Ashburton DISTRICT COUNCIL

Mount Somers Water Supply

Water Safety Plan

Mount Somers Water Supply

Water Safety Plan

Version 2.1: August 2018

Authorised by: _____

Andrew Guthrie
Assets Manager
Ashburton District Council

Ashburton District Council
PO Box 94
Ashburton 7740

Redrafted by: _____

Kelly Governor
Compliance Co-ordinator
Ashburton District Council

Phone: +64 3 307 7700
Facsimile: +64 3 308 1836

Contributors: Robin Jenkinson
Ashburton Contracting Ltd

Approved by: _____

Drinking Water Assessor

Review Date: May 2020

Document Control

Version No	Description	Authorised	Approval Date
V1.0	Public Health Risk Management Plan 2008	AG	February 2008
V2.0	Water Safety Plan Rewrite	AG	June 2015
V 2.1	Minor update to add CCPs	CS	August 2018

Contents

1 Background

Ashburton District Council (ADC) own and manage the Mount Somers 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.

Mount Somers is classified as a small supply under the legislation and is therefore required to be compliant with the Act by 01 July 2015. In 2008 the Ministry of Health (MoH) approved a PHRMP for Mount Somers.

The original PHRMP focused on identifying water quality and reliability of supply risks in need of attention. Since the approval of the 2008 PHRMP a significant upgrade has taken place. This WSP update has been prepared to ensure the risk information contained within the plan remains current and relevant.

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	*Mount Somers*
WINZ Community Code	*MTS001*
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	*260*
Supply Grading	*Uu*
Source	
Source Name	*Woolshed Creek*
Source WINZ Code	*S00219*
Location	*Confluence of Woolshed Creek and Stony Creek*
Map Reference	*NZMS 260 K36:7668-2371* *NZTM X and Y: 1466680 - 5162071*
Type of Source	*Surface Water*
Depth of Bore	*N/A: Shallow infiltration gallery 4.0m below ground level*
Consent Number	*CRC022026*
Consent Expires	*15 July 2037*
Maximum Consented water take:	*4.9 l/s; 65,000m^3/year*
Treatment Plant	
Treatment Plant Name	*Mount Somers*
Treatment Plant WINZ Code	*TP00329*
Location	*Ashburton Gorge Road*
Map Reference	*NZTM X and Y: 1470259 - 5160136*
Treatment Processes	*Chlorination, UV, Filtration*
Consented Volume	*65,000m^3*
Average Volume (2013/14)	*30,666m^3*
Distribution	
Distribution Zone Name	*Mount Somers Township*
Distribution Zone WINZ Code	*MTS001MS*
Distribution Zone Population	*260*

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	*Yet to be assigned*
Protozoa treatment process	*UV disinfection unit (Wedeco Spektron 50e) and Filtec 1micron cartridge filter*
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	*No*
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.	*N/A*
Identify any transgressions that have occurred in the last 4 quarters *Nil*	

3.1 Contact Details

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 2008 in consultation with Ashburton District Council water supply management and operational staff and in accordance with existing documentation.

A site visit with the Plant Operator took place on 7 October 2014. 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 Assets Manager Andrew Guthrie and Robin Jenkinson of 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 be consolidated into a master list for implementation. 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 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, developing an Emergency Response Plan, and reviewing and maintaining Activity Management Plans 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

Water is abstracted from an infiltration gallery located on the flood plain near the confluence of Stony and Woolshed Creeks. It is inferred that the shallow groundwater is recharged primarily from these surface water courses with the South Branch of the Ashburton River about 800m away.

Water is abstracted via an infiltration gallery. Water is conveyed by gravity to the Mount Somers Water Treatment Plant on Ashburton Gorge Road, approximately 4.2 km away. There are 103 properties connected to the Mount Somers water supply, with an approximate resident population of 260.

Vulnerable population groups include:

- Mt Somers Primary School
- Hotel/Café
- Tearooms/Dairy
- Camping ground

5.1 Plant Upgrade

A number of works have been carried out since the initial PHRMP. The trunk main into the township was duplicated with the addition of a new 150mm PVC-U pipeline, reservoir storage was increased from 65m^3 to 125m^3 to provide greater reliability, a standby generator was installed, and additional telemetry equipment commissioned to allow more effective monitoring of the site.

In 2013 the Mount Somers drinking water scheme was further upgraded. A new treatment plant building was constructed with cartridge filtration, UV disinfection, a turbidity meter, and two new booster pumps installed. During the 2013 upgrade improvements to the chlorine dosing system were made including the installation of a new storage tank and chlorine analyser.

5.2 Description of Source

The intake comprises two DN150mm perforated AC pipes, approximately 90m long, running in parallel between two manhole chambers. The pipes are reported to be buried at a depth of 4-5 metres below ground level. The water from the infiltration gallery flows through a predominantly DN100mm PVC trunkmain to the water treatment plant on Ashburton Gorge Road.

The surrounding rural catchment is largely agricultural land. There are several lime quarries in the area, some disused coal workings, and typical hill country agricultural activities. Overall, the upper catchment poses a low risk to the water supply. The greatest potential for contamination would appear to be land-use activities in the immediate vicinity of the intake.

