Ashburton DISTRICT COUNCIL

Methven Water Supply

Water Safety Plan

Methven Water Supply
Water Safety Plan

Version 2.1: August 2018

Authorised by: _____

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Drinking Water Assessor

Document Control

Version No	Description	Authorised	Approval Date
V 1.0	For submission to DWA for approval	AG	November 2010
V1.1	Amended to include more details on UV and costs in improvement schedule	AG	June 2011
V 2.0	Five yearly revision to DWA for approval	AG	June 2015
V 2.1	Minor revision to add CCPs	CS	August 2018

Contents

1 Background

Ashburton District Council (ADC) owns and manages the Methven 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].

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

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

Methven is classified as a minor supply under the legislation and is therefore required to be compliant with the Act by 01 July 2014. In 2011 the Ministry of Health (MoH) approved a PHRMP for Methven. A significant treatment plant upgrade has taken place since the approval of the 2011 PHRMP and therefore this WSP has been prepared to ensure the risk information contained within the plan is current and relevant.

Since the approval of the initial PHRMP Council commissioned an Issues and Options Report to inform decision makers of the options available for upgrading the Methven drinking water supply. Following a review of the options it was decided that the best option was to upgrade the existing system. This upgrade is discussed in greater detail in Section 5.1 of this plan.

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 the Activity Management Plan (AMP) for prioritisation and funding via the Long Term Plan (LTP).

3 Supply Details

Supply	
Supply Name	*Methven*
WINZ Community Code	*MET001*
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	*1,707 (Census 2013)*
Supply Grading	*Ed (current, lasted graded 26/10/2006)*
Source	
Source Name	*Ashburton River*
Source WINZ Code	*S00223*
Location	*Ashburton River North Branch flood plain*
Map Reference of Source	*NZMS 260 K36:9322-3007* *NZMG 2393220 easting, 5730070 northing* *NZTM 1483245 easting, 5168455 northing*
Type of Source	*Surface water*
Depth of Bore	*NA – 3m deep intake gallery*
Consent Number	*CRC011923*
Consent Expires	*8 August 2037*
Maximum Consented water take:	*36 L/s, 470,000 m^3 per year*
Treatment Plant	
Treatment Plant Name	*Methven*
Treatment Plant WINZ Code	*TP00342*
Location	*Longs Ford Road*
Map Reference	*NZMS 260 K36:9651-2923* *NZMG 2396510 easting, 5729230 northing* *NZTM 1486535 easting, 5167615 northing*
Treatment Processes	*Chlorination, Fluoridation, UV , Filtration*
Average Daily Volume (2013/14)	*1,023m^3/day*
Peak Daily Volume (2013/14)	*1,792 m^3/day*
Distribution	
Distribution Zone Name	*Methven*
Distribution Zone WINZ Code	*MET001ME*

Distribution Zone Population	*1,707 (*Census 2013)
Regulatory Compliance	
Standards compliance assessed against	*DWSNZ 2005 (rev 2008)*
Laboratory undertaking analyses	*Ashburton District Council*
Secure bore water	*No*
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	*4 (assigned 19/11/2013)*
Protozoa treatment process	*UV system – Trojan Swift SC D06* *Filtration - Amiad 10 micron filter (10 µm) and 3M CUNO 1 micron filter (1 µm)*
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	*Fluoride*
Chemical compliance achieved for the last 4 quarters.	*Yes*
Cyanobacteria identified in the supply	*No*
Cyanobacterial compliance has been achieved for the last 4 quarters.	*NA*
Identify any transgressions that have occurred in the last 4 quarters *Nil*	

3.1 Contact Information

Water Supply Owner:

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

Water Supply Operator:

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

4 Methodology

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

4.1 System Description

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 7 and 8).

4.2 Consultation

Version 1 of this plan was prepared in 2011 in consultation with Ashburton District Council water supply management and operational staff and in accordance with existing documentation.

The initial PHRMP was drafted following consultation with the scheme's plant operator. This process helped identify the critical points, barriers to contamination, risks to the supply, the preventative measures in place, monitoring requirements and the corrective actions necessary. The information provided through this consultation was used to compile the risk tables.

In May 2015 the plan was comprehensively revised to take into account improvements made to the water supply system by means of capital works, and management, operation and maintenance modifications.

The Version 2.0 WSP draft was reviewed and discussed with by Andrew Guthrie, Assets Manager, Ashburton District Council, and Robin Jenkinson, Ashburton Contracting Ltd, prior to completion.

4.3 Risk Assessment

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

The scales used have been adapted slightly from those suggested in Appendix 2 of "A Framework on How to Prepare and Develop Public Health Risk Management 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 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:

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

These full tables can be found in section 10.

4.4 Improvement Schedule

An improvement schedule (section 11) has been derived from the risk tables and is prioritised according to the assessed level of public health risk associated with hazards that are not adequately controlled at present.

Improvement measures identified in this WSP will be carried forward to the next AMP and LTP for approval and inclusion in annual budgets following the statutory public consultation process. Implementation of the improvement schedule is ultimately subject to Council funding approval, and/or obtaining alternative funding.

4.5 Benefits of Proposed Improvements

The proposed improvements will provide public health benefits by reducing the risk of adverse health outcomes associated with drinking water quality. In particular, risks will be reduced through the provision of water treatment systems that are appropriate to the raw water quality and catchment conditions, and that are compliant with the Drinking-water Standards for New Zealand.

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

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

The proposed improvement schedule includes undertaking a criticality analysis, and reviewing and maintaining AMP's and associated asset renewal programmes to minimise failures. Each of these will facilitate strategic planning and assist in guiding the overall management of the scheme.

4.6 Contingency Plans

Contingency plans have been prepared (section 12) to provide guidance in the event that control measures fail to prevent the occurrence of a risk event that may present acute risk to public health. The Water Supply Operator is responsible for implementation of the contingency plans when monitoring has identified the occurrence of a risk event.

5 General Description

The Methven water supply scheme supplies water to 958 connections serving a population of 1,707 (2013 Census). Methven experiences seasonal fluctuations in population with extra visitors in the town during the Mt Hutt ski season.

5.1 Plant Upgrade

In 2011 a Public Health Risk Management Plan (PHRMP) was approved and implemented for the Methven drinking water scheme. The 2011 PHRMP improvement schedule included undertaking an issues and options assessment to identify plant upgrade options.

The Issues and Options report completed by Opus International Consultants considered three upgrade options: drill a new deep bore within 2km of the existing assets, upgrade the existing system, or draw water from the stockwater race and treat it to drinking water standards. The recommendation was to upgrade the existing system.

This recommendation was accepted and the plant upgrade was completed in October 2012. The upgrade included the installation of two new filters, a new UV disinfection unit, and modifications to the chlorine and fluoride dosing systems.

The generator and concrete slab were relocated onsite to allow for the treatment plant building to be extended, chemical dosing equipment was separated from the other treatment equipment, and a new chemical storage shed was constructed. A new soak pit was installed for the treatment plant building drainage.

5.2 Source

Water is sourced from an infiltration gallery (K36/0130) on the Ashburton River off Ashburton River Road. The river is to the south-west of the gallery, between 200-300m away.

The catchment covers an area of around 280Km^2 with approximately 10% in bush and the remaining 90% in alpine environment and pasture. A catchment risk categorisation survey was completed in 2013 and at that time the scheme was assigned a log credit requirement of 4.

Water in the gallery is believed to be hydraulically linked to the North Branch of the Ashburton River. The infiltration gallery has a consented take of 36L/s and a maximum volume of 470,000m^3/year. The water level in the infiltration gallery is continuously monitored.

The intake comprises a 201m long porous concrete pipe buried between 2m to 4m deep in alluvial gravels within the flood plain of the North Branch Ashburton River. Water flows by gravity into twin raw water trunk mains (3.5km long) and is conveyed to the treatment plant and service reservoir located on Longs Ford Road.

Flow into the plant is controlled by an actuated valve which operates based on the water level in the reservoir. An orifice plate maintains a consistent flow rate through the treatment system. Figure 1 illustrates the Methven water supply from source to reticulation.

