing would result in loss of the systemic protection provided by the chlorine residual*
UV disinfection	*Possible failure or inadequate dosing would result in loss of reliable microbiological and protozoal protection*
Treated water storage	*Possible point for microbiological contamination* *Possible point for loss of supply*
Reticulation	*Possible point for microbiological contamination* *Possible point for loss of supply*

Figure 4: Methven Springfield Water Supply Schematic



7 Barriers to Contamination

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

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

7.1 Prevent contaminants from entering the raw water

In June 2017, ADC submitted a catchment survey risk assessment to the Drinking Water Assessor for assessment. Following assessment, the Drinking Water Assessor provided the following report:

"The submitted survey report detailed that the water for the Methven Springfield drinking-water supply is sourced from a shallow infiltration gallery adjacent to the confluence of Pudding Hill Stream and the North Branch of the Ashburton River. Crown conservation land (83%) dominates most of the catchment area with agricultural land use activities covering most of the balance.

Faecal contamination from production animals is thought to be the primary contamination source in the catchment. Human faecal contamination from septic tanks and recreational activities, feral animals and other land use activities such as pesticide and herbicide applications are all considered to be minimal in context. In addition, water contamination mitigating measures such as riparian strip management are in place and the majority of contaminating land use activities aren't in close proximity to the drinking-water supply intake. The monitoring results from January 2017 also do not indicate any chemical determinands are present at levels of concern.

Following assessment of the information provided it is considered in accordance with table 10.1 from the DWSNZ, that a ***bacterial and 3-log protozoal treatment*** *requirement is appropriate for the Methven Springfield drinking water supply. This is comparable to the previous catchment risk assessment in 2013, where a 4 log credit requirement had been assigned."*

Overall, this barrier is considered to be a **partially effective barrier to contamination.**

7.2 Remove particles from the water

Water is drawn into the infiltration gallery through the alluvial river gravel material. This provides some degree of filtration but it is not considered to be a reliable barrier to contamination.

A turbidity instrument to measure the raw water turbidity was installed in July 2017, as part of a trial, to further understand the nature of the raw water with a view to the plant being upgraded. This meter has

not yet been incorporated into the general operations and maintenance requirements of the plant. Typical readings of turbidity by the weekly water samples return an NTU of between 0.5 and 0.8 NTU. However, during periods of heavy rain this can reach 2-3 NTU and sometimes higher. These high turbidity events pose a risk of contamination. Analysis is currently underway to determine the particle size and distribution of the raw water, along with the total number of suspended and dissolved solids.

Other than the infiltration gallery, there are no barriers to remove particles. Improvements are included.

Raw Water Turbidity
Process objectives:

- Provides a **raw water quality Critical Control Point** to assess the quality of the water being fed into the treatment plant.
- Provides a **raw water Quality Control Point** to help determine whether downstream processes, namely chlorination and UV irradiation, will maintain efficacy.

Operational monitoring of control process:	
What	Raw water turbidity (NTU)
When	Continuous on-line SCADA monitoring
Where	Raw water line entering the treatment plant
How	Hach TU5300 Turbidimeter – online values and alarms to SCADA
Who	ACL Operator / ADC staff via SCADA
Records	SCADA data historian and plant log-book

Process performance criteria at the operational monitoring point:		**Correction if operating criteria are not met:**
Target Range:	< 1.0 NTU	No correction currently possible. This is the raw water coming into the plant with no control over it.
Action Limits:	NTU: > 1.0 NTU < 2.5 NTU	Duty Operator to respond by keeping a closer eye on the SCADA readings and weather conditions (high or constant rain) Duty Operator to notify Duty Supervisor and ADC Compliance Officer to monitor and prepare for Contingency Plan 10.11
Critical Limits:	NTU: > 2.5 NTU	Duty Operator to notify Duty Supervisor. Duty Supervisor to contact ADC Compliance Officer. Contingency plan 10.11

Supporting programs:

- Monthly verification of the turbidimeter by the Operator.
- Three-monthly calibration of the turbidimeter by the Operator.
- Follow manufacturer's guidelines regarding further operation and maintenance of the turbidimeter.
- Monthly Operator check of accuracy of calibration standards and discarding of outdated calibration standards.
- Training and competency of Operator in the calibration, verification, operation and maintenance of turbidity instruments.
- Only utilise materials provided by the recognised supplier.
- Periodic in-depth servicing of instruments by a Hach Service Engineer, in accordance with the manufacturer's guidelines.
- Periodic end-to-end testing of critical signals

Overall, this barrier is considered to be a **partially effective barrier to contamination.**

7.3 Kill germs in the water

The treatment plant uses chlorination and a UV reactor to disinfect the water. The UV disinfection provides an effective barrier for the inactivation of protozoa. That being said, the current UV unit was installed in 2002 and is not currently certified according to the requirements of NZDWS.

Liquid sodium hypochlorite solution is injected into the water main upstream of the UV reactor prior to delivery into the storage tanks. The chlorine dosing pumps operate on a fixed dosing .

There is no in-line chlorine analyser to confirm that necessary Free Available Chlorine (FAC) is maintained under varying conditions, rather this is manually sampled.

Chlorine Disinfection

Process objectives:

- Provides a **primary disinfection Critical Control Point** to inactivate bacterial, viral and most protozoal pathogens that may have entered upstream of dosing point.
- Provide **residual disinfection Quality Control Point** to help inactivate pathogens entering downstream of the dosing point

Operational monitoring of control process:	
What	Free available chlorine (FAC) concentration in mg/L
When	Twice Weekly (short-term[1])
Where	At the tagged sampling point inside the treatment plant, "Plant Methven Springfield Water TP00343"
How	Hand-held pocket Colorimeter with vendor-supplied reagents (short-term[2])
Who	ACL Operator
Records	Log-book (short-term[3])

Process performance criteria at the operational monitoring point:		**Correction if operating criteria are not met:**
Target Range:	FAC: 0.6-0.7 mg/L	Operator to adjust dosing system to achieve target range if noticed to be outside of target range during routine checking procedures
Action Limits:	FAC: < 0.5 mg/L (upon inspection) > 0.8 mg/L (upon inspection)	Duty Operator to respond by adjusting dosing to within target limits. Duty Operator to notify Duty Supervisor
Critical Limits:	FAC: < 0.3 mg/L (upon inspection) > 1.2 mg/L (upon inspection)	Duty Operator to respond by adjusting dosing to within target limits. Duty Operator to notify Duty Supervisor. Duty Supervisor to contact ADC Compliance Officer. Contingency plan 10.5 (over disinfection) or contingency plan 10.6 (inadequate disinfection) is to be followed.

Supporting programs:

1. Monthly monitoring instrument checking and calibration by Operator as necessary.
2. Monthly Operator check of accuracy of reagents and discarding of outdated reagents.
3. Training and competency of Operator in free chlorination of drinking water.
4. Only utilise potable water grade chlorine stock solution from approved supplier.
5. Lab verification checks for *E.coli*, in accordance with the sampling program.

Notes:

1. In the longer term this should be moved to on-line continuous on-line chlorine aanalyser (incorporating pH compensation) continuous monitoring, as detailed in the improvement schedule.
2. In the longer term this should move to reagents related to verification and calibration of on-line chlorine analysers (incorporating pH compensation)
3. In the longer term this should move to the SCADA historian.