A temporary alternative supply was established during the dry summer months of 2003/04 when insufficient water was able to be abstracted from the gallery. A privately owned shallow bore (Acland bore) near the gallery was used to pump into a 5,000 litre tank connected to the raw water trunk main.
The Acland bore remains available as an emergency source of water however the capacity is very limited. A flow of roughly 1.8 L/s is able to be maintained to provide a life line supply. The bore is regularly

(approximately monthly) given a test run by the Plant Operator. The operation procedure for utilising the bore is kept at the treatment plant.

The Acland bore is not currently included in the water quality monitoring programme and the bore does not appear to have a water permit to take water. The improvement schedule in this WSP includes formalising the use of this bore.

Figure 1 (below) illustrates the Mount Somers water supply from source to reticulation.

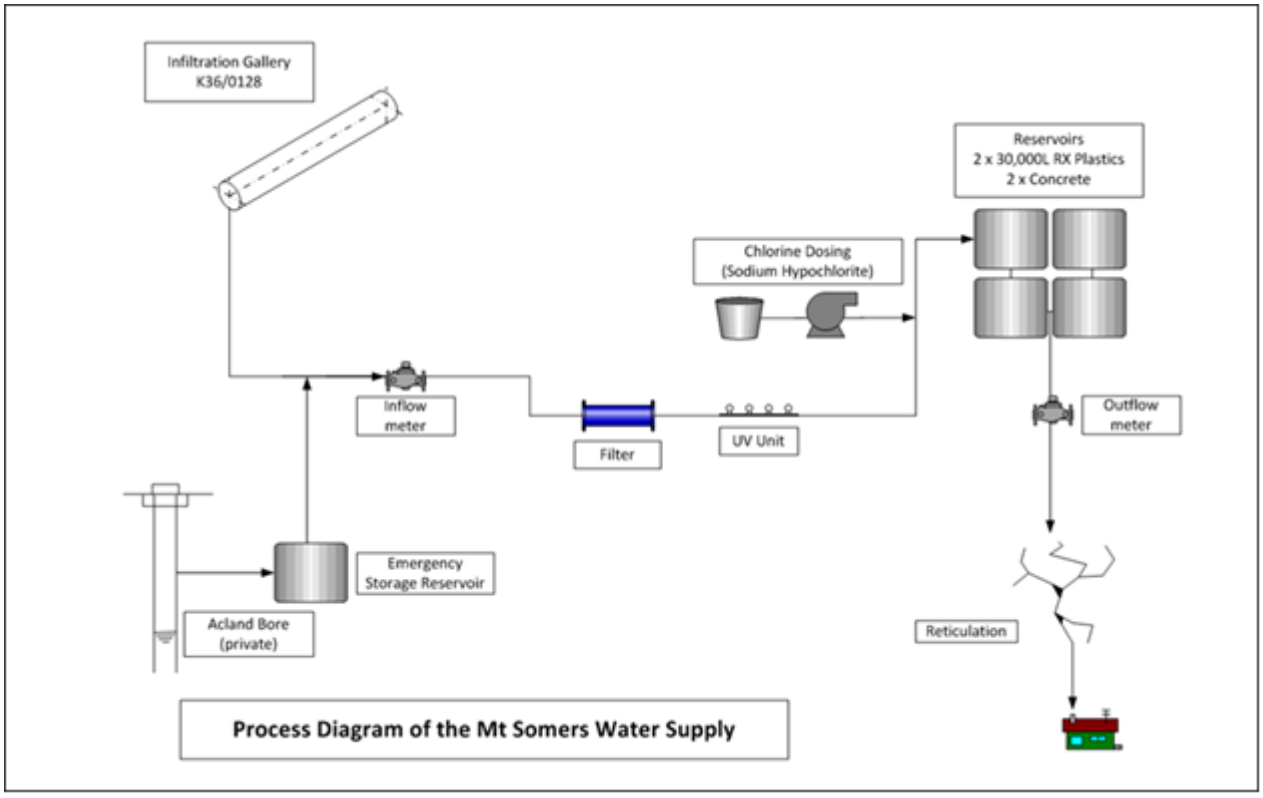

Figure 1: Mount Somers Water Supply Process Diagram

5.3 Treatment and Distribution

To address the risk of protozoa contamination, filtration and UV disinfection equipment was installed as part of the 2013 upgrade. Water passes through the 1 micron cartridge filter and Wedeco UV unit before being chlorinated with sodium hypochlorite.

Treated water is stored in three of the four reservoirs which supply the distribution zone. The fourth reservoir has been decommissioned and is no longer in use. As this is a gravity system, supply pressure is maintained from the storage tanks.

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 quality monitoring is carried out by the Ashburton District Council Environmental Monitoring 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. Zone samples are taken at the distribution sample bollard located on Tramway Road.

E.coli, turbidity, free available chlorine (FAC), and pH are sampled weekly at the treatment plant and monthly in the distribution zone (Tramway Road). Monthly nitrate monitoring is also carried out at the treatment plant.

Mount Somers is connected to the district wide telemetry system. SCADA is used to report power failure, booster pump fault, generator run/fault, cartridge filter fault, UV intensity warning, high and low chlorine residual, high and low reservoir level, and high turbidity to the operator by alarms.