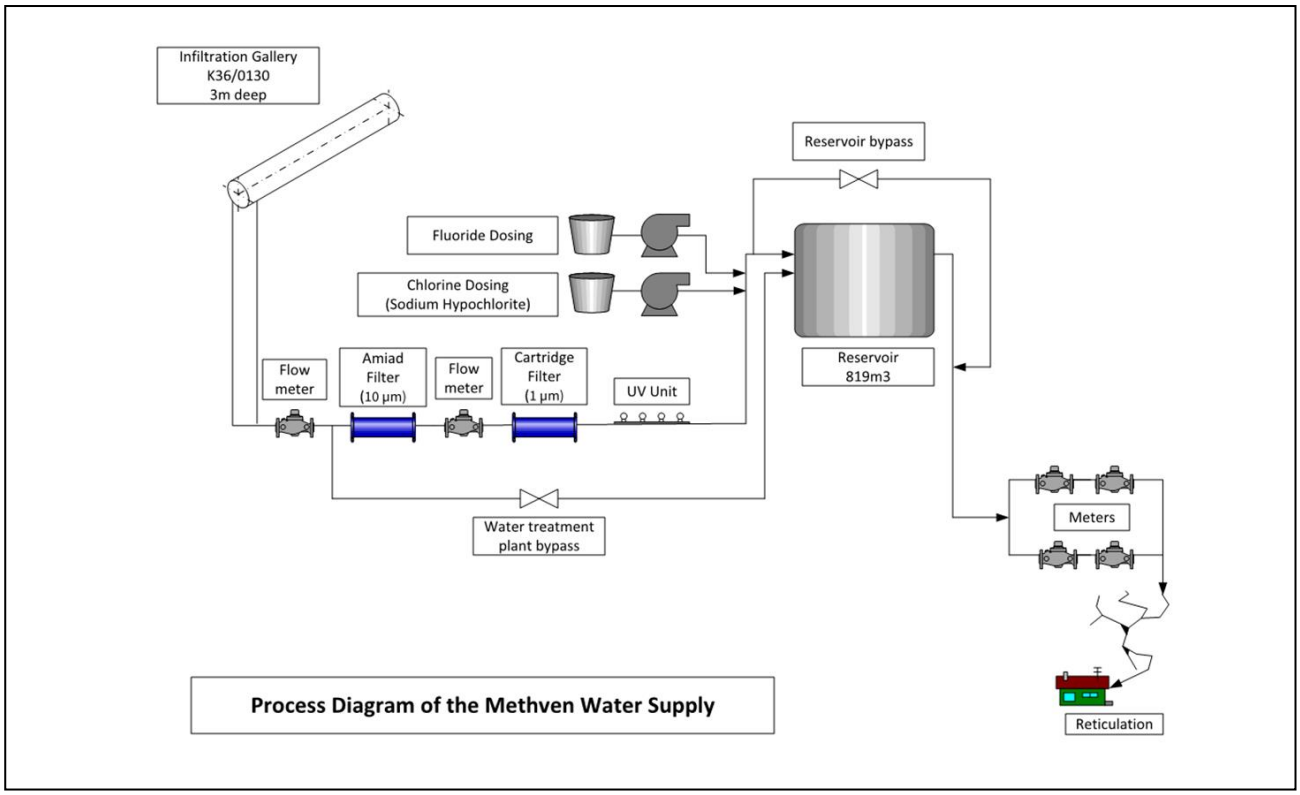


Figure 1: Methven Water Supply Process Diagram

5.3 Treatment and Distribution

To address the risk of protozoal contamination, cartridge filtration and UV sterilisation equipment was installed as part of the 2012 upgrade.

After the raw water enters the treatment plant it is directed through an Amiad 10 micron filter (10 µm) then a 3M CUNO 1 micron filter (1 µm) prior to passing through a Trojan UVSwift SC D06 UV disinfection system. If necessary the pipework allows the UV system to be bypassed for maintenance.

Following UV disinfection a chlorination system doses sodium hypochlorite solution at a fixed dose rate whenever there is flow through the treatment plant. Fluoride is dosed after chlorination. Fluoride powder is fed into a mixing tank at a fixed rate whenever there is flow through the treatment plant and a dosing pump doses the solution into the water line. Manual dose rate checks are regularly made by the Plant Operator and fluoride tests are carried out using a third-party laboratory every week.

The infiltration gallery is approximately 20m higher than the service reservoir top water level. The concrete service reservoir, with a high level inlet and a low level outlet, has a volume of 819m^3, although the top water level setpoint has been lowered to provide seismic resilience, reducing the operational capacity to 700m^3. Pipework allows the reservoir to be bypassed if necessary. The reservoir level is continuously monitored.

Water is supplied (by gravity) from the service reservoir to Methven down a pair of trunk mains (3.7km long). Flow through each trunk main is metered both at the reservoir end and at the lower end. This allows for identification of potential losses along the treated water trunk mains.

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

5.4 Monitoring and Alarms

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

Water quality monitoring is carried out in accordance with the DWSNZ. Turbidity is continuously monitored at the plant and an online chlorine analyser monitors free available chlorine (FAC) in water leaving the reservoir. SCADA is used to report a high or low FAC alarm to the plant operator.

E. coli, pH and fluoride is sampled at the plant twice a week by Council Environmental Monitoring staff. Monthly nitrate monitoring is also carried out at the treatment plant. Annual basic water chemistry testing of the source water commenced in May 2015, and is analysed at an IANZ approved laboratory.

Three sampling bollards in the distribution zone are located at Line Road, Hobbs Road, and Barkers Road. Weekly E. coli, pH, FAC, and turbidity samples are taken in the distribution zone.

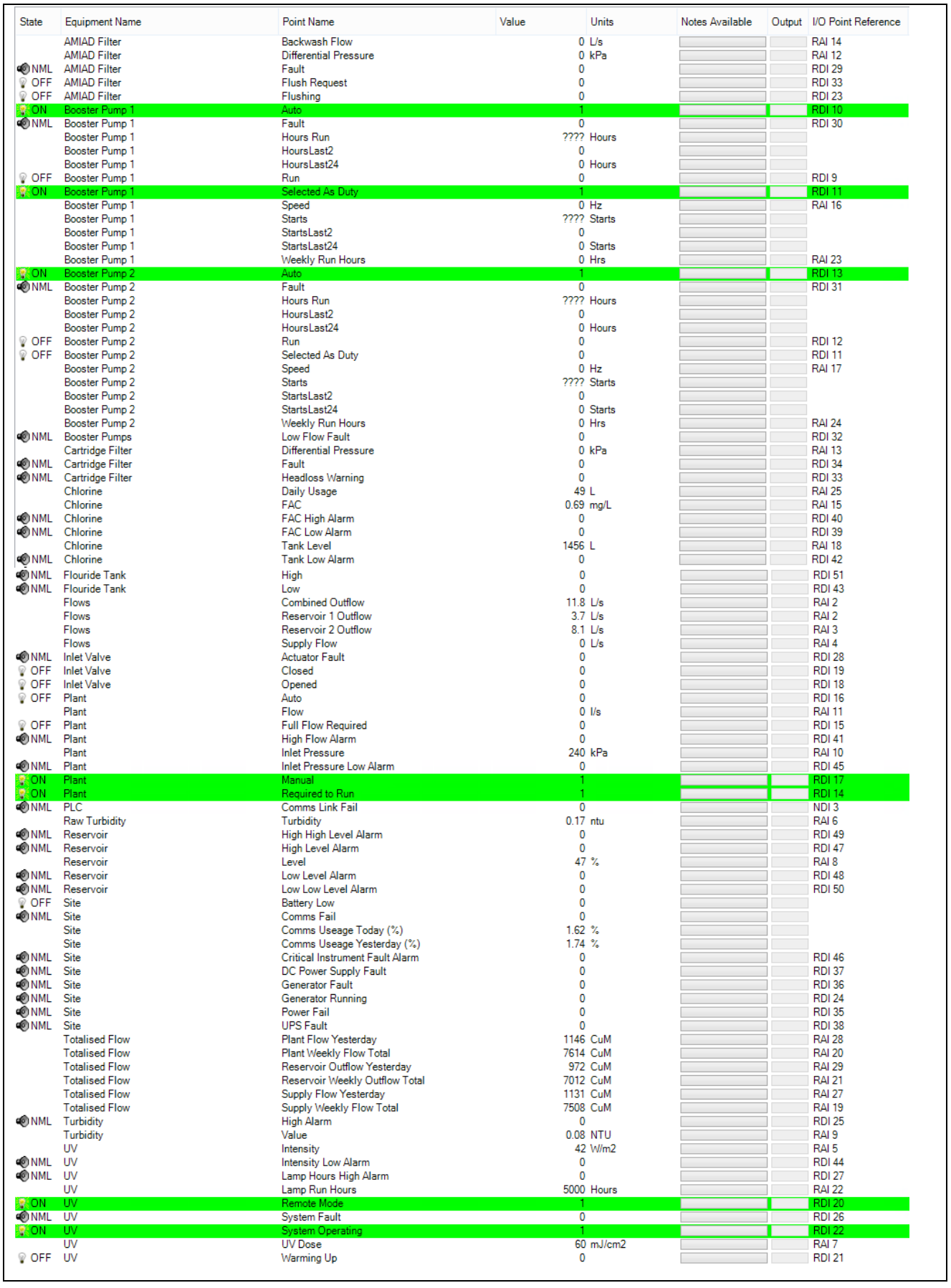
Methven is connected to the district-wide telemetry system (see figure 2, page 13). SCADA is used to report power failure, booster pump faults, generator fault, filtration faults, UV low intensity, generator run, high and low chlorine residual, high and low reservoir level, low sodium hypochlorite tank level, high turbidity and low system pressure to the operator by alarms, sent by SMS.