UV Disinfection

Process objectives:

- Provides a **primary disinfection Critical Control Point** to inactivate bacterial, viral and most protozoal pathogens that may have entered upstream of dosing point.
- Provide **residual disinfection Quality Control Point** to help inactivate pathogens entering downstream of the dosing point

The UV unit installed at Methven Springfield is an old (~2002) unit and as such is limited in the information that it provides – a needle gauge intensity meter and a UV fault alarm to telemetry. As part of the improvement schedule, a new UV unit is to be installed. Until then, it is not possible to complete a Process Performance and Operating Criteria table as it is unknown what the target ranges are (UVT, UV intensity, UV Dose, flow rate).

Overall, this barrier is considered to be a **partially effective barrier to contamination.**

7.4 Maintain the quality of the water during distribution

The water supplied is dosed with sodium hypochlorite to ensure there is a residual available to protect against microbiological contamination throughout the system.

Disinfection

A chlorine residual is maintained in the reticulation to provide protection in the case of bacterial contamination. The FAC levels in the water are tested by ADC staff weekly post-treatment and monthly at the sample point in the distribution zone. The ACL Plant Operator also carries out testing of FAC in the distribution zone.

ADC Sampling Officer undertakes FAC, pH and turbidity samples as part of the *E.coli* monitoring program. Three *E. coli* samples per quarter are required from the distribution zone. The samples must be taken with a maximum of 45 days between samples and cover at least 2 days of the week. Immediate action is required if a positive *E. coli* test result occurs, see Contingency Plan 10.7.

To increase the public health risk grading of the distribution one FAC, pH and turbidity sample is taken for every *E. coli* sample taken in the distribution. These samples should demonstrate a consistent FACE of at least 0.2mg/L (90% of samples but none less than 0.05mg/L) and a median turbidity less than 1 NTU

Chlorine Disinfection - reticulation

Process objectives:

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

Operational monitoring of control process:	
What	Free available chlorine (FAC) concentration in mg/L
When	ADC Monthly (short-term[1]) ACL Twice Weekly
Where	ADC staff: The Methven Springfield zone sample tap is located on Braemar Lauriston Road between Pole Road and Braemar Road. The sample tap is located inside a locked bollard on the roadside on the west side of the road, approximately 700 metres from Braemar Road when heading towards Pole Road. The bollard is located at the point where the hedge line ends. ACL operators: Sampling bollard as above
How	Hand-held pocket Colorimeter with vendor-supplied reagents (short-term[2])
Who	ADC Sampling Officer and ACL Operator
Records	ACL: Log-book (short-term[3]) ADC: WaterOutlook

Process performance criteria at the operational monitoring point:		**Correction if operating criteria are not met:**
Target Range:	FAC: 0.2 – 0.7 mg/L	Operator to adjust dosing system to achieve target range if noticed to be outside of target range during routine checking procedures
Critical Limits:	FAC: < 0.2 mg/L (upon inspection) > 2.0 mg/L (upon inspection)	ADC Sampling Officer / ACL Operator to contact ADC Compliance Officer. Contingency plan 10.5 (over disinfection) or contingency plan 10.6 (inadequate disinfection) is to be followed.

Supporting programs:

- Monthly monitoring instrument checking and calibration by Operator / Sampling Officer as necessary.
- Monthly Operator / Sampling Officer check of accuracy of reagents and discarding of outdated reagents.
- Training and competency of Operator / Sampling Officer in free chlorination of drinking water.
- Only utilise potable water grade chlorine stock solution from approved supplier.
- Lab verification checks for *E.coli*, in accordance with the sampling program.

Backflow and other issues

Methven Springfield operates as a Rural Agricultural Drinking Water Supply. The supply provides stock water as well as potable drinking water for houses. Each property receives a restricted supply connection. They are only allowed so much water per day, which is fed into a tank. Post the restrictor, the pipeline around the farm and housing is a private network. Potential backflow issues may occur from poor installation at the tank and at stock troughs, as well as on the private reticulation lines.

In accordance with ADC's Backflow Prevention Policy (2015) and Service Connection Procedure, all connections (existing or new) on new pipeline replacements are to include toby boxes and manifolds for backflow prevention. Similarly, any new service connections on the scheme are to be fitted in accordance with this policy and procedure.

A program of works will progress to install a manifold, backflow preventer and flowmeter on the point of supply into the property (currently the site of the restrictor). This program of work will also audit the installation at the tank and provide active discussions with the property owner regarding backflow preventors on their property and enforcement under the Backflow prevention Policy if necessary.

Reservoirs

There is no public storage for the scheme, rather the private storage tanks on each property connected. As these tanks are privately owned, the scheme would benefit from an education programme, outlining how property owners should maintain their tanks from a potential contamination viewpoint. (see Improvements section).

Pressure Relief Valves (PRV)

There are 20 PRVs installed on the distribution network. These require attention as some of them are not operating correctly. This poses a potential risk for contamination. See improvements schedule.

Emergency Generator

There is a manual standby generator onsite to maintain power supply. Power supply to the site is usually reliable but storm and snow events may result in localised or widespread power outages in this area. The gravity supply of raw water is not interrupted by a power supply failure, however, the disinfection dosing pump will not operate, nor the UV reactor, so untreated water could be delivered to the distribution zone.

Maintenance and Training

Hygiene procedures are documented and followed for all distribution system maintenance. The personnel involved with the operation and maintenance of the plant are all trained and experienced. Having said that, these training records need to be reviewed and any needs addressed.

Overall, this barrier is considered to be a **partially effective barrier to contamination.**

7.5 General

Staff Training

It is acknowledged that the staff managing and operating the Methven Springfield water supply are educated and trained. However, it would be beneficial to carry out a detailed assessment of training needs to highlight any deficiencies.

8 Risk Tables

8.1 Risk Assessment Worksheet – Catchment and Intake

The events associated with raw water on the Methven Springfield Water Supply that create the greatest risks are **animal or human waste** and **not being able to draw enough water**.

The most important preventive measures are:

- monitoring, to decide if and where contamination of the water is occurring; this is best done when contamination is most likely
- knowing where the catchment (surface water) of the source is and the nature of the land in this area
- collection of all available information about possible sources of contamination
- educating the local farming community on the importance of minimising contamination

Table 8.1 Risk Assessment Worksheet – Catchment and Intake

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
C1	Bacterial or protozoal contamination in catchment	Unprotected catchment surface water – humans, livestock, septic tanks, agricultural activities, surface runoff, etc.	No	Raw water *E.coli*	Some parts of the catchment are fenced from farming stock. Chlorine and UV disinfection used to treat water. Methven Springfield now included in the annual basic water chemistry testing.	Partial	Unlikely	Medium	Medium	Ongoing liaison with adjacent landowners to raise/maintain awareness of catchment protection. Encourage best practice agricultural activities and riparian management. Create a catchment zone information booklet.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
C2	Chemical contamination in catchment	Unprotected catchment surface water – agrichemicals, surface runoff, etc.	No	No P2s have been formally identified.	Some parts of the catchment are fenced from farming stock. Community drinking water supply protection zone under LWRP. Methven Springfield now included in the annual basic water chemistry testing.	Partial	Unlikely	Medium	Medium	Encourage best practice agricultural activities and riparian management. Ongoing liaison with adjacent landowners to raise/maintain awareness of catchment protection.
C3	Contamination of source water	Contaminant entry via intake structure.	No		Gallery area fenced and stock excluded. Intake	Partial	Unlikely	Medium	Medium	

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
					structures are secure against bird/vermin entry and unauthorised access. Intake structure is inspected monthly.					

8.2 Risk Assessment Worksheet – Surface Water Abstraction

The events creating the two greatest risks involved in abstracting water from the source for the Methven Springfield Water Supply are **not being able to draw enough water** and **drawing water that cannot be properly treated because the quality is too poor**.