SCADA also records booster pumps on/off, pump run hours, sodium hypochlorite tank level, fluoride tank high and low level, system pressure, filtration differential pressure, totalised flows, reservoir level and turbidity. Figure 2 over the page provides a screenshot of the information recorded in the SCADA system.

5.5 Maintenance and Administration

Mount Somers 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
	Site	Comms Useage Today (%)	2.05	%			
	Site	Last Comms	2014-09-22 13:3..				
	Site	Comms Useage Yesterday (%)	2.04	%			
NML	Site	Critical Instrument Fault Alarm	0				RDI 46
NML	Site	DC Power Supply Fault	0				RDI 37
	Site	DLP Version	0	????			NAI 3
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
	Reservoir	Level	89	%			RAI 1
	Reservoir	Level PLC	89	%			RAI 8
NML	Reservoir	High Level	0				NDI 2
NML	Reservoir	High Level PLC	0				RDI 47
	Reservoir	High Level SP	99	%			NAO 2
NML	Reservoir	Low Level	0				NDI 3
NML	Reservoir	Low Level PLC	0				RDI 48
	Reservoir	Low Level SP	70	%			NAO 3
	Chlorine	Residual	0.67	mg/L			RAI 15
NML	Chlorine	Residual High	0				RDI 40
	Chlorine	Residual High SP	1.9	????			NAO 4
NML	Chlorine	Residual Low	0				RDI 39
	Chlorine	Residual Low SP	0.3	????			NAO 5
	Chlorine	Tank Level	290	L			RAI 18
NML	Chlorine	Tank Low Level	0				RDI 42
	Chlorine	Used Today	3	L			RAI 25
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
	Booster Pump 1	Speed	0	Hz			RAI 16
	Booster Pump 1	Starts	0	Starts			
	Booster Pump 1	StartsLast2	1				
	Booster Pump 1	StartsLast24	1	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	0.06	Hours			
	Booster Pump 2	HoursLast2	0.1				
	Booster Pump 2	HoursLast24	0.1	Hours			
OFF	Booster Pump 2	Run	0				RDI 12
	Booster Pump 2	Speed	0	Hz			RAI 17
	Booster Pump 2	Starts	0	Starts			
	Booster Pump 2	StartsLast2	1				
	Booster Pump 2	StartsLast24	1	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	Differential Pressure High Fault	0				RDI 34
NML	Cartridge Filter	Differential Pressure High Warning	0				RDI 33
	Flows	Reservoir Outflow	1.1	L/s			RAI 12
NML	Inlet Valve	Actuator Fault	0				RDI 28
ON	Inlet Valve	Closed	1				RDI 19
OFF	Inlet Valve	Opened	0				RDI 18
OFF	Plant	Auto	0				RDI 16
	Plant	Flow	0	l/s			RAI 11
ON	Plant	Manual	1				RDI 17
OFF	Plant	Required to Run	0				RDI 14
NML	PLC	Comms Link Fail	0				NDI 6
	Totalised Flow	Plant Flow Yesterday	16930	CuM			RAI 28
	Totalised Flow	Plant Weekly Flow Total	16772	CuM			RAI 20
	Totalised Flow	Reservoir Outflow Yesterday	69	CuM			RAI 29
	Totalised Flow	Reservoir Weekly Outflow Total	551	CuM			RAI 21
	Totalised Flow	Supply Weekly Flow Total	0	CuM			RAI 19
NML	Turbidity	High Alarm	0				RDI 25
	Turbidity	Turbidity - Raw	0.15	NTU			RAI 9
	Turbidity	Turbidity - Treated	0.09	NTU			RAI 10
	UV	Intensity	0	W/m2			RAI 7
NML	UV	Lamp Hours High Alarm	0				RDI 27
	UV	Lamp Run Hours	2424	Hours			RAI 22
NML	UV	System Fault	0				RDI 26
ON	UV	System Operating	1				RDI 22
	UV	TEST - Target Intensity	0	W/m²			RAI 11
NML	UV	UV Intensity Warning	0				RDI 29
OFF	UV	UV Ready	0				RDI 20
NML	UV	UV Warning	0				RDI 15