SCADA also records booster pumps on/off, booster pump flow, pump run hours, sodium hypochlorite tank level, fluoride tank high and low level, system pressure, filtration differential pressure, totalised flows, reservoir level and turbidity.

5.5 Maintenance and Administration

Methven 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.



State	Equipment Name	Point Name	Value	Units	Notes Available	Output	I/O Point Reference
	AMIAD Filter	Backwash Flow	0	L/s			RAI 14
	AMIAD Filter	Differential Pressure	0	kPa			RAI 12
NML	AMIAD Filter	Fault	0				RDI 29
OFF	AMIAD Filter	Flush Request	0				RDI 33
OFF	AMIAD Filter	Flushing	0				RDI 23
ON	Booster Pump 1	Auto	1				RDI 10
NML	Booster Pump 1	Fault	0				RDI 30
	Booster Pump 1	Hours Run	????	Hours			
	Booster Pump 1	HoursLast2	0				
	Booster Pump 1	HoursLast24	0	Hours			
OFF	Booster Pump 1	Run	0				RDI 9
ON	Booster Pump 1	Selected As Duty	1				RDI 11
	Booster Pump 1	Speed	0	Hz			RAI 16
	Booster Pump 1	Starts	????	Starts			
	Booster Pump 1	StartsLast2	0				
	Booster Pump 1	StartsLast24	0	Starts			
	Booster Pump 1	Weekly Run Hours	0	Hrs			RAI 23
ON	Booster Pump 2	Auto	1				RDI 13
NML	Booster Pump 2	Fault	0				RDI 31
	Booster Pump 2	Hours Run	????	Hours			
	Booster Pump 2	HoursLast2	0				
	Booster Pump 2	HoursLast24	0	Hours			
OFF	Booster Pump 2	Run	0				RDI 12
OFF	Booster Pump 2	Selected As Duty	0				RDI 11
	Booster Pump 2	Speed	0	Hz			RAI 17
	Booster Pump 2	Starts	????	Starts			
	Booster Pump 2	StartsLast2	0				
	Booster Pump 2	StartsLast24	0	Starts			
	Booster Pump 2	Weekly Run Hours	0	Hrs			RAI 24
NML	Booster Pumps	Low Flow Fault	0				RDI 32
	Cartridge Filter	Differential Pressure	0	kPa			RAI 13
NML	Cartridge Filter	Fault	0				RDI 34
NML	Cartridge Filter	Headloss Warning	0				RDI 33
	Chlorine	Daily Usage	49	L			RAI 25
	Chlorine	FAC	0.69	mg/L			RAI 15
NML	Chlorine	FAC High Alarm	0				RDI 40
NML	Chlorine	FAC Low Alarm	0				RDI 39
	Chlorine	Tank Level	1456	L			RAI 18
NML	Chlorine	Tank Low Alarm	0				RDI 42
NML	Flouride Tank	High	0				RDI 51
NML	Flouride Tank	Low	0				RDI 43
	Flows	Combined Outflow	11.8	L/s			RAI 2
	Flows	Reservoir 1 Outflow	3.7	L/s			RAI 2
	Flows	Reservoir 2 Outflow	8.1	L/s			RAI 3
	Flows	Supply Flow	0	L/s			RAI 4
NML	Inlet Valve	Actuator Fault	0				RDI 28
OFF	Inlet Valve	Closed	0				RDI 19
OFF	Inlet Valve	Opened	0				RDI 18
OFF	Plant	Auto	0				RDI 16
	Plant	Flow	0	l/s			RAI 11
OFF	Plant	Full Flow Required	0				RDI 15
NML	Plant	High Flow Alarm	0				RDI 41
	Plant	Inlet Pressure	240	kPa			RAI 10
NML	Plant	Inlet Pressure Low Alarm	0				RDI 45
ON	Plant	Manual	1				RDI 17
ON	Plant	Required to Run	1				RDI 14
NML	PLC	Comms Link Fail	0				NDI 3
	Raw Turbidity	Turbidity	0.17	ntu			RAI 6
NML	Reservoir	High High Level Alarm	0				RDI 49
NML	Reservoir	High Level Alarm	0				RDI 47
	Reservoir	Level	47	%			RAI 8
NML	Reservoir	Low Level Alarm	0				RDI 48
NML	Reservoir	Low Low Level Alarm	0				RDI 50
OFF	Site	Battery Low	0				
NML	Site	Comms Fail	0				
	Site	Comms Useage Today (%)	1.62	%			
	Site	Comms Useage Yesterday (%)	1.74	%			
NML	Site	Critical Instrument Fault Alarm	0				RDI 46
NML	Site	DC Power Supply Fault	0				RDI 37
NML	Site	Generator Fault	0				RDI 36
NML	Site	Generator Running	0				RDI 24
NML	Site	Power Fail	0				RDI 35
NML	Site	UPS Fault	0				RDI 38
	Totalised Flow	Plant Flow Yesterday	1146	CuM			RAI 28
	Totalised Flow	Plant Weekly Flow Total	7614	CuM			RAI 20
	Totalised Flow	Reservoir Outflow Yesterday	972	CuM			RAI 29
	Totalised Flow	Reservoir Weekly Outflow Total	7012	CuM			RAI 21
	Totalised Flow	Supply Flow Yesterday	1131	CuM			RAI 27
	Totalised Flow	Supply Weekly Flow Total	7508	CuM			RAI 19
NML	Turbidity	High Alarm	0				RDI 25
	Turbidity	Value	0.08	NTU			RAI 9
	UV	Intensity	42	W/m2			RAI 5
NML	UV	Intensity Low Alarm	0				RDI 44
NML	UV	Lamp Hours High Alarm	0				RDI 27
	UV	Lamp Run Hours	5000	Hours			RAI 22
ON	UV	Remote Mode	1				RDI 20
NML	UV	System Fault	0				RDI 26
ON	UV	System Operating	1				RDI 22
	UV	UV Dose	60	mJ/cm2			RAI 7
OFF	UV	Warming Up	0				RDI 21