The most important preventive measures are:

- regularly inspect the intake for damage or clogging
- put an alarm on the flow from the intake to warn of an intake failure
- investigate using an abstraction method that reduces water quality variability so periods of very poor quality are avoided

Table 8.2 Risk Assessment Worksheet – Surface Water Abstraction

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
C4	Insufficient water available	Drought, low river levels.	No		Intake level recorded on SCADA Ability to supplement supply from Methven Water Scheme Permanent hosing ban in place. All property owners have some level of on-site storage.	Partial	Unusual	Minor	Minor	Develop a Water Conservation Plan to address increased demand management. Develop site-specific Emergency Response Plan and implement if water supply cannot be maintained.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
					Regular checks of the intake					
C5	Insufficient water available	Damage to intake structures – natural hazards, e.g. flooding, earthquakes.	No		Intake 200-300m from river. No history of damage. Regular inspection, cleaning and maintenance of intake structure including increased frequency during / after flood event	Partial	Unusual	Minor	Medium	Investigate resilience of plant to natural hazards via an Issues and Options report. Develop site-specific Emergency Response Plan and implement if water supply cannot be maintained. Implementation of telemetric alarm for low flows from intake.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
C6	Insufficient water available	Damage to intake structures – vandalism.	No		Intake structure is not situated in a location prone to vandalism.	Partial	Rare	Minor	Low	Intake structure is not situated in a location prone to vandalism.
C7	Insufficient water available	Intake pump failure or power supply interruption.	No		N/A - No intake pump. Gravity supply from intake.	Yes				
C8	Insufficient water available	Intake failure – deterioration of the gallery structures and/or the supply	No		Gallery is less than 30 years old and is constructed of PVC. Regular inspections of	Partial	Unusual	Minor	Medium	Review and maintain Activity Management Plans and associated asset renewal programmes to minimise failures.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
		pipelines.			the intakes.					
C9	Insufficient water available	Raw water trunk main failure.	No			No	Unusual	Minor	Medium	As C8 above.
C11	Contamination of source water	Contaminant entry via raw water trunk mains (air valves).	No		Partially effective downstream disinfection barrier.	Partial	Unusual	Minor	Medium	Develop a schedule to regularly inspect air valves and undertake remedial works as required to address potential backflow issues.

8.3 Risk Assessment Worksheet – Chlorine Disinfection

The event creating the greatest risk involved in chlorinating drinking-water for the Methven Springfield Water Supply is **not having enough Free Available Chlorine (FAC) to kill germs in the water**, **not only at the beginning of the process but all the way through it**.

The most important preventive measures are:

- monitor the process to be sure there is enough FAC in the water, regardless of how the quality of the incoming water might change
- put an alarm on the chlorine supply to let you know when the supply is running low. Maintain records so you are aware of when this might happen; always have a spare supply on hand or readily available.

Table 8.3 Risk Assessment Worksheet – Chlorine Disinfection

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
T1	Inadequate disinfection (not enough free available chlorine)	Dosing pump malfunction, control system malfunction, or power supply interruption.	Yes	Free chlorine	Manual standby power generation. Power failure SCADA alarm. Routine checks and inspections. E. coli monitoring. UV disinfection provided in addition to chlorination.	Partial	Quite common	Minor	Medium	Install an automatically controlled chlorine dosing system – analyser, dosing pumps and associated telemetry signals. Develop a schedule and carry out end to end testing of critical alarms and signals

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
T2	Inadequate disinfection (not enough free available chlorine)	Incorrect dose rate or solution strength too low or run out of chlorine solution.	Yes	Free chlorine	Routine checks and inspections. Sodium hypochlorite solution delivered by reputable supplier. UV disinfection provided in addition to chlorination.	Partial	Quite common	Minor	Medium	Install low level chlorine storage alarm to telemetry. Install an automatically controlled chlorine dosing system – analyser, dosing pumps and associated telemetry signals. Develop a schedule and carry out end to end testing of critical alarms and signals
T3	Inadequate disinfection (not enough free available chlorine)	High chlorine demand as a result of high turbidity.	Yes	Turbidity Free chlorine	UV disinfection provided in addition to chlorination.	No	Likely	Minor	Medium	Carry out a cost-benefit-analysis into installing selective abstraction. Make current installed trial raw water turbidimeter part of the plant process

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
										Install an automatically controlled chlorine dosing system – analyser, dosing pumps and associated telemetry signals. Develop a schedule and carry out end to end testing of critical alarms and signals
T4	Over-chlorination (too much free available chlorine)	Dosing pump or control system malfunction.	Yes	Free chlorine	Regular FAC sampling undertaken by ADC staff.	Partially	Quite common	Minor	Medium	Install an automatically controlled chlorine dosing system – analyser, dosing pumps and associated telemetry signals. Develop a schedule and carry out end to end testing of critical alarms and signals

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
T5	Over-chlorination (too much free available chlorine)	Incorrect dose rate or solution strength too high.	Yes	Free chlorine	Sodium hypochlorite solution delivered by reputable supplier.	Partially	Unlikely	Minor	Medium	Install an automatically controlled chlorine dosing system – analyser, dosing pumps and associated telemetry signals. Ensure that written instructions for refilling the chlorine solution are on site. Develop a schedule and carry out end to end testing of critical alarms and signals

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
T6	Failure to remove chemical contaminants from raw water	Treatment system inadequate.	No	No P2s have been formally identified.	No known chemicals in source water (i.e. no official P2 determinands). Methven Springfield source water in included in the annual basic water chemistry testing.	Yes	Unusual	Medium	Medium	

8.4 Risk Assessment Worksheet – Ultraviolet Irradiation Disinfection

The events creating the greatest risk involved in UV irradiation of drinking-water in the Methven Springfield Water Supply **are the UV dose being too low to kill germs in the water** and **poor water quality reducing the effectiveness of the light in killing germs**

The most important preventive measures are:

- regularly maintain the unit and clean the surface of the lamp, or lamp sleeve, to make sure enough UV light passes into the water
- use a sensor to measure the UV irradiation
- ensuring that the water quality is of a sufficient standard in order for the UV irradiation to be effective

Table 8.4 Risk Assessment Worksheet – Ultraviolet Irradiation Disinfection

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
T7	Inadequate protozoa removal/inactivation	Treatment system inadequate.	No		UV disinfection system in place. Manual UV intensity recording and logging (twice weekly)	Partially	Quite common	Minor	Medium	Install a new, fully compliant UV unit. Renew monitoring program for demonstrating UV efficacy. Install in-line UVT analyser, connected to telemetry. Develop a schedule and carry out end to end testing of critical alarms and signals
T8	Inadequate protozoa removal/inactivation	UV system malfunction, bulb/ballast failure,	No		Routine checks, inspections, cleaning and lamp replacement in	Partial	Quite common	Minor	Medium	Install a new, fully compliant UV unit. Renew monitoring

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
		control system malfunction, or power supply interruption.			accordance with manufacturer's recommendations. Power failure SCADA alarm. Manual UV intensity recording and logging (twice weekly).					program for demonstrating UV efficacy. Develop a schedule and carry out end to end testing of critical alarms and signals
T10	Inadequate protozoa removal/inactivation	High turbidity (low UVT).	No			No	Quite common	Minor	Medium	Install a new, fully compliant UV unit. Make current installed trial raw water turbidimeter part of the plant process Renew monitoring program for demonstrating UV

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
										efficacy. Install in-line UVT analyser, connected to telemetry Develop a schedule and carry out end to end testing of critical alarms and signals

8.5 Risk Assessment Worksheet – Storage and Distribution

The event creating the greatest risks involved in treated water storage and distribution for Methven Springfield Water Supply is **contamination getting into the supply** and **the users not receiving enough water**.