Figure 2: SCADA Monitoring and Alarms

6 Water Supply Catchment and Distribution Maps

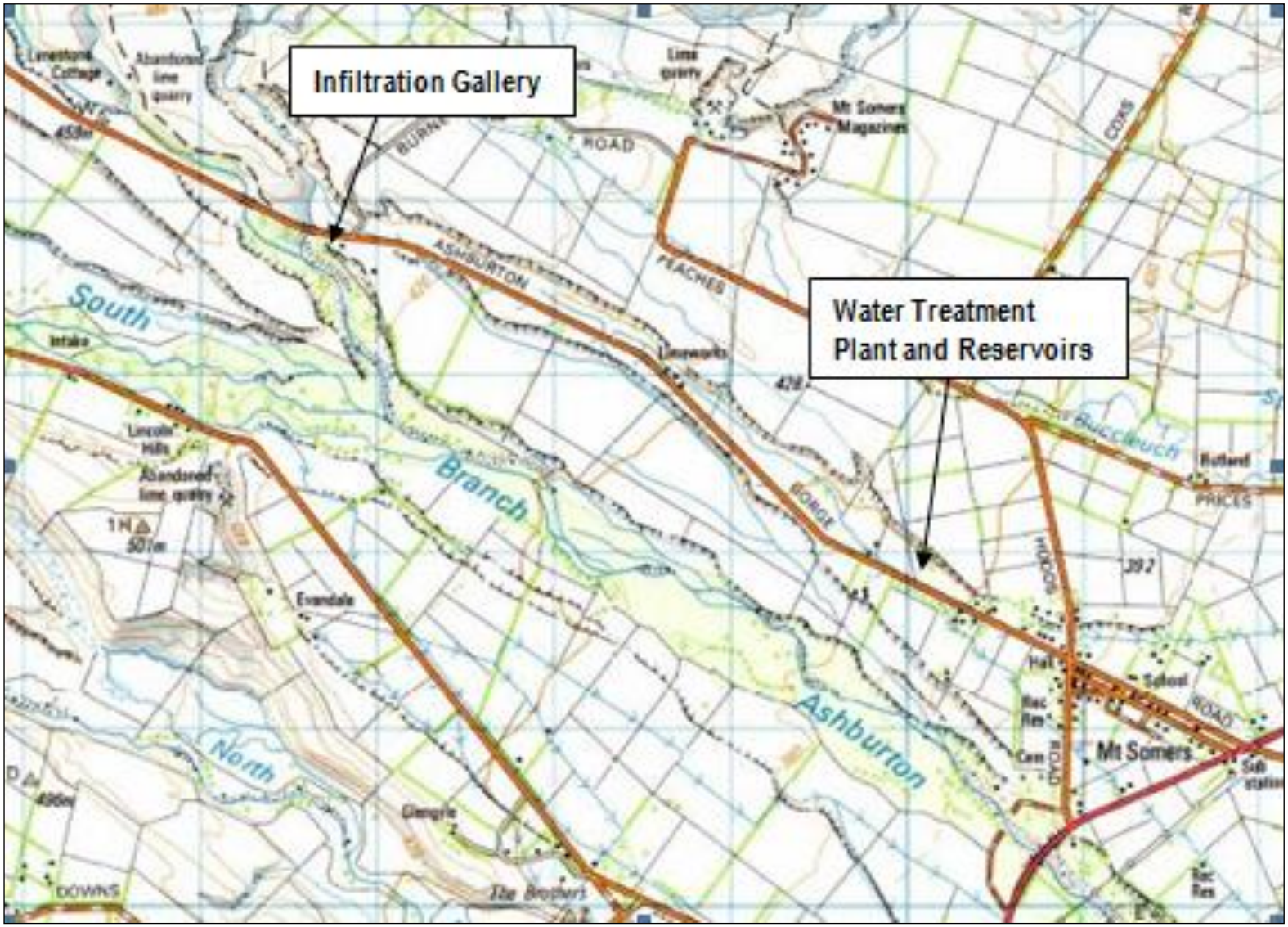

Figure 3: Mount Somers Water Supply Location

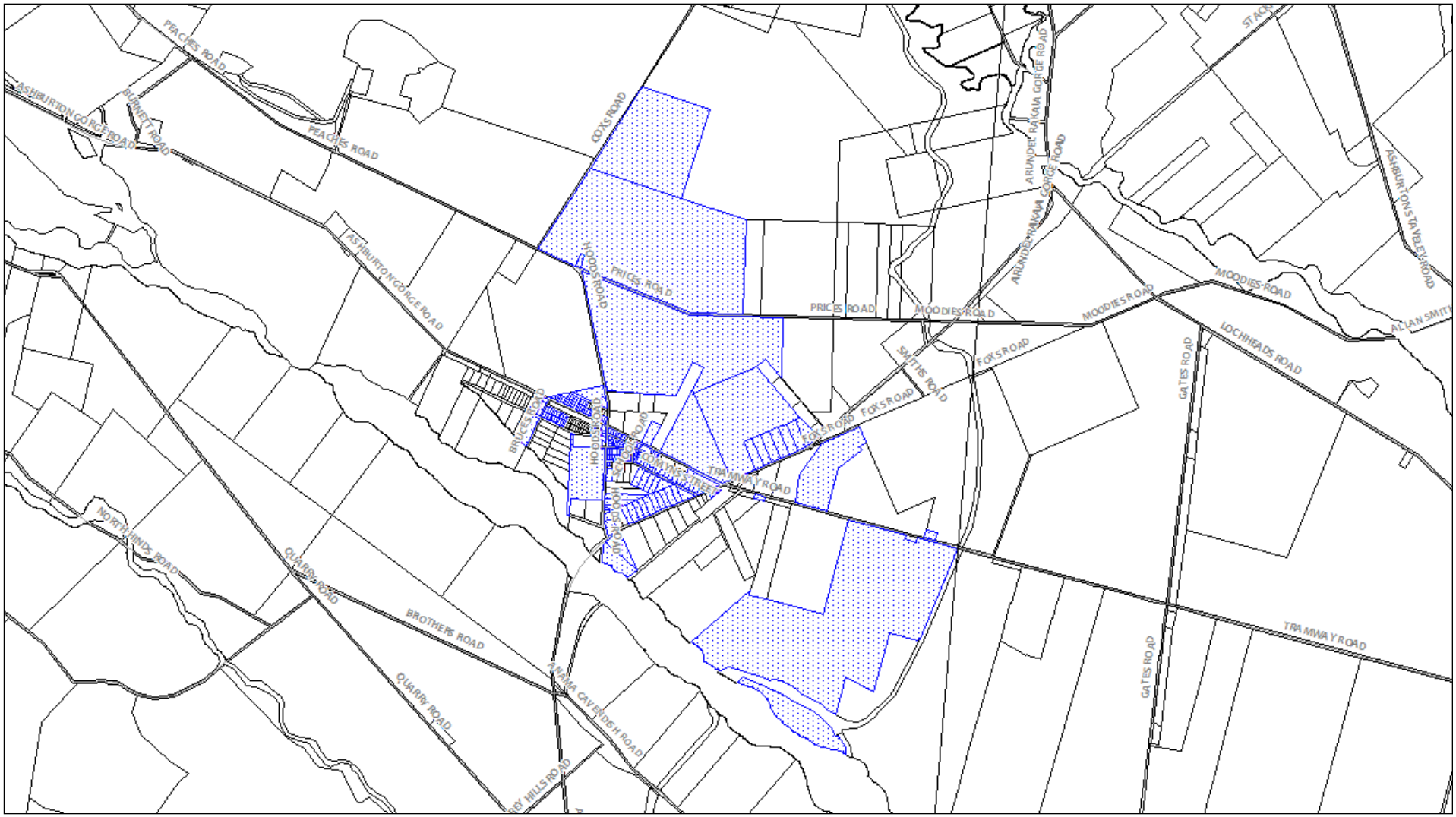

Figure 4: Distribution Map

7 Critical Points for Hazard Management

Figure 5 (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	*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*