Figure 2: SCADA monitoring and alarm

6 Water Supply Distribution and Catchment Maps

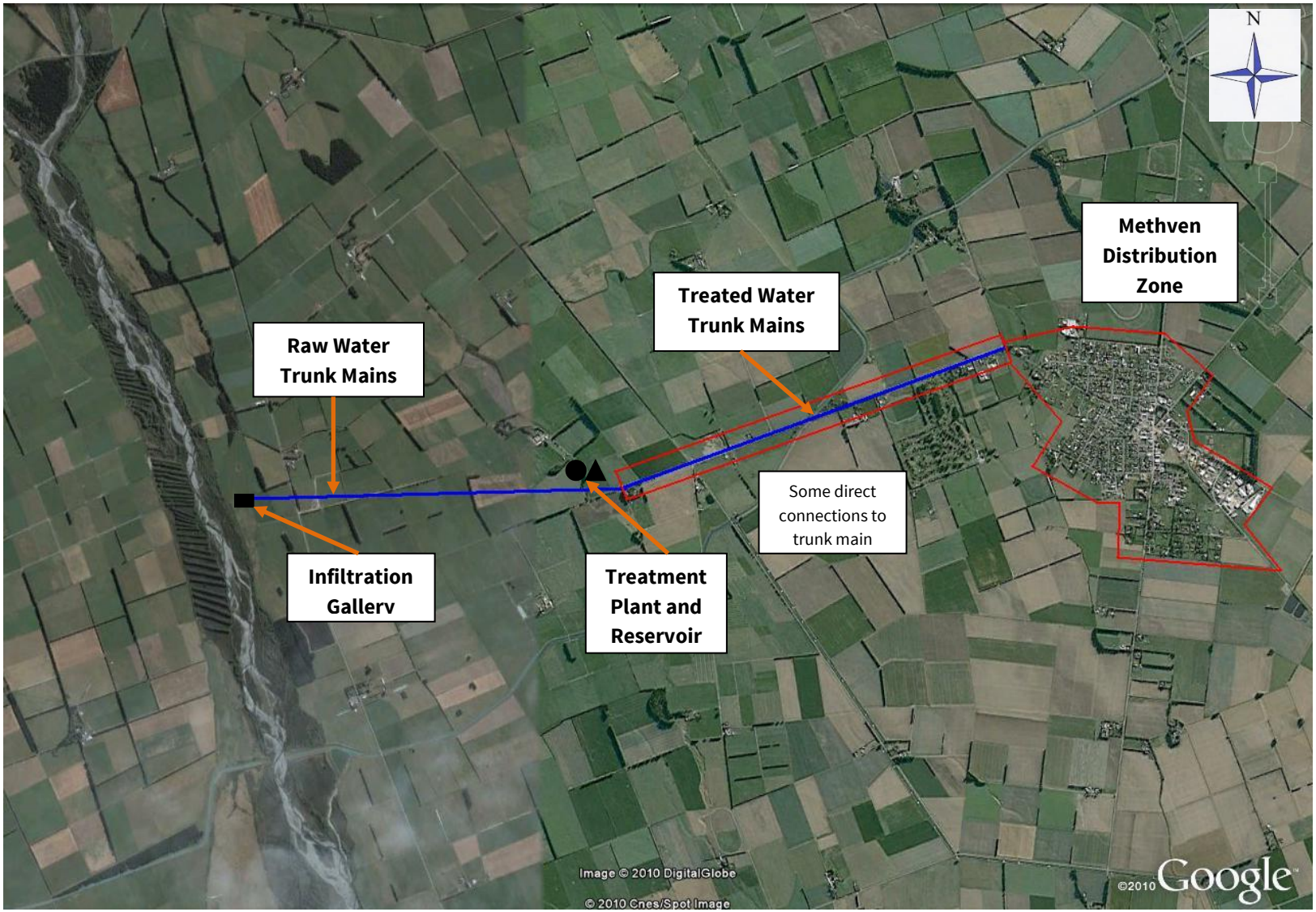


Figure 3: Water Supply Distribution Map

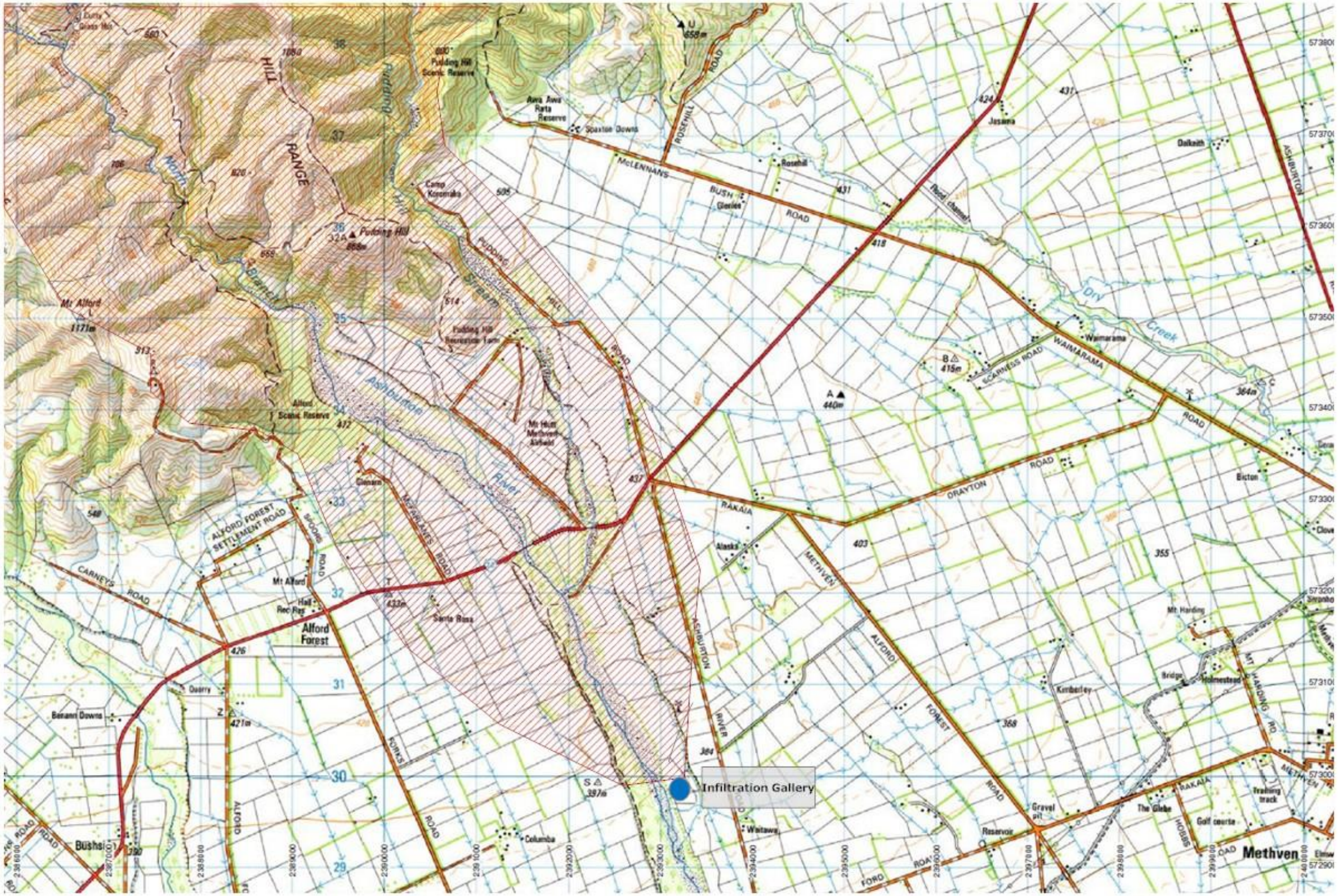


Figure 4: Water Supply Catchment Map

7 Critical Points for Hazard Management

Figure 5 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	*A contamination event in the catchment may make water unsuitable for treatment*
Intake	*Intake failure means eventual loss of supply*
Chlorine dosing	*Failure may result in a lack of bacterial and viral control* *Overdosing may exceed chemical MAV*
Fluoride dosing	*Overdosing may exceed chemical MAV*
UV disinfection and filtration	*Failure may result in a lack of protozoal control*
Treated water storage	*Possible point for microbiological contamination*