The most important preventive measures are:

- Educate private owners on the importance of reducing the risk of contamination, particularly around their storage tanks and stock troughs (back flow prevention)
- Use appropriate water hygiene procedure for working on the reticulation and use the appropriate materials and equipment
- Provide appropriate isolation and flushing points throughout the network
- Effective monitoring of the network for flow and pressure

Table 8.5 Risk Assessment Worksheet – Storage & Distribution

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
S1	Stored water quality deterioration	Inadequate reservoir turnover	No		All customer tanks should have high inlets and low level outlets. ADC are responsible for providing safe drinking water to the boundary. Ensuring adequate private reservoir turnover is the responsibility of the property owner.	Partial	Unusual	Minor	Medium	Provide educational material or awareness sessions to the end user

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
S2	Introduction of contaminants into the distribution system	Backflow from customer connections.	No		Chlorine residual maintained in system. As per ADC's Backflow prevention Policy (2015) and Service Connection procedure, all connections (existing or new) on new pipeline replacements are to include toby boxes and manifolds with backflow prevention Any new connections are required to follow	No	Likely	Minor	Medium	Provide educational material or awareness sessions to the end user Implement renewals programme for pressure reducing valves Implement a program of works to install a manifold, backflow preventer and flowmeter on the point of supply into the property (currently the site

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
					Council's Service Connection Procedure.					of the restrictor) Audit quality of tank installation Provide active discussions with the property owner regarding backflow on their property and applying enforcement of the Backflow Prevention Policy if necessary. Add annual inspections of the backflow prevention devices to the operations and maintenance

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
										procedures
S3	Introduction of contaminants into the distribution system	Operation and maintenance activities.	No		Operators follow documented hygiene procedures to minimise risk. Chlorine residual maintained in system.	Partial	Unlikely	Minor	Medium	Identify and record any staff training needs. Re-audit current water hygiene practices and procedures. Produce an updated training record, policy and procedure.
S4	Introduction of contaminants into the distribution system	Not maintained or cleaned private storage	No			No	Unlikely	Minor	Medium	Provide educational material or awareness sessions to the end user

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
S5	Introduction of contaminants into the distribution system	Pressure fluctuation resulting in negative pressures.	No		Pressure fluctuations unlikely to occur in this gravity supply system.	Partial	Unusual	Medium	Medium	Inspect air valves and undertake remedial works as required to address potential backflow issues. Implement renewals programme for pressure reducing valves
S6	Introduction of contaminants into the distribution system	Pipe materials, age and condition, plumbosolvency.	No		Customers are notified of plumbosolvency twice per year as required by DWSNZ. Activity Management	Partial	Unusual	Medium	Medium	Review and maintain activity management plans and associated asset renewal programmes to minimise

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
					Plans and associated asset renewal programmes in place.					deterioration.
S7	Insufficient water available	Catastrophic failure, e.g. seismic activity damaging equipment.	No		Gallery intake, treatment plant, and associated equipment inspected following a significant earthquake. Manual standby generator onsite to maintain power supply.	Partial	Unusual	Medium	Medium	Investigate resilience of plant to natural hazards via an Issues and Options report. Develop site-specific Emergency Response Plan and implement if drinking water quality standards cannot be met.

8.6 Risk Assessment Worksheet – Other

The event creating the greatest risks not covered in previous section come under Other. The greatest risks are:

- **the reporting of incorrect water quality data that is used for supply management decisions**
- **introduction of microbiological contaminants into the water supply, or the inadequate inactivation, or removal, of microbiological contaminants**
  – causing sickness from disease-causing organisms
- **introduction of chemical contaminants (incorrect application of treatment chemicals)**
  – causing sickness from health-significant chemical determinands.

The most important preventive measures are:

- collect, handle and transport samples correctly
- use suitable, approved methods of analysis, and quality assurance systems
- make sure all instrumentation and methods used are calibrated
- make sure that the staff who have to collect samples, or analyse them, are properly trained

To determine whether the appropriate competencies exist within the organisation / structure, and whether up-skilling or cross-skilling (ie, training) is required, a detailed assessment of training needs is required.

The most important preventive measures in order to develop a detailed assessment of training needs are:

- prepare job descriptions
- training needs analysis – “skill gap analysis”
- training program development
- development and budgeting for a training program for water supply staff
- links with other components of the water supply system

Table 8.6 Risk Assessment Worksheet – Other

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

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
					clearly labelled. Annual IANZ audit for Council laboratory.					
O2	System does not perform as intended	Incorrect operation, inadequate maintenance.	No		Operators have sound knowledge of systems. Key operation instructions are displayed permanently on site. An operations log is kept on site. Plant records are	Partial	Unusual	Negligible	Low	Review and maintain activity management plans and associated asset renewal programmes to plan for regular maintenance and inspection/monitoring tasks. Ensure all plant records – including manuals, drawings, procedure instructions and

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
					copied and filed.					emergency response plan are up to date and available at the plant. Develop and maintain Operation and Maintenance Manual. Council to place a requirement in the service provider to ensure Operation and Maintenance Procedure Manual is up to date and available at the plant.
O3	System does not perform as intended	Inadequate skills or training.	No		Staff are qualified and experienced, and supported by an ongoing	Partial	Unusual	Negligible	Low	Council to place a requirement in the service provider to ensure Operation and

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
					training programme.					Maintenance Procedure Manual is up to date and available at the plant. Identify staff training needs and provide training.
O4	System damaged or contaminated by construction/ maintenance work	Inadequate controls on construction and maintenance work.	No		All maintenance is undertaken by contractor's trained/authorised staff. Construction work is appropriately supervised. Carriageway Access Request (CAR) and Before You Dig used to	Yes				

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
					permit maintenance and construction works.					
O5	Inability to access site(s) for operation/ maintenance/ emergency works	Flood, slip, bridge washout, snow fall or other hazard preventing vehicular access.	No		Operations staff are equipped with suitable 4WD vehicles and given training in these use of these.	Partial	Quite common	Negligible	Low	

9 Improvements

Comparison of the information in the Risk Information Table with the actual supply, shows the following areas that would benefit from some interventions. If any improvements suggest carrying out a cost-benefit-analysis, then the benefit would be that the proposed intervention will provide public health benefits by reducing the adverse health outcomes associated with poor drinking water quality.

9.1 Catchment and Intake

- Being an uncontrolled catchment, there is a risk of contamination to the drinking water source. Whilst it is near on impossible to remove all risks, more can be done with regards educating landowners in ways to minimise any risks.

  Action needed: Ongoing liaison with adjacent landowners to raise / maintain awareness of catchment protection. Encourage best practice agricultural activities and riparian management. Create a catchment zone information booklet. The primary focus is on minimisation – managing the catchment to reduce the chances of potential hazards entering the water supply.

9.2 Treatment

9.2.1 Surface Water Abstraction

- There is currently a risk that there may be insufficient water available due to drought or low river levels.

  Action needed: Develop Water Conservation Plans and a site-specific Emergency Response Plan should the intake level become too low to sustain a reliable water source

- There is currently a risk that there may be insufficient water available due to failure at the intake. This may be deterioration of the gallery and / or the supply pipelines, raw water trunk main failure.

  Action needed Produce an Issues and Options Report to assess the resilience of the plant to natural hazards. As with the item above, a site-specific Emergency Response Plan needs to be developed in response to an event that results in a water supply that cannot be maintained. Implementation of a telemetric alarm for low flows from the intake. Review and maintain Activity Management Plans and associated renewal programmes to minimise failures.