UV disinfection and filtration	*Failure may result in a lack of protozoan control*
Treated water storage	*Possible point for microbiological contamination*

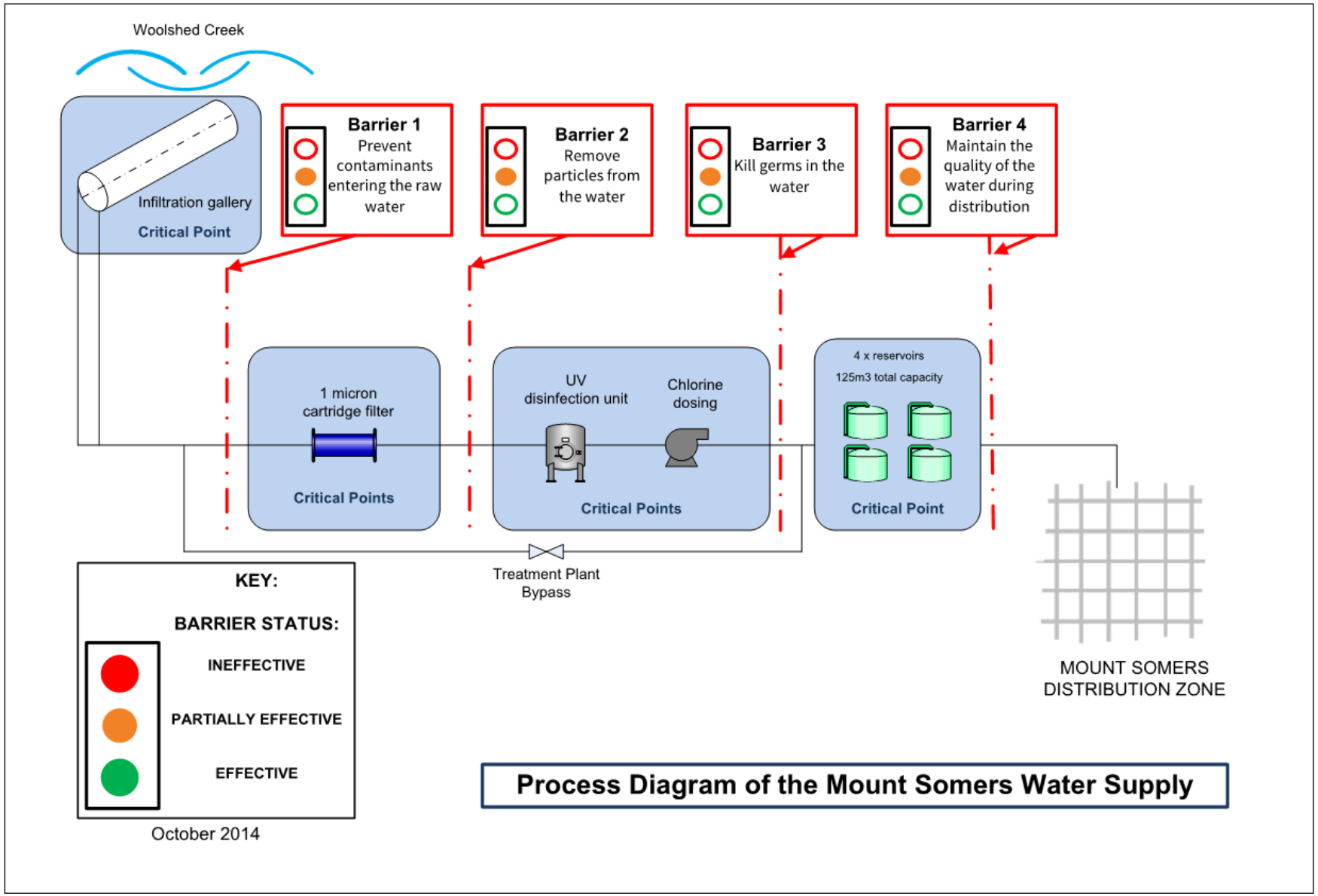

Figure 4: Mount Somers Water Supply Schematic

8 Barriers to Contamination

The following section discusses what barriers are in place to reduce the risk to public health from the Mount Somers 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