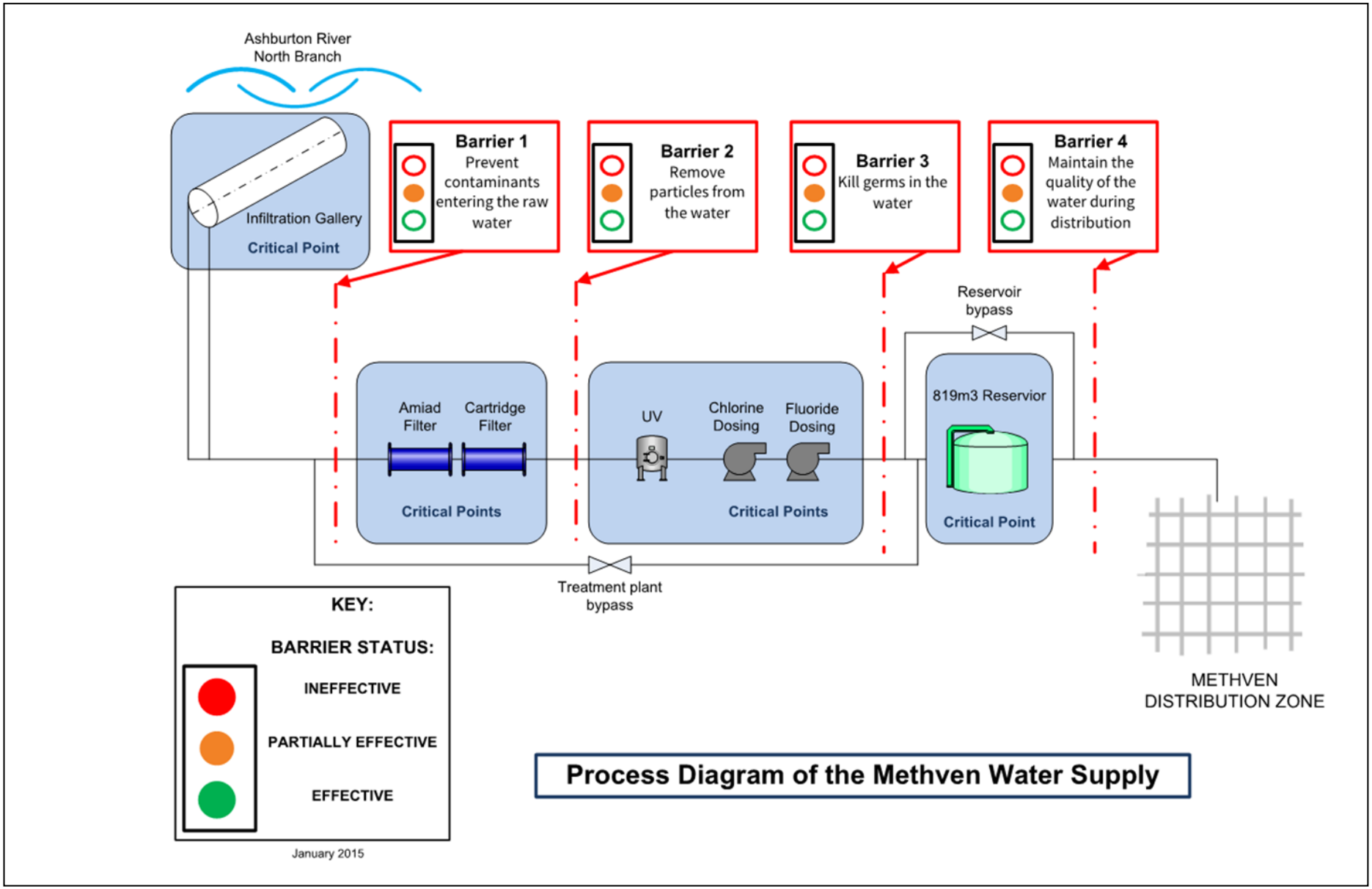

Ashburton River
North Branch
Infiltration Gallery
Critical Point
Barrier 1
Prevent contaminants entering the raw water
Barrier 2
Remove particles from the water
Barrier 3
Kill germs in the water
Barrier 4
Maintain the quality of the water during distribution
Reservoir bypass
Amiad Filter
Cartridge Filter
Critical Points
UV
Chlorine Dosing
Fluoride Dosing
Critical Points
819m3 Reservior
Critical Point
Treatment plant bypass
METHVEN
DISTRIBUTION ZONE
KEY:
BARRIER STATUS:
INEFFECTIVE
PARTIALLY EFFECTIVE
EFFECTIVE
January 2015
Process Diagram of the Methven Water Supply

Figure 5: Methven Water Supply Schematic

8 Barriers to Contamination

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

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

1. Prevent Contaminants from Entering the Raw Water

The source water for the supply is shallow ground water. This has lower concentrations of suspended solids and microbiological contamination than surface water. However, proximity to the North Branch of the Ashburton River suggests some degree of hydraulic connection and water quality can be assumed to be influenced by surface water and land use.

There is a 12m wide clay sanitary seal constructed over the length of the gallery. This is 150mm thick and 300mm below the ground surface. The gallery area is fenced off and sown with grass. This provides protection from contamination in the immediate area of the intake.

Human and animal access to the wider catchment (refer to Figure 4 above) is not controlled and could contribute contaminants to the water source. Farming operations in the catchment may also affect water quality. There is no known industrial activity or significant potentially contaminating activities (e.g. mining, landfill) in the catchment.

Furthermore, some protection is provided by the Land and Water Regional Plan (LWRP), as the infiltration gallery is regarded as a community drinking water supply under Section 16, Schedule 1. This means that a community drinking water supply protection zone applies, restricting and in some cases prohibiting some activities within a specified distance of the gallery. This includes activities such as stormwater discharges, on-site wastewater treatment/disposal devices, and discharge of agrichemicals.

A catchment risk categorisation survey has been undertaken (DWSNZ Appendix 3) and the scheme has been assigned a log credit requirement of 4. The source therefore provides only a partial barrier to contamination. Full protection of this catchment, including elimination of agricultural activities and restricted access is not considered feasible.

2. Remove Particles from the Water

Water is drawn into the intake through the alluvial river gravel material which provides some degree of filtration but this is not considered to be a reliable barrier to contamination. The clay sanitary seal provides an effective physical barrier against contamination from directly above the infiltration gallery for the full length of the pipeline. The source and gallery therefore provides a partial barrier to contamination.

The filtration equipment installed as part of the 2012 upgrade further contributes to this barrier. The Amiad 10 µm filter removes any large sediment from the raw water before it passes through the finer 3M CUNO 1µm filter. Section 5.12 of the DWSNZ specifies the criteria for cartridge filtration compliance. Council expects the cartridge filter to contribute log credits which will aid protozoa compliance.

3. Kill Germs in the Water

The treatment plant uses chlorination and a Trojan UV Swift SC D06 UV unit to disinfect the water. Ultraviolet transmittance (UVT) is measured at the plant, which the Plant Operator monitors and records during routine inspections. UV dose and intensity are continuously monitored and there is a power failure alarm for the site which indicates that the UV along with other onsite equipment is not functional.

There is a high turbidity alarm which alerts the Plant Operator that a turbidity event is occurring, and a UV intensity low alarm, both of which indicate that the UV disinfection may not be fully effective.

The UV unit run hours are monitored and the UV lamps are replaced every 14,000 hours. At the same time the quartz sleeves and sensor are cleaned and inspected. This procedure is well documented and is in accordance with the manufacturer's recommendations.

Chlorination and UV disinfection further enhance the partial barrier to contamination.

4. Maintain the Quality of Water during Distribution

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

Reservoir

The reservoir has a high level inlet and low level outlet to promote circulation to ensure that water does not remain in the reservoir for extended periods of time. The reservoir is covered to prevent unauthorised access and ingress of rainwater or contaminants.

Emergency Generator

The plant is on mains electricity supply with a backup generator that is regularly tested and the results recorded. An onsite generator ensures power is available to maintain water treatment and a constant supply. The generator is located inside the locked compound**.**

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.

5. General

The building housing the treatment equipment and pump station is clean and locked. There is a separate locked chemical shed where the sodium fluoride is stored.

New domestic connections are fitted with a backflow prevention device.

These measures contribute to the provision of a partial barrier against contamination of water following treatment.