- Whilst the intake structure is regular visited, inspected and cleaned, there is a risk of plant failure – either through natural hazards or by general wear and tear. This plant failure has the potential to result in insufficient water being available or the water becoming contaminated.

  Action needed: An investigation needs to be carried out in order to access the resilience of the plant to natural hazards. As with the item above, a site-specific Emergency Response Plan needs to be developed in response to an event that results in a water supply that cannot be maintained. Implementation of a telemetric alarm for low flows from the intake. Review and maintain Activity Management Plans and associated renewal programmes to minimise failures.

- There remains a risk that there could be contaminant entry into the raw water main via problematic air valves.

  Action needed: In order to minimise this risk, the air valves should be regularly inspected and any remedial works undertaken.

- There is currently no mechanism in place to monitor as to whether the raw water quality is too poor to be effectively treated by UV Irradiation Disinfection and Chlorine Disinfection, as well as by future filtration mechanisms.

  Action needed: Carry out a cost-benefit-analysis feasibility study into install selective abstraction as a viable means to prevent poor quality water from entering the plant. Carry out a cost-benefit-analysis feasibility study into installing a raw water storage facility. Install an in-line UVT analyser to assess UVT levels.

9.2.2 Pre-treatment

- Selective abstraction could potentially be a viable option in removing any pathogens that are in the supply. The turbidity instrument in the plant will detect when the raw water becomes too turbid to treat effectively. The supply will then by-pass the treatment plant until the turbidity levels return to acceptable values.

  Action needed: Carry out a cost-benefit-analysis feasibility study looking into the viability of using selective abstraction as an option. The study would need to pay cognisance to the frequency and duration of turbidity events and the available storage.

- There is currently no raw water storage facilities on the Methven Springfield Water Supply. A raw water storage facility would aid in both providing additional storage during times of water shortage and would aid in improving water quality through the pre-settlement process.

  Action needed: Carry out a cost-benefit-analysis feasibility study looking into the viability of installing a raw water storage facility on the Methven Springfield Water Supply.

9.2.3 Raw water turbidity measurement and control process

- Currently there is a raw water turbidity unit installed as part of a trial. It is the intention to make this unit part of the operation of the plant.

  Action needed: Confirm the unit is working properly, including signals back to telemetry. Ensure it is fully incorporated into the everyday operation of the plant, including operation and maintenance and control processes are in place.

9.2.4 Filtration

- There is presently no way of removing particles from the water, other than that offered by the filtration gallery. This will allow the larger germs, such as *Giardia* and *Cryptosporidium*, to pass through the treatment to the consumers. Cloudiness in the water will also reduce the effectiveness of the chlorine. The higher levels of NTU will also reduce the efficacy of the UV irradiation.

  Action needed: A form of filtration will be required in order to remove particles. This will also provide log credits for protozoa.

9.2.5 Chlorine disinfection

- There are current risks that there can be both inadequate disinfection (not enough free available chlorine) and also over-chlorination (too much free available chlorine).

  Action needed: Install an automatically controlled chlorine dosing system – analyser, dosing pumps and associated telemetry signals. The chlorine dosing system will include pH compensation. Install a low level sensor on the chlorine storage tank, which would include an alarm to telemetry. Clear written instruction on how to prepare and re-fill the chlorine solution storage tank should be available on site. Develop a schedule and carry out end to end testing of critical alarms and signals

9.2.6 UV Irradiation disinfection

- There are current risks that there can be inadequate protozoa removal / inactivation

  Action needed: Install a new, fully compliant, UV unit. Renew the monitoring program for demonstrating UV efficacy. Install an in-line UVT analyser, connected to telemetry. Develop a schedule and carry out end to end testing of critical alarms and signals.

9.2.7 Plant Construction and Operation

- The operation and maintenance of the plant is currently handled by a third party to the Water Supply Owner. Should there be a failure of the equipment, or a misunderstanding as to how the plant should operate then there is a risk that the plant could be producing water that is not of a good enough quality. Inspection and maintenance reports need to be produced, up to date and readily accessible. A detailed operations manual should be current and be present on site.

  Action needed: Inspection reports and maintenance schedules need to be produced, up to date and readily accessible. All plant records – including manuals, drawings, procedure instructions and emergency response plans need to be up to date and available at the plant. An Operations and Maintenance Manual needs to be produced that is current and should be present on site.

9.3 Storage & Distribution

- There are 20 pressure reducing valves (PRVs) within the distribution network. The operating efficiency of these PRVs ranges from inoperable to working correctly. They need to be kept operational and functional to provide adequate flow and pressure downstream. Also, if inoperable, they may pose a risk of contamination, depending upon the degree of malfunction.

  Action needed: Implement Inspect and renewals programme for the PRVs. This is to be a rolling programme, starting in the 2018 financial year.

- Methven Springfield Water Supply serves a large rural area. As such, there are many private storage tanks on private property. If not maintained and inspected in the same manner as on the public scheme, there is a risk to the end users from contamination. Whilst technically speaking anything on the private side of the supply is the responsibility of that private individual, the Water Supplier should have an obligation to inform the private properties of the apparent risks.

  Action needed: Provide educational material or awareness sessions to the end user. This may take several forms eg letters, information leaflets or public information evenings.

9.3.1 Operation & Structure

- One area that requires further examination is the training and certification of staff with regards to hygiene standards. Incorrect or non-existent training could result in inappropriate practices occurring which could potentially result in contamination getting into the distribution network.

  Action needed: Identify and record any staff training needs. Provide appropriate training if necessary. Re-audit current practices and procedures – including water hygiene practices and procedures - , implementing any changes as and when required, culminating in an updated training record and policy and procedure.

- There is a potential risk that there could be an introduction of contaminants into the distribution system because of the type of pipe materials used, its age and condition and also from any plumbosolvency effects.

  Action needed: Review and maintain activity management plans and associated asset renewal programmes to minimise deterioration.

9.3.2 Backflow Prevention

- Methven Springfield operates as a Rural Agricultural Drinking Water Supply. The supply provides stock water as well as potable drinking water for houses. Each property receives a restricted supply connection. They are only allowed so much water per day, which is fed into a tank. Post the restrictor, the pipeline around the farm and housing is a private network. Potential backflow issues may occur from poor installation at the tank and at stock troughs, as well as on the private reticulation lines.

Action needed: Investigate and then provide educational material and / or awareness sessions to the end user in order to highlight the risk of contamination and what measures can be undertaken to prevent contamination. Implement a program of works to install a manifold, backflow preventer and flowmeter on the point of supply into the property (currently the site of the restrictor). Audit quality of tank installation. Provide active discussions with the property owner regarding backflow on their property and applying enforcement of the Backflow Prevention Policy if necessary. Add annual inspections of the backflow prevention devices to the operations and maintenance procedures

9.4 General

9.4.1 Staff Training

- It is imperative that the personnel who are managing and operating the Methven Springfield Water Supply are fully trained to do so. Inadequate training, and their consequences for public health are the introduction of microbiological and chemical contaminants into the supply, or the inadequate inactivation or removal or such contaminants.

  Action needed: A detailed assessment of training needs is required, to include: preparing job descriptions; training needs analysis – "skill gap analysis"; training development program; development and budgeting for a training program for water supply staff; links with other components of the water supply system; making sure staff understand how the supply operates, how it has to be maintained, what to look for to check it is operating properly, who to contact if they need help.

Discussing these issues has highlighted that there is room for improvement in all four key barriers to contamination on the Methven Springfield Water Supply. The supply is currently not compliant for its 3-log protozoal removal and that is a key area to address.