8.1 Prevent Contaminants from Entering the Raw Water

Shallow groundwater typically has lower concentrations of suspended solids and microbiological contamination than surface water. The alluvial river gravels provide a level of natural filtration prior to abstraction via the gallery. A clay sanitary seal along the intake pipeline provides an effective physical barrier against contamination.

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 discharge, on-site wastewater treatment/disposal devices, and discharge of agrichemicals.

The source and gallery therefore provides a partial barrier to contamination. Full protection of this catchment, including elimination of agricultural activities and restricted access is not considered feasible. A catchment risk categorisation survey is yet to be completed for the Mount Somers scheme.

8.2 Remove particles from the water

The surface watercourses are subject to periods of high turbidity following rainfall in the catchment. Filtration through the river gravels at the intake is believed to be reasonably effective at removing suspended solids, but it can be assumed that the raw water delivered to the treatment plant will have elevated turbidity on occasion.

In 2014 the average turbidity value of treated water recorded at the treatment plant and in the distribution zone was 0.19NTU. The maximum values were recorded in April 2014 following a period of heavy rainfall. The maximum value at the treatment plant was 1.22NTU and 0.54NTU in the distribution zone. The minimum values recorded were 0.07NTU at the treatment plant and 0.08NTU in the distribution zone.

The cartridge filter installed as part of the 2013 upgrade removes sediment from the raw water prior to the UV and chlorine treatment. This filter further enhances the partial barrier and will contribute to protozoa compliance once the log credit requirement has been assigned.

8.3 Kill germs in the water

The treatment plant uses chlorination and a Wedeco Spektron 50e UV unit to disinfect the water. UVT is measured at the plant, which the Plant Operator monitors and records during routine inspections. UV intensity is 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 that the UV unit may not be working to its full capacity.

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.

8.4 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.

Reservoir

The reservoirs are located within a locked fence. The reservoirs have high level inlets and low level outlets to promote circulation to ensure water does not remain in the reservoirs for extended periods of time. The reservoirs are covered to prevent unauthorised access and ingress of contaminants or rainwater.

Emergency Generator

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 so untreated could be delivered to the distribution zone. A standby generator is located onsite to maintain a treated supply in the event of power failure.

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.

8.5 General

Access to the Mount Somers water supply components is restricted. The gallery, treatment plant, and reservoirs are all located in fenced compounds. The building housing the treatment equipment and the chemical shed are both clean and locked.

New connections are fitted with a backflow prevention device. Together these measures contribute to the provision of a partial barrier against contamination.