9 Photographs of supply elements

Photo 1: Catchment looking East

Photo 2: Catchment looking West

Photo 3: Supply well for infiltration gallery with monitoring equipment

Photo 4: Methven WTP treatment building

Photo 5: Methven WTP generator

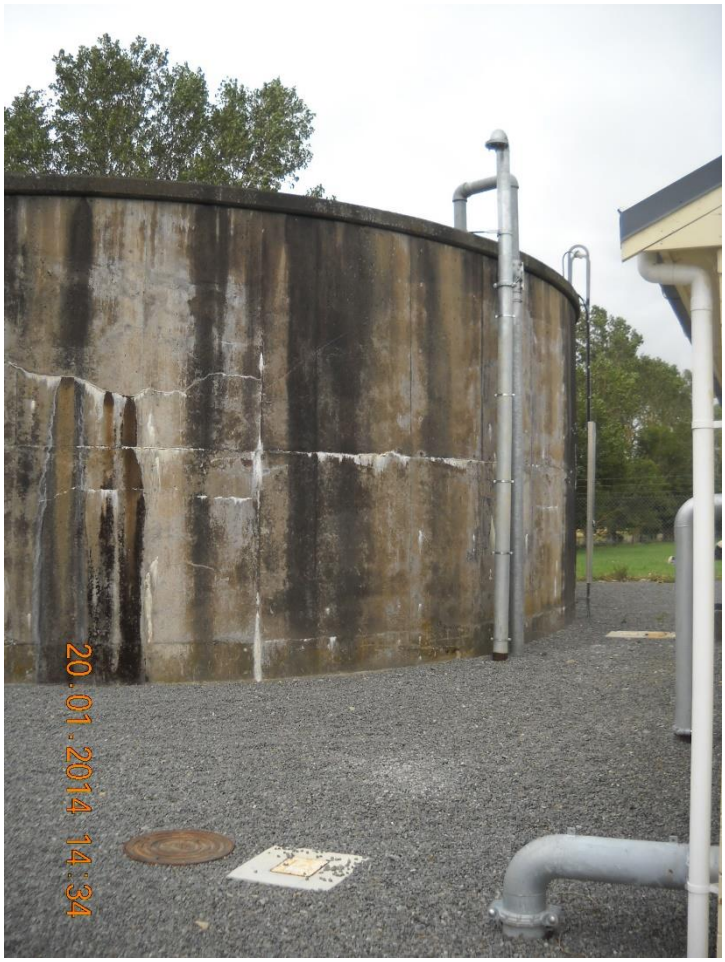


Photo 6: 819 m^3 Supply Reservoir

Photo 7: Amiad filter

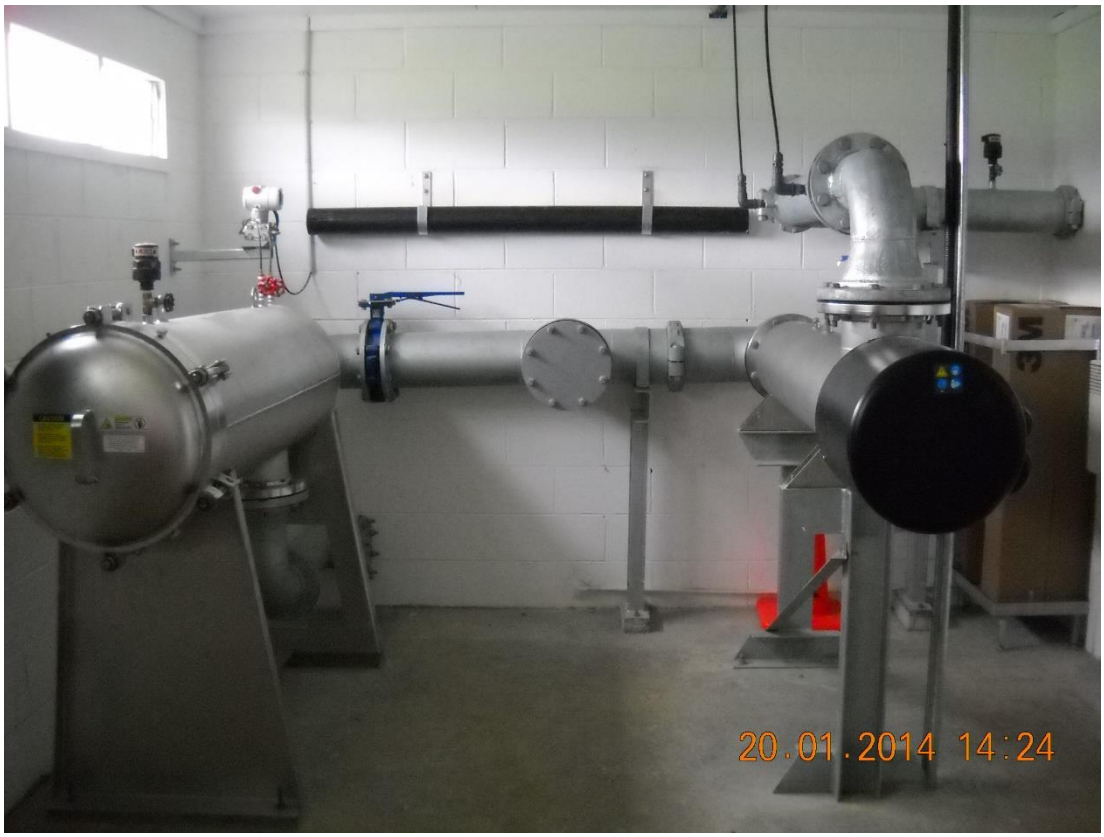


Photo 8: Cartridge filter (left) and UV unit (right)

Photo 9: Flowmeter, chlorine and turbidity instrumentation

Photo 10: Sodium hypochlorite storage and analyser

Photo 11: Fluoride storage shed

Photo 12: Fluoride dosing equipment

Photo 13: Electrical and Control Equipment

10 Risk Tables

Risk Assessment Worksheet – Catchment and Intake *(including raw water trunk main)*

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			***Is this under control?***		***If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.***			***What could be done to improve?***
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
C1	Bacterial or protozoal contamination in catchment	Unprotected catchment surface water – humans, livestock, septic tanks, agricultural activities, surface runoff, etc.	Raw water turbidity monitoring. Alluvial river gravel provides some degree of filtration.	Partial	Unusual	Major	High	Ongoing liaison with adjacent landowners to raise/maintain awareness of catchment protection. Encourage best practice agricultural activities and riparian management.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
C2	Chemical contamination in catchment	Unprotected catchment surface water – agrichemicals, surface runoff, etc.	Community drinking water supply protection zone under NRRP / LWRP. Alluvial river gravel provides some degree of filtration.	Partial	Unusual	Major	High	Ongoing liaison with adjacent landowners to raise/maintain awareness of catchment protection. Encourage best practice agricultural activities and riparian management. Include the Methven source water in the annual basic water chemistry testing. Use the Ministry of Health 'Priority 2 Determinand Identification Guide September 2012' to determine if there are any other chemical risks, e.g. disinfection by-products.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
C3	Contamination of source water	Contaminant entry via intake structure.	Sanitary seal over infiltration gallery. Gallery area fenced and stock excluded. Intake structure is secured against bird/vermin entry and unauthorised access. Intake structure is inspected monthly.	Yes				
C4	Insufficient water available	Drought, low river levels.	Intake water level monitoring. Demand management when intake level is low.	Partial	Unusual	Major	High	Review need for increased demand management.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
C5	Insufficient water available	Damage to intake structures – natural hazards, e.g. flooding, earthquakes.	CCTV condition inspection undertaken as part of the Opus Methven Water Supply Headworks: Issues and Option Report in 2013.	No	Unusual	Major	High	Investigate resilience of plant to natural hazards. Develop Emergency Response Plan and implement if water supply cannot be maintained. Resilience incorporated, where practicable, into plans for repair, renewal or replacement of the intake gallery.
C6	Insufficient water available	Damage to intake structures – vandalism.	Intake structure is secured against unauthorised access and is not situated in a location prone to vandalism.	Yes				
C7	Insufficient water available	Intake pump failure or power supply interruption.	N/A - No intake pump. Gravity supply from intake	Yes				

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
C8	Insufficient water available	Intake failure – deterioration of the infiltration gallery and/or the supply pipelines.	Declining performance in terms of flow availability to treatment plant. CCTV inspection undertaken as part of the Opus Methven Water Supply Headworks: Issues and Option Report in 2013.	No	Unlikely	Major	Very High	Review and maintain Activity Management Plans and associated asset renewal programmes to minimise failures. Renewal of the infiltration gallery (year 1) and older raw water pipeline (years 4 and 10) are included in the proposed LTP 2015-2025.
C9	Insufficient water available	Raw water trunk main failure.	Duplicate mains allow supply (possibly restricted) to be maintained if one main is out of service.	Partial	Quite Common	Major	Very High	As above.
C10	Contamination of source water	Contaminant entry via raw water trunk mains (air valves).	Partially effective downstream disinfection barrier.	Partial	Unusual	Major	High	Regularly inspect air valves and undertake remedial works as required to address potential backflow issues.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
C11	Contamination of source water	Catastrophic failure, e.g. seismic activity disrupting the aquifer confinement or wellhead protection	Inspection of facilities following a significant earthquake. Annual water chemistry profiles to determine changes in water quality over time. Monthly monitoring of nitrate-nitrogen both in abstracted water and in distribution zone. Monthly E. coli sampling of source water.	Partial	Unusual	Medium	Medium Risk	Investigate resilience of plant to natural hazards. Develop Emergency Response Plan and implement if water supply cannot be maintained from this source.

Risk Assessment Worksheet – Treatment

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
T1	Inadequate disinfection (not enough free available chlorine)	Dosing pump malfunction, control system malfunction, or power supply interruption.	Routine checks and inspections. FAC monitoring (SCADA value and alarm). Standby power generation. Power failure SCADA alarm. E. coli monitoring. UV disinfection and filtration provided in addition to chlorination.	Yes				

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
T2	Inadequate disinfection (not enough free available chlorine)	Incorrect dose rate or solution strength too low or run out of chlorine solution.	Routine checks and inspections. Sodium hypochlorite solution delivered by reputable supplier Duty and standby containers of chlorine solution. FAC monitoring (SCADA value and alarm). E. coli monitoring. UV disinfection and filtration provided in addition to chlorination.	Yes				

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
T3	Inadequate disinfection (not enough free available chlorine)	High chlorine demand as a result of high turbidity.	Turbidity monitoring (SCADA alarm) prompts manual dose rate adjustment. FAC monitoring (SCADA value and alarm). E. coli monitoring. UV disinfection and filtration provided in addition to chlorination.	Yes				
T4	Inadequate disinfection (not enough free available chlorine)	Short-circuiting through reservoir reducing contact time.	High level inlet, low level outlet. UV disinfection and filtration provided in addition to chlorination.	Partial	Unusual	Medium	Medium	Evaluate the Methven Water Supply Headworks Issues and Options Report and undertake improvements to reservoir as appropriate.
T5	Over-chlorination (too much free available chlorine)	Dosing pump or control system malfunction.	FAC monitoring (SCADA value and alarm). Routine calibration of FAC equipment.	Yes				