The priority rankings that should be given to the actions noted above are listed in the following Improvements Schedule, along with the timetabling of these improvements.

9.5 Improvements Schedule

AM = Asset Manager, Ashburton District Council (Water Supply Owner)

ACL = Ashburton Contracting Limited (Water Supply Operator)

Methven Springfield Water Supply Improvement Schedule							
Priority	**Risk Level**	**Water Supply Area**	**Reference to Risk Table**	**Details of Proposed Works**	**Person Responsible**	**Expected Cost**	**Intended date of Completion**
LOW	MEDIUM	Catchment and intake	C1	Create a catchment zone information booklet.	AM	Administration costs +staff time	01/01/2021
LOW	MEDIUM	Catchment and intake	C1,C2	Ongoing liaison with adjacent landowners to raise/maintain awareness of catchment protection.	AM	Administration costs +staff time	01/01/2021
LOW	MEDIUM	Catchment and intake	C1,C2	Encourage best practice agricultural activities and riparian management.	AM	Administration costs +staff time	01/01/2021
LOW	MEDIUM	Catchment and intake	C4	Develop Water Conservation Plan to address demand management.	AM	Staff time	01/01/2021
LOW	MEDIUM	Catchment and intake, storage and distribution	C4,C5,S7	Develop site-specific Emergency Response Plan and implement if water supply cannot be maintained	AM	Staff time	01/01/2021
LOW	MEDIUM	Catchment and intake, storage and distribution	C5,S7	Produce an Issues and Options Report to assess the resilience of the plant to natural hazards.	AM	$5,000 – $10,000 +staff time	01/01/2021

Methven Springfield Water Supply Improvement Schedule							
Priority	**Risk Level**	**Water Supply Area**	**Reference to Risk Table**	**Details of Proposed Works**	**Person Responsible**	**Expected Cost**	**Intended date of Completion**
LOW	MEDIUM	Catchment and intake	C5	Implementation of telemetric alarm for low flows from intake	AM	$5,000 + staff time	01/01/2021
LOW	MEDIUM	Catchment and intake, storage and distribution, other	C8 ,S6, O2	Review and maintain Activity Management Plans and associated asset renewal programmes to minimise failures, and / or deterioration, and to plan for regular maintenance and inspection / monitoring tasks	AM	Staff time	01/01/2021
MEDIUM	MEDIUM	Catchment and intake, storage and distribution	C11,S5	Regularly inspect air valves and undertake remedial works as required to address potential backflow issues.	ACL	Staff time	01/01/2019
MEDIUM	MEDIUM	Catchment and intake, storage and distribution	T3,T10	Raw water turbidity measurement and control processes	ADC & ACL	Staff time	31/02/2018
MEDIUM	MEDIUM	Catchment and intake, treatment	T3	Carry out a cost-benefit-analysis feasibility study looking into the viability of using selective abstraction as an option	AM	Staff time	01/01/2019
MEDIUM	MEDIUM	Catchment and intake		Carry out a cost-benefit-analysis feasibility study looking into the viability of installing a raw water storage facility	AM	Staff time	01/01/2019

Methven Springfield Water Supply Improvement Schedule							
Priority	**Risk Level**	**Water Supply Area**	**Reference to Risk Table**	**Details of Proposed Works**	**Person Responsible**	**Expected Cost**	**Intended date of Completion**
HIGH	MEDIUM	Catchment and intake, treatment, other	T7,T8,T10	Increase monitoring pre and post UV to confirm that the UV plant is performing correctly	AM	Staff time	01/07/2018
HIGH	MEDIUM	Catchment and intake, treatment, other	T7,T10	Install in-line UVT analyser to assess raw water UVT levels	AM	$15,000 - $20,000 + Staff time	01/01/2018
HIGH	MEDIUM	Treatment		Install filtration system to remove crypto and giardia	AM	$30,000+, plus staff time	01/07/2018
HIGH	MEDIUM	Treatment	T1,T2,T3,T4,T5	Install an automatically controlled chlorine dosing system – analyser, dosing pumps and associated telemetry signals	AM	$15,000 - 20,000 + Staff time	01/07/2018
HIGH	MEDIUM	Treatment	T1,T2,T3,T4,T5,T7,T8,T10	Develop a schedule and carry out end to end telemetry testing of critical alarms and signals	AM	$10,000 - 20,000 + Staff time	01/07/2018
HIGH	MEDIUM	Treatment	T2	Install a low level sensor on the chlorine storage tank. Alarmed to telemetry.	AM	$5,000 + staff time	01/07/2018
HIGH	MEDIUM	Treatment	T5	Clear written instructions on how to prepare and re-fill the chlorine solution storage tank should be available on site	ACL	Staff time	01/07/2018

Methven Springfield Water Supply Improvement Schedule							
Priority	**Risk Level**	**Water Supply Area**	**Reference to Risk Table**	**Details of Proposed Works**	**Person Responsible**	**Expected Cost**	**Intended date of Completion**
HIGH	MEDIUM	Treatment	T7,T8,T10	Install a new, fully compliant, UV unit	AM	$30,000+, plus Staff time	01/07/2018
MEDIUM	MEDIUM	Storage and distribution	S1,S2,S4	Investigate and then provide educational material or awareness sessions to the end user	AM	Staff time	01/01/2019
MEDIUM	MEDIUM	Storage and distribution	S2,S5	Implement renewals programme for pressure reducing valves.	AM	$75,000/year+ Staff time	31/12/2022
MEDIUM	MEDIUM	Storage and distribution	S3	Implement a program of works to install a manifold, backflow preventer and flowmeter on the point of supply into the property	AM	$25000+ Staff time	31/12/2018
MEDIUM	MEDIUM	Storage and distribution	S3	Audit quality of tank installation	AM	$5000+ Staff time	31/12/2018
MEDIUM	MEDIUM	Storage and distribution	S3	Provide active discussions with property owners re backflow prevention on their property	AM	Staff time	31/12/2018
MEDIUM	MEDIUM	Storage and distribution	S3	Add annual inspections of the backflow prevention devices to the operations and maintenance procedures	AM	Staff time	31/12/2018
MEDIUM	MEDIUM	Storage and distribution, other	S4,O3	Identify and record any staff training needs	AM/ACL	Staff time	01/01/2019
MEDIUM	MEDIUM	Storage and distribution	S4	Re-audit current practices and procedures	AM	Staff time	01/01/2019

Methven Springfield Water Supply Improvement Schedule							
Priority	**Risk Level**	**Water Supply Area**	**Reference to Risk Table**	**Details of Proposed Works**	**Person Responsible**	**Expected Cost**	**Intended date of Completion**
MEDIUM	MEDIUM	Storage and distribution	S4	Produce an updated training record, policy and procedure.	AM/ACL	Staff time	01/01/2019
MEDIUM	MEDIUM	Other	O2	Ensure all plant records – including manuals, drawings, procedure instructions and emergency response plan are up to date and available at the plant.	AM/ACL	Staff time	01/01/2019
MEDIUM	MEDIUM	Other	O2,O3	Council to place a requirement in the service provider to ensure Operation and Maintenance Procedure Manual is up to date and available at the plant.	AM	Staff time	01/01/2019
LOW	MEDIUM	Other / general training		Provide a detailed assessment of training needs eg preparing job descriptions, skills gap analysis, training program development	AM / ACL	Staff time	01/01/2020

10 Contingency Plans

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

The occurrence of a hazard, or risk event, may be indicated by monitoring systems, observed by ADC (Ashburton District Council – Water Supply Owner) or ACL (Ashburton Contracting Ltd – Supply Operator) staff or reported by the public. Consumer complaints of illness or water quality issues may also indicate that a risk event has occurred.