9 Photographs of supply elements

Photo 1: Intake gallery manholes inside locked compound

Photo 2: Intake gallery fenced compound with far manhole in the distance

Photo 3: Treatment plant and generator

Photo 4: Chlorine dosing shed

Photo 5: Booster pumps

Photo 6: Inflow and outflow meters

Photo 7: UV and filtration units

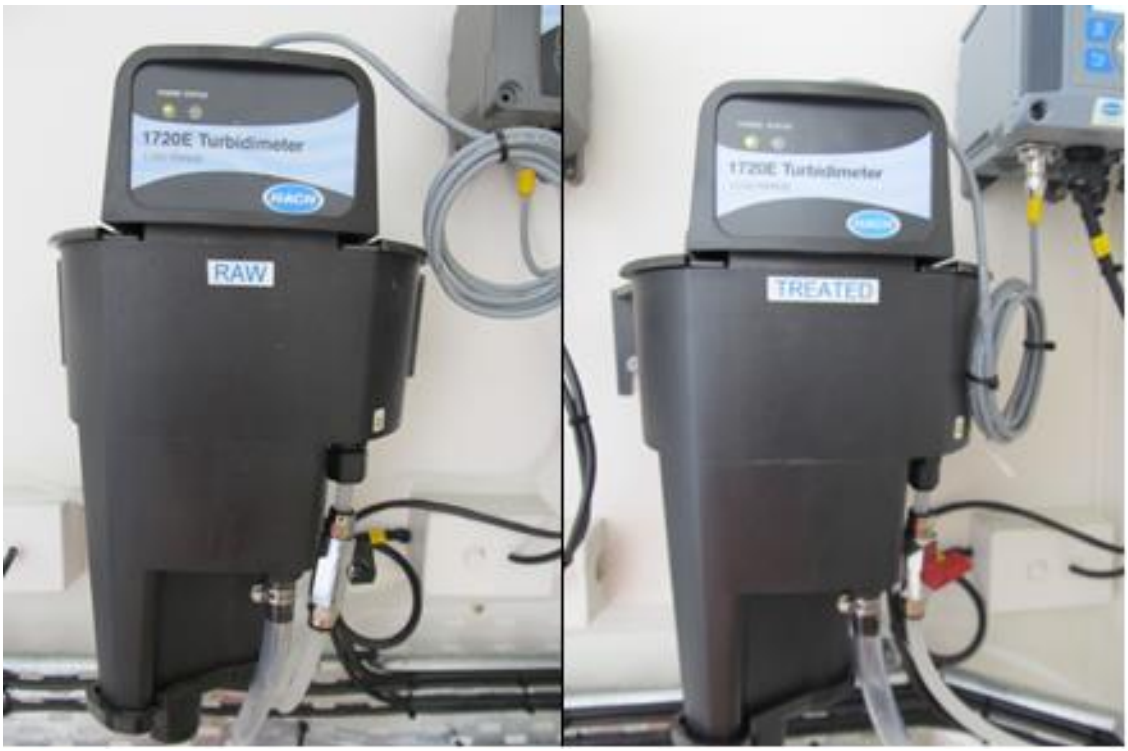

Photo 8: Raw and treated water turbidity meters

Photo 9: UV display unit

Photo 10: Chlorine tank

Photo 11: Chlorine analyser

Photo 12: Sampling taps

Photo 13: Control Panel

Photo 14: Reservoirs

10 Risk Tables

10.1 Risk Assessment Worksheet – Catchment and Intake

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this 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.	Alluvial river gravels provide a certain degree of filtration. Raw water turbidity is continuously monitored. Chorine, UV disinfection and filtration used to treat water. Mount Somers 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.

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.	Alluvial river gravels provide a certain degree of filtration. Community drinking water supply protection zone under NRRP / LWRP.	Partial	Unlikely	Medium	Medium	Complete catchment assessment and have log credit requirement assigned. Encourage best practice agricultural activities and riparian management. Ongoing liaison with adjacent landowners to raise/maintain awareness of catchment protection. 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 fortnightly.	Partial	Unlikely	Medium	Medium	Ensure all manholes are locked and/or adequately secured.
C4	Insufficient water available	Drought, low river levels.	Fortnightly intake water level monitoring. Demand management when intake level is low.	Partial	Quite common	Medium	High	Review need for increased demand management.
C5	Insufficient water available	Damage to intake structures – natural hazards, e.g. flooding, earthquakes.	Acland bore available as an alternative source.	No	Unusual	Medium	Medium	Investigate resilience of plant to natural hazards. Develop 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 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**
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				
C8	Insufficient water available	Intake failure – deterioration of the infiltration gallery and/or the supply pipelines.	Monitoring flows to treatment plant.	No	Unusual	Medium	Medium	Review and maintain Activity Management Plans and associated asset renewal programmes to minimise failures.
C9	Insufficient water available	Raw water trunk main failure.	Duplicate mains allow supply to be maintained if one of the mains is out of service.	Partial	Unusual	Medium	Medium	As above.

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**
C10	Insufficient water available	Drought conditions, gallery runs dry.	Acland bore available as an alternative source.	Partial	Unlikely	Medium	High	Formalise the use of the Acland bore (water quality monitoring, resource consent, establish protocols for implementation, operation procedure). Investigate alternative source. Investigate resilience of plant to natural hazards. Develop Emergency Response Plan and implement if water supply cannot be maintained.
C11	Contamination of source water	Contaminant entry via raw water trunk mains (air valves).	Partially effective downstream disinfection barrier.	Partial	Unusual	Medium	Medium	Regularly inspect air valves and undertake remedial works as required to address potential backflow issues.

10.2 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.	Standby power generation. Power failure SCADA alarm. Routine checks and inspections. 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**
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. FAC value and alarms recorded on SCADA. Chlorine tank low level alarm on SCADA. 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). 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. FAC monitored on telemetry. Low FAC alarm on SCADA. 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**
T5	Over-chlorination (too much free available chlorine)	Dosing pump or control system malfunction.	Chlorine analyser installed onsite. FAC monitoring (SCADA value and alarm). Regular FAC sampling undertaken by ADC staff. FAC equipment routinely calibrated.	Yes				
T6	Over-chlorination (too much free available chlorine)	Incorrect dose rate or solution strength too high.	Sodium hypochlorite dose rate is flow paced at a ratio of 1:6. High FAC alarm on SCADA. 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 chemicals in source water (i.e. no official P2 determinands). Mount Somers source water in included in the annual basic water chemistry testing.	No	Unusual	Medium	Medium	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	Unlikely	Medium	Medium	Investigate resilience of plant to natural hazards. Develop Emergency Response Plan and implement if drinking water standards cannot be met.
T10	Inadequate protozoa removal/inactivation	High turbidity (low UVT).	Filtration unit installed. Manual UVT checks. UV dose recorded on SCADA.	Partial	Unlikely	Medium	Medium	Investigate resilience of plant to natural hazards. Develop Emergency Response Plan and implement if drinking water standards cannot be met.