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

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
T7	Failure to remove chemical contaminants from raw water	Treatment system inadequate.	No known chemical contaminants in source water (i.e. no P2 determinands in source water).	No	Unlikely	Medium	High	Cannot implement treatment based control measures to deal with all potential contaminants – control at source. Use the Ministry of Health 'Priority 2 Determinand Identification Guide September 2012' to determine if there are any other chemical risks, e.g. disinfection by-products.
T8	Inadequate protozoa removal/inactivation	Treatment system inadequate.	UV disinfection and filtration systems in place. Manual UVT checks.	Yes				

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
T9	Inadequate protozoa removal/inactivation	UV system malfunction, bulb/ballast failure, control system malfunction, or power supply interruption.	Routine checks, inspections, cleaning and lamp replacement in accordance with manufacturer's recommendations. Standby power generation. Power failure SCADA alarm. Manual UVT checks. UV dose recorded on SCADA.	Partial	Unusual	Major	High	Establish and adopt protocols for utilising UV bypass line.
T10	Inadequate protozoa removal/inactivation	High turbidity (low UVT).	Turbidity monitoring - high turbidity SCADA alarm. Filtration and provided in addition to UV disinfection. Manual UVT checks.	Yes				

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
T11	Fluoride overdose	Dosing system malfunction or incorrect dosing	Fluoride powder is fed into a mixing tank at a fixed rate whenever there is flow through the treatment plant. A dosing pump doses the solution into the water line. Manual dose rate checks are made by the Plant Operator. Fluoride tank high/low alarms on SCADA.	Yes				
T12	Insufficient water available	Inadequate treatment plant capacity.	Capacity adequate for existing peak day with reservoir storage to meet peak instantaneous flow rate.	Partial	Unusual	Medium	Medium	Review demand projections and plan for future upgrades accordingly.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
T13	Insufficient water available	Damage to plant by natural hazard	Storage on-site in the event of damage to treatment plant. Contingency plans in place for alternative supply (e.g. tankers) if necessary.	Partial	Rare	Medium	Medium Risk	Investigate resilience of plant to natural hazards. Develop Emergency Response Plan and implement if water supply cannot be maintained.
T14	Inadequate disinfection	UV system bypassed.	Chlorination and filtration provided in addition to UV disinfection.	Partial	Unlikely	Major	Very High	Establish and implement protocols for utilising UV bypass line.

Risk Assessment Worksheet – Storage and Distribution

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
S1	Stored water quality deterioration	Inadequate reservoir turnover	Separate inlet and outlet pipes. Less than one day's storage in reservoir.	Yes				
S2	Introduction of contaminants into the distribution system	Contamination via storage reservoir – bird/vermin entry, roof runoff, unauthorised access.	Reservoirs covered and locked. Reservoirs inspected weekly. Chlorine residual maintained in system. Access ladder locked.	Yes				
S3	Introduction of contaminants into the distribution system	Backflow from customer connections.	Chlorine residual maintained in system. All new and replaced service connections contain a double check valve.	Partial	Unlikely	Major	Very High	Adopt and implement backflow prevention policy for customer connections.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
S4	Introduction of contaminants into the distribution system	Operation and maintenance activities.	Operators follow documented hygiene procedures to minimise risk. Chlorine residual maintained in system.	Yes				
S5	Introduction of contaminants into the distribution system	Pressure fluctuation resulting in negative pressures.	Pressure fluctuations unlikely to occur in this gravity supply system.	Partial	Unusual	Major	High	Regularly inspect air valves and undertake remedial works as required to address potential backflow issues.
S6	Introduction of contaminants into the distribution system	Pipe materials, age and condition, plumbosolvency.	Customers are notified of plumbosolvency twice per year as required by DWSNZ. Activity Management Plans and associated asset renewal programmes in place.	No	Unusual	Major	High	Review and maintain activity management plans and associated asset renewal programmes to minimise deterioration.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
S7	Insufficient water	Reservoir or water main failure.	The reservoir is inspected weekly. The reservoir level is monitored. Shutdowns are managed to avoid pressure surges and undue damage to the existing mains. Duplicate raw and treated water trunk mains (redundancy).	Partial	Unlikely	Major	Very High	Evaluate the Methven Water Supply Headworks Issues and Options Report and undertake improvements to reservoir as appropriate. Undertake a criticality analysis of the network to assist renewals planning. Investigate reservoir bypass pressure relief system to ensure adequate protection provided to downstream pipework. Implement and use Asset Management System (AMS) for programming and monitoring regular maintenance and inspection/monitoring tasks.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
S8	Insufficient water	Vandalism of reservoir	Reservoir level is monitored (SCADA alarm). Reservoir is not situated in a location prone to vandalism. Reservoir is covered and locked and access ladder locked. Reservoirs inspected weekly.	Yes				
S9	Insufficient water available	Catastrophic failure, e.g. seismic activity damaging equipment.	Reservoir, treatment plant, and associated equipment inspected following a significant earthquake. Pump, equipment and power status monitored and alarmed through the telemetry system.	Partial	Unusual	Major	High	Investigate resilience of plant to natural hazards. Develop Emergency Response Plan and implement if water supply cannot be maintained.

Risk Assessment Worksheet – Other

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

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

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			
Ref	**Risk Event**	**Potential Cause of Risk Event**	**Measures in Place to Control Risk Event**	**Controlled? Yes / No**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
O4	System damaged or contaminated by construction/ maintenance work	Inadequate controls on construction and maintenance work.	All maintenance is undertaken by contractor's trained/authorised staff. Construction work is appropriately supervised. Carriageway Access Request (CAR) and BeforeUDig used to permit maintenance and construction works.	Yes				
O5	Inability to access site(s) for operation/ maintenance/ emergency works	Flood, slip, bridge washout, snow fall or other hazard preventing vehicular access.	Access roads are in good condition and are not generally vulnerable to natural hazards. Operations staff are equipped with suitable 4WD vehicles and given training in these use of these.	Yes				

11 Improvement Schedule

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

Part I: Major Projects and Capital Works

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

Part II: Management and Operational Improvements

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

Prioritisation

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

Extreme risk	=	Priority 1
Very High Risk	=	Priority 2
High risk	=	Priority 3
Medium risk	=	Priority 4
Low risk	=	Priority 5

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

Responsibility

Responsibility for implementation of specific improvement items have been identified.

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

Cost Estimates

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

Timeframes

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

Other Considerations

Compliance Timeframe

The Methven water supply falls in the category of a Minor drinking water supply under the Health Act. This requires that all practicable steps are taken to comply with the Drinking Water Standards by 1 July 2014.

Tourism

Methven is establishing itself as a key visitor destination, especially in relation to nearby Mount Hutt ski field. The consequence of waterborne illness originating from the community water supply would be particularly significant. Improvement planning should be considered in this context.

11.1 Improvement Schedule - Part I

Methven Water Supply Improvement Schedule				Part I: Major Projects and Capital Works			
Priority	**Risk Level**	**Water Supply Area**	**Reference to Risk Table**	**Details of Proposed Works**	**Person Responsible**	**Expected Cost**	**Intended date of Completion**
2	Very High	Catchment and intake	C8	Renewal of the infiltration gallery is included in year 1 of the proposed LTP 2015-2025.	AM	$470,000	30/06/2016
2	Very High	Catchment and intake	C8	Renewal of the older raw water treatment plant pipeline is included in year 4 of the proposed LTP 2015-2025.	AM	$552,000	30/06/2019
2	Very High	Catchment and intake	C8	Renewal of the older raw water gallery pipeline is included in year 10 of the proposed LTP 2015-2025.	AM	$145,000	30/06/2025

11.2 Improvement Schedule - Part II

Methven Water Supply Improvement Schedule				Part II: Minor Projects and Operational Improvements			
Priority	**Risk Level**	**Water Supply Area**	**Reference to Risk Table**	**Details of Proposed Works**	**Person Responsible**	**Expected Cost**	**Intended date of Completion**
3	High	Source	C1, C2	Ongoing liaison with adjacent landowners to raise/maintain awareness of catchment protection. Encourage best practice agricultural activities and riparian management.	AM	Administration costs + staff time	Ongoing
3	High	Source	C2	Include the Methven source water in the annual basic water chemistry testing.	AM	$500 + staff time	2015 onwards
3	High	Source and treatment	C2, T7	Use the Ministry of Health 'Priority 2 Determinand Identification Guide September 2012' to determine if there are any other chemical risks, e.g. disinfection by-products.	AM	Staff time	Ongoing
3	High	Source	C4	Review need for increased demand management.	AM	Staff time	01/12/2015
3	High	Source, storage and distribution	C5, C11, T13, S9	Develop Emergency Response Plan and implement if water supply/quality cannot be maintained.	AM	$5,000 + staff time	01/07/2018
2	Very High	Source, treatment and storage	C8, S6, S7	Review and maintain Activity Management Plans and associated asset renewal programmes to minimise failures.	AM	Staff time	Ongoing