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

10.1 Insufficient Source Water Available

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

10.2 Microbiological Contamination of Source Water

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

10.3 Chemical Contamination of Source Water

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

10.4 E. coli Transgression in Water leaving the Treatment Plant

Indicators	E. coli transgression reported following routine monitoring
Actions	Follow transgression response procedure in DWSNZ Advise Drinking Water Assessor (DWA) Commence daily E. coli testing at Water Treatment Plant Use an enumeration test method Sample in distribution system Investigate cause, inspect plant and source Take remedial action Continue to sample for E. coli until three consecutive samples are free of E. coli If E. coli is found in repeat samples consult with DWA, intensify remedial action, consider alternative supply
Responsibility	Assets Manager

10.5 Over Disinfection

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

10.6 Inadequate Disinfection

Indicators	Monitoring shows low FAC
Actions	Identify cause of contamination and rectify problem as quickly as possible Assess the situation and consider issuing a precautionary boil water notice if deemed appropriate Notify DWA of situation and actions taken Consider provision of emergency treatment equipment or alternative water supply (e.g. tankers) Disinfect contaminated reservoirs and flush mains Keep customers informed and advise once regular service is restored
Responsibility	Assets Manager

10.7 E. coli Transgression in Water in the Distribution Zone

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

10.8 Chemical Contamination of Water in Distribution Zone

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

10.9 Insufficient Water Available in the Distribution Zone

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

Responsibility	Assets Manager

10.10 Insufficient Water Available due to Unplanned Shutdown

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

10.11 Raw Water Turbidity Value High

Indicators	Raw water turbidity value on SCADA is >2.5 NTU
Actions	Issue a precautionary boil water notice Notify DWA of situation and actions taken Disinfect contaminated reservoirs and flush mains Carry out daily monitoring for E.coli at the treatment plant and reticulation until the turbidity value returns to normal. If E.coli is detected, follow contingency plan 10.4 (treatment plant) or 10.7 (distribution system) Monitor the turbidity value on SCADA Consider provision of emergency treatment equipment or alternative water supply (e.g. tankers) Keep customers informed and advise once regular service is restored
Responsibility	Assets Manager

The individual *Ministry of Health Water Safety Plan Guides 2014* used in the preparation of this Plan were:

- S1.1 Surface and Groundwater Sources
- P1.1 Surface Water Abstraction - Rivers, Streams and Infiltration Galleries
- P7.1 Chlorine Disinfection
- P7.4 UV Disinfection
- P11 Plant Construction & Operation
- D1 Post-Treatment Storage
- D2.3 Operation
- D2.4 Backflow prevention
- G1 Training
- G2 Monitoring

11 Critical Control Points

11.1 Raw Water Turbidity

Process objectives:

- Provides a **raw water quality Critical Control Point** to assess the quality of the water being fed into the treatment plant.
- Provides a **raw water Quality Control Point** to help determine whether downstream processes, namely chlorination and UV irradiation, will maintain efficacy.

Operational monitoring of control process:	
What	Raw water turbidity (NTU)
When	Continuous on-line SCADA monitoring
Where	Raw water line entering the treatment plant
How	Hach TU5300 Turbidimeter – online values and alarms to SCADA
Who	ACL Operator / ADC staff via SCADA
Records	SCADA data historian and plant log-book

Process performance criteria at the operational monitoring point:		**Correction if operating criteria are not met:**
Target Range:	< 1.0 NTU	No correction currently possible. This is the raw water coming into the plant with no control over it.
Action Limits:	NTU: > 1.0 NTU < 2.5 NTU	Duty Operator to respond by keeping a closer eye on the SCADA readings and weather conditions (high or constant rain) Duty Operator to notify Duty Supervisor and ADC Compliance Officer to monitor and prepare for Contingency Plan 10.11
Critical Limits:	NTU: > 2.5 NTU	Duty Operator to notify Duty Supervisor. Duty Supervisor to contact ADC Compliance Officer. Contingency plan 10.11

Supporting programs:

- Monthly verification of the turbidimeter by the Operator.
- Three-monthly calibration of the turbidimeter by the Operator.
- Follow manufacturer's guidelines regarding further operation and maintenance of the turbidimeter.
- Monthly Operator check of accuracy of calibration standards and discarding of outdated calibration standards.
- Training and competency of Operator in the calibration, verification, operation and maintenance of turbidity instruments.
- Only utilise materials provided by the recognised supplier.
- Periodic in-depth servicing of instruments by a Hach Service Engineer, in accordance with the manufacturer's guidelines.
- Periodic end-to-end testing of critical signals

11.2 Chlorine Disinfection - Primary

Process objectives:

- Provides a **primary disinfection Critical Control Point** to inactivate bacterial, viral and most protozoal pathogens that may have entered upstream of dosing point.
- Provide **residual disinfection Quality Control Point** to help inactivate pathogens entering downstream of the dosing point

Operational monitoring of control process:	
What	Free available chlorine (FAC) concentration in mg/L
When	Twice Weekly (short-term[1])
Where	At the tagged sampling point inside the treatment plant, "Plant Methven Springfield Water TP00343"
How	Hand-held pocket Colorimeter with vendor-supplied reagents (short-term[2])
Who	ACL Operator
Records	Log-book (short-term[3])

Process performance criteria at the operational monitoring point:		**Correction if operating criteria are not met:**
Target Range:	FAC: 0.6-0.7 mg/L	Operator to adjust dosing system to achieve target range if noticed to be outside of target range during routine checking procedures
Action Limits:	FAC: < 0.5 mg/L (upon inspection) > 0.8 mg/L (upon inspection)	Duty Operator to respond by adjusting dosing to within target limits. Duty Operator to notify Duty Supervisor
Critical Limits:	FAC: < 0.3 mg/L (upon inspection) > 1.2 mg/L (upon inspection)	Duty Operator to respond by adjusting dosing to within target limits. Duty Operator to notify Duty Supervisor. Duty Supervisor to contact ADC Compliance Officer. Contingency plan 10.5 (over disinfection) or contingency plan 10.6 (inadequate disinfection) is to be followed.

Supporting programs:

- Monthly monitoring instrument checking and calibration by Operator as necessary.
- Monthly Operator check of accuracy of reagents and discarding of outdated reagents.
- Training and competency of Operator in free chlorination of drinking water.
- Only utilise potable water grade chlorine stock solution from approved supplier.
- Lab verification checks for *E.coli*, in accordance with the sampling program.

Notes:

1. In the longer term this should be moved to on-line continuous on-line chlorine analyser (incorporating pH compensation) continuous monitoring, as detailed in the improvement schedule.
2. In the longer term this should move to reagents related to verification and calibration of on-line chlorine analysers (incorporating pH compensation)
3. In the longer term this should move to the SCADA historian.

11.3 Chlorine Disinfection - Reticulation

Process objectives:

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

Operational monitoring of control process:	
What	Free available chlorine (FAC) concentration in mg/L pH in pH units
When	ADC Monthly (short-term[1]) ACL Twice Weekly
Where	ADC staff: The Methven Springfield zone sample tap is located on Braemar Lauriston Road between Pole Road and Braemar Road. The sample tap is located inside a locked bollard on the roadside on the west side of the road, approximately 700 metres from Braemar Road when heading towards Pole Road. The bollard is located at the point where the hedge line ends. ACL operators: Sampling bollard as above
How	Hand-held pocket Colorimeter with vendor-supplied reagents (short-term[2])
Who	ADC Sampling Officer and ACL Operator
Records	ACL: Log-book (short-term[3]) ADC: WaterOutlook

Process performance criteria at the operational monitoring point:		**Correction if operating criteria are not met:**
Target Range:	FAC: 0.2 – 0.7 mg/L	Operator to adjust dosing system to achieve target range if noticed to be outside of target range during routine checking procedures
Critical Limits:	FAC: < 0.2 mg/L (upon inspection) > 2.0 mg/L (upon inspection)	ADC Sampling Officer / ACL Operator to contact ADC Compliance Officer. Contingency plan 10.5 (over disinfection) or contingency plan 10.6 (inadequate disinfection) is to be followed.