Methven Water Supply Improvement Schedule				Part II: Minor Projects and Operational Improvements			
Priority	**Risk Level**	**Water Supply Area**	**Reference to Risk Table**	**Details of Proposed Works**	**Person Responsible**	**Expected Cost**	**Intended date of Completion**
2	Very High	Source, treatment and storage	C8, C9, T4, S7	Evaluate the Methven Water Supply Headworks Issues and Options Report and undertake replacements as appropriate.	AM	Staff time + replacement costs	01/07/2018
4	Medium	Source, treatment, distribution	C5, C11, T13, S9	Investigate resilience of plant to natural hazards.	AM	Staff time	1/12/15
2	Very High	Storage and distribution	S3	Adopt and implement backflow prevention policy for customer connections.	AM	$15,000 + staff time	01/07/2016
2	Very High	Treatment	T9, T14	Establish and implement protocols for utilising UV bypass line.	AM	Staff time	01/12/2015
4	Medium	Treatment	T12	Review demand projections and plan for future upgrades accordingly.	AM	Staff time	01/07/2018
3	High	Source , storage and distribution	C10, S5	Regularly inspect air valves and undertake remedial works as required to address potential backflow issues.	AM	$2,000 + staff time	01/07/2016
4	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.	ACL	Staff time	01/12/2015

Methven Water Supply Improvement Schedule			Part II: Minor Projects and Operational Improvements				
Priority	**Risk Level**	**Water Supply Area**	**Reference to Risk Table**	**Details of Proposed Works**	**Person Responsible**	**Expected Cost**	**Intended date of Completion**
5	Low	Other	O2	Council to place a requirement on the service provider to ensure Operation and Maintenance Procedure Manual is up to date and available at the plant.	CL	Staff time	01/07/2016
5	Low	Other	O3	Council to place a requirement on the service provider to provide staff with relevant training and skills.	CL	Staff time	01/07/2016
2	Very High	Storage and distribution	S7	Undertake a criticality analysis of the network to assist renewals planning.	AM	Staff time	01/07/2018
2	Very High	Storage and distribution	S7	Investigate reservoir bypass pressure relief system to ensure adequate protection provided to downstream pipework.	AM	Staff time	01/07/2016
2	Very High	Storage and distribution	S7	Implement and use Asset Management System (AMS) for programming and monitoring regular maintenance and inspection/monitoring tasks.	AM	Unspecified amount + staff time	01/07/2018

12 Contingency Plan

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

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

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

12.1 Severe Microbiological Contamination of Source Water

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

12.2 Chemical Contamination of Source Water

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

12.3 Insufficient Source Water Available

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

12.4 Insufficient Water Available due to Leakage

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

12.5 E. coli Transgression in Water Leaving Treatment Plant

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

12.6 Over-Chlorination

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

12.7 Over Fluoridation

Indicators	Monitoring shows fluoride concentration in excess of 1.5 mg/L
Actions	Assess potential risk to consumers and advise accordingly Investigate the cause of exceedance Flush system if necessary Keep customers informed and advise once regular service is restored Notify DWA if deemed appropriate (refer to DWSNZ for guidance) Document actions taken
Responsibility	Assets Manager

12.8 Inadequate Disinfection

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

12.9 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, enumerate E. coli Resample distribution at original and adjacent sites Investigate cause and undertake remedial action If E. coli < 10 per 100mL consult DWA, resample distribution zone and enumerate for E. coli for three days, continue investigation of fault If E. coli > 10 per 100mL consult DWA, consider 'Boil Water' notice, continue investigation of cause, begin disinfection, consider flushing contaminated water to waste, intensify action, consider providing alternative supply Continue until fault is corrected and E. coli is absent for three consecutive days and DWA is satisfied that there is no remaining contamination
Responsibility	Assets Manager

12.10 Chemical Contamination of Water in Distribution Zone

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

12.11 Insufficient Water Available in the Distribution Zone

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

12.12 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

12.13 Filtered Water Turbidity Value High

Indicators	Filtered water turbidity value on SCADA is >1.0 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 12.5 (treatment plant) or 12.9 (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

13 Critical Control Points

13.1 Filtered Water Turbidity

Process objectives:

- Provides a **filtered water Quality Control Point** to help determine whether the filtration has been effective.

Operational monitoring of control process:	
What	Filtered water turbidity (NTU)
When	Continuous on-line SCADA monitoring
Where	Reservoir inlet line
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.
Action Limits:	NTU: > 0.5 NTU (for more than 5 minutes)	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 12.13
Critical Limits:	NTU: > 1.0 NTU (for more than 3 minutes)	Duty Operator to notify Duty Supervisor and ADC Compliance Officer to monitor and implement Contingency Plan 12.13.

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

13.2 UV Dose

Process objectives:

- Provides a **UV Dose Control Point** to help determine whether the UV treatment is providing the necessary log removal of protozoa.

Operational monitoring of control process:	
What	UV Dose
When	Continuous on-line SCADA monitoring
Where	Reservoir inlet line
How	UV reactor built-in instrumentation– 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:	29.5 mJ/cm^2	No correction currently possible.
Action Limits:	< 35 mJ/cm^2	Duty Operator to respond by reducing plant flow which will increase the dose. Duty operator should keep a close 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 12.8.
Critical Limits:	< 29.5 mJ/cm^2	Duty Operator to notify Duty Supervisor and ADC Compliance Officer to monitor and implement Contingency Plan 12.8.

Supporting programs:

- Monthly verification of the UVT instrumentation by the Operator.
- Annual calibration (or replacement) of the UVT instrumentation by the supplier.
- Follow manufacturer's guidelines regarding further operation and maintenance of the UVT instrumentation.
- Training and competency of Operator in the calibration, verification, operation and maintenance of UVT instrumentation.
- Periodic calibration of the plant flowmeter by a suitable expert, in accordance with the manufacturer's guidelines.

Periodic end-to-end testing of critical signals.

13.3 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.

Operational monitoring of control process:	
What	Free available chlorine (FAC) concentration in mg/L
When	Continuous on-line SCADA monitoring
Where	Sample point inside the treatment plant
How	On-line chlorine analyser
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:	FAC: 0.8-1 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: < 0.7 mg/L > 1.1 mg/L	Duty Operator to respond by adjusting dosing to within target limits. Duty Operator to notify Duty Supervisor.
Critical Limits:	FAC: < 0.3 mg/L > 1.5 mg/L	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 12.6 (over-chlorination) or contingency plan 12.8 (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.

13.4 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 weekly ACL twice weekly
Where	ADC staff: Methven has three zone sample taps, located on Line Road past Dolma St, Hobbs Road, and Barkers Road. ACL operators: Sampling bollards as above
How	Hand-held pocket colorimeter with vendor-supplied reagents
Who	ADC Environmental Monitoring Officer and ACL Operator
Records	ACL: Log-book ADC: Water Outlook

Process performance criteria at the operational monitoring point:		**Correction if operating criteria are not met:**
Target Range:	FAC: 0.8-1 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: < 0.3 mg/L > 1.5 mg/L	ADC Sampling Officer / ACL Operator to contact ADC Compliance Officer. Contingency plan 12.6 (over-chlorination) or contingency plan 12.8 (inadequate disinfection) is to be followed.

13.5 Fluoridation

Process objectives:

- Provides a **fluoridation Critical Control Point** to ensure that fluoride dosing is within a range that is effective but not harmful.

Operational monitoring of control process:	
What	Fluoride concentration in mg/L
When	Twice-weekly (ACL), weekly (ADC)
Where	Sample point inside the treatment plant
How	Hand-held colorimeter (ACL) and samples analysed at external laboratory (ADC)
Who	ACL Operator / ADC staff
Records	Plant log-book (ACL), Water Outlook & DWO (ADC)

Process performance criteria at the operational monitoring point:		**Correction if operating criteria are not met:**
Target Range:	F: 0.6-1 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:	F: < 0.6 mg/L > 1.0 mg/L	Duty Operator to respond by adjusting dosing to within target limits. Duty Operator to notify Duty Supervisor.
Critical Limits:	F: > 1.5 mg/L	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 12.7 (over-fluoridation) 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 fluoridation of drinking water.
- Only utilise potable water grade chemical from approved supplier.