Supporting programs:

- In the longer term this should be moved to on-line continuous on-line chlorine analyser (incorporating pH compensation) continuous monitoring, as detailed in the improvement schedule.
- In the longer term this should move to reagents related to verification and calibration of on-line chlorine analysers (incorporating pH compensation).
- In the longer term this should move to the SCADA historian.

12 Section 10 Compliance

In this section, the WSP details how the water supply is complying with, or working towards compliance, of Section 10 of the DWSNZ 2005 (2008).

The compliance requirements of Section 10 of the DWSNZ 2005 (2008) must be met and they are outlined as follows (abstracted from the DWSNZ 2005 (2008):

1. A Water Saftey Plan (WSP) must have been approved by a drinking-water assessor (DWA) and be in the process of being implemented.
2. Appropriate bacterial and chemical treatment, as determined by the catchment assessment in the WSP must be met.
3. Appropriate protozoal treatment (Table 10.1) must be in use.
4. Water quality must be monitored and meet the requirements in Section 10.4.
5. The remedial actions that have been specified in the WSP must be undertaken when a MAV is exceeded or treatment process controls are not met.

When the water supplier can show these requirements have been met, the supply will be deemed to comply with the DWSNZ, otherwise the compliance requirements for the supply revert to those in sections 4, 5 and 7 to 9.

When monitoring data show that water quality is unsatisfactory but the steps specified in the WSP to improve the water quality are being taken, reversion to the requirements of section 4, 5 and 7 to 9 may be delayed to provide time to establish the effectiveness of the remedial actions.

12.1 A Water Saftey Plan (WSP) must have been approved by a drinking-water assessor (DWA) and be in the process of being implemented.

This document is the WSP and once approved, will therefore satisfy item 1 of the Section 10 compliance criteria.
This WSP includes some significant upgrades and it is the intention of ADC on satisfactory completion of the upgrades to amend the WSP accordingly and re-issue for approval.

12.2 Appropriate bacterial and chemical treatment, as determined by the catchment assessment in the WSP must be met

The catchment assessment identified the supply as requiring ***bacterial and 3-log protozoal treatment,*** in accordance with table 10.1 of Section 10. The current treatment process does not currently comply with this requirement and an upgrade is planned. This treatment will include filtration, UV irradiation and chlorine dosing. This will be to the appropriate standards and level to meet the bacterial and 3-log protozoal treatment.

12.3 Appropriate protozoal treatment (Table 10.1) must be in use.

As outlined above, the planned upgrade will include filtration (cartridge) followed by UV disinfection. On the submission of this current WSP, the existing treatment process cannot demonstrate 3-log protozoal removal so will therefore be non-compliant in this respect. This WSP aims to demonstrate that although the supply is not currently there, it is something that the supply is actively working towards.

12.4 Water quality must be monitored and meet the requirements in Section 10.4.

Currently the supply follows a well established programme of water quality monitoring: For drinking-water leaving the treatment plant, compliance criterion 1 is followed, as the protozoal compliance requirements are not currently met. The actions followed under compliance criterion 1 also includes the appropriate remedial action should *E.coli* be found. For drinking-water in the distribution system, compliance criterion 6a is followed.

In terms of bacterial monitoring, the supply will continue with its well established programme following compliance criterion 1 and 6a. These far exceed the requirements detailed in Section 10.4.2. What isn't currently covered in Section 10.4.2 is the requirement for "samples to be taken from randomly selected locations throughout the distribution system". The supply has a dedicated water sample bollard installed at the far end of the reticulation and has been long used as an overall indicator for water quality within the reticulation. However, if there is still a requirement to take samples from randomly selected locations then the Complaince Officer will liaise with the Drinking Water Assessor in order to determine that specific programme.

With regards protozoal monitoring, Section 10.4.3 details the following:
Monitoring of protozoa is not required. As a surrogate, inspection and monitoring of the source protection, abstraction and treatment practices and the network protection is required.

The operational requirements that need to be monitored to demonstrate protozoal compliance are dependent on the water treatment process being used. The monitoring programme adopted must be given in the WSP.

As detailed in the Barriers to Contamination, the Risk Tables and the Improvements sections, the catchment zone and abstraction points either have current actions or initatives in place to monitor water quality risk, or have recommended improvement strategies.

The intended treatment process for 3-log protozoa is one of cartridge filtration and UV disinfection. Compliance will be demonstrated by the following (this will be confirmed upon upgrade completion):

- As described in Table 10.1 of Section 10, the cartridge filter must have a pore size no greater than 5 µm (nominal) and be a rigid cartridge (i.e. not pleated), fabric or wound.

- The filter housing will be a Harmsco NSF-61 listed MUNI 170 MP Hurricane Filtration System with an NSF-61 HC/170 Hurricane High Performance Filter Cartridge.
- Operators will follow the manufactures guidelines with regards routine maintenance on the filtration system.
- A differential pressure transmitter, connected to SCADA, will monitor the differential pressure across the filter. The manufactures guidelines will indicate when this differential pressure indicates that a filter change is required. Operators will look at this during weekly plant checks but there will also be an alarm to the SCADA.
- An in-line turbidity meter will monitor the turbidity value post cartridge filter. This is connected to SCADA.
- The UV unit will be a Wedeco Spektron 75e model, ÖNORM certified and validated to provide a dose of 40 mJ/cm^2 between 60-98 UVT (1cm) at a max flow rate of 130 m^3/hr.
- Relevant values (intensity / dose) will be provided to SCADA, along with any alarms.
- Operators will follow manufactures guidelines with regards operation and maintenance.
- An in-line UVT monitor will be installed between the filter and the UV unit and will be connected to SCADA, with appropriate alarms.
- Operators will follow manufactures guidelines with regards operation and maintenance.
- The treatment process will be deemed to be compliant as long as the filter has not breached its high pressure differential value and the UVT reading is within that of the ÖNORM certified and validated unit, and there are no alarms from the UV unit.
- The fully developed CCP and Contingency Plans would cover these aspects in more detail.

12.5 The remedial actions that have been specified in the WSP must be undertaken when a MAV is exceeded or treatment process controls are not met.

Please refer to the Contingency Plans and CCPs, noting that there will be a need to fully develop specific ones for protozoal treatment following the plant upgrade.

12.6 Summary

In its current form, the water supply does not comply with any aspect of the DWSNZ for protozoa. With the analysis of the Barriers to Contamination and the Risk Tables, an Improvement Schedule has been identified. This Improvement Schedule will be implemented over the coming years, with the higher risk initiatives happening first. The treatment plant upgrade will address the shortcomings on the protozoal treatment and compliance. When the upgrade is being completed, the Contingency Plan and CCP will be developed for the protozoal treatment. Until then, the primary process control points will be chlorination and turbidity.

The supply is not currently compliant but is actively working towards compliance, of which this Water Safety Plan is a key element. Following the upgrade, the WSP will be amended to incorporate the changes, and submitted to the DWA for approval.