10.3 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	All reservoirs have high level inlets and low level outlets. 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.	Partial	Unusual	Medium	Medium	Lock the access ladder on large reservoir.
S3	Introduction of contaminants into the distribution system	Backflow from customer connections.	Chlorine residual maintained in system. New connections are examined against the ADC backflow prevention policy.	Partial	Unusual	Medium	Medium	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	Medium	Medium	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.	Partial	Unusual	Medium	Medium	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.	Three reservoirs and duplicate mains provides some redundancy. The reservoirs are inspected weekly. The reservoir levels are monitored. Shutdowns are managed to avoid pressure surges and undue damage to the existing mains.	Partial	Unusual	Medium	Medium	Implement and use Asset Management System (AMS) for programming and monitoring regular maintenance and inspection/monitoring tasks. Undertake a criticality analysis of the network to assist renewals planning. Investigate resilience of plant to natural hazards. Develop Emergency Response Plan and implement if drinking water standards cannot be met.
S8	Insufficient water	Vandalism of reservoir	Reservoir level is monitored (SCADA alarm). Reservoir sites are not situated in locations prone to vandalism. Reservoirs are located in fenced area.	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**
S9	Insufficient water available	Catastrophic failure, e.g. seismic activity damaging equipment.	Reservoir, treatment plant, and associated equipment inspected following a significant earthquake. Standby generator onsite to maintain power supply.	Partial	Unusual	Medium	Medium	Investigate resilience of plant to natural hazards. Develop Emergency Response Plan and implement if drinking water standards cannot be met.

10.4 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 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. Annual IANZ accreditation for Council laboratory.	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	Review and maintain activity management plans and associated asset renewal programmes to plan for regular maintenance and inspection/monitoring tasks. 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 emergency response plan are up to date and available at the plant.

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**
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 in the service provider to ensure Operation and Maintenance Procedure Manual is up to date and available at the plant. Council to place a requirement on the service provider to provide staff with relevant training and skills.
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 Before You Dig used to permit maintenance and construction works.	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**
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

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.

Compliance Timeframe

The Mount Somers water supply falls in the category of a small 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 2015.

11.1 Table 13.1: Improvement Schedule - Part I

Mount Somers 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**
No major projects or capital works are anticipated at this stage.							

11.2 Table 13.2: Improvement Schedule - Part II

Mount Somers 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**
4	Medium	Catchment and intake	C1, C2	Ongoing liaison with adjacent landowners to raise/maintain awareness of catchment protection.	AM	Administration costs +staff time	Ongoing
4	Medium	Catchment and intake	C1, C2	Encourage best practice agricultural activities and riparian management.	AM	Administration costs +staff time	Ongoing
4	Medium	Catchment and intake	C2	Complete catchment assessment and have log credit requirement assigned.	AM	Staff time	01/12/2014
4	Medium	Catchment and intake, 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
4	Medium	Catchment and intake	C3	Ensure all intake manholes are locked and/or adequately secured.	AM	$300	01/12/2015
3	High	Catchment and intake	C4	Review need for increased demand management.	AM	Staff time	01/12/2015
3	High	Catchment and intake	C10	Formalise the use of the Acland bore (water quality monitoring, resource consent, establish protocols for implementation, operation procedure).	AM	$500 + staff time	01/12/2015
3	High	Catchment and intake	C10	Investigate alternative source.	AM	$2,000 + staff time	01/12/2015

Mount Somers 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**
4	Medium	Catchment and intake, treatment, storage and distribution	C5, C10, T9, T10, S7, S9	Develop Emergency Response Plan and implement if water supply cannot be maintained or drinking water standards cannot be achieved.	AM	$5,000 + staff time	01/07/2018
4	Medium	Source, treatment, distribution	C5, C10, T9, T10, S7, S9	Investigate resilience of plant to natural hazards.	AM	Staff time	1/12/15
4	Medium	Catchment and intake, storage and distribution, Other	C8, C9, S6, O2	Review and maintain Activity Management Plans and associated asset renewal programmes to minimise failures.	AM	Staff time	Ongoing
4	Medium	Catchment and intake, storage and distribution	C11, S5	Regularly inspect air valves and undertake remedial works as required to address potential backflow issues.	AM	Staff time	Ongoing
4	Medium	Storage and distribution	S2	Lock the access ladder on large reservoir.	AM	$1,000	01/12/2015
4	Medium	Storage and distribution	S3	Adopt and implement backflow prevention policy for customer connections.	AM	$15,000 + staff time	01/07/2016
4	Medium	Storage and distribution	S7	Undertake a criticality analysis of the network to assist renewals planning.	AM	Staff time	01/07/2018

Mount Somers 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**
4	Medium	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
5	Low	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
5	Low	Other	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	01/07/2016
5	Low	Other	O3	Council to place a requirement on the service provider to provide staff with relevant training and skills.	AM	Staff time	01/07/2016

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 Gallery runs dry
Actions	Advise customers to conserve water Apply demand management strategies as required Implement 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 reparation 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 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

12.8 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

12.9 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

12.10 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

12.11 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

12.12 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 and is providing the necessary log removal of protozoa.

Operational monitoring of control process:	
What	Filtered water turbidity (NTU)
When	Continuous on-line SCADA monitoring
Where	Inside treatment plant, after compliance cartridge filter
How	Hach 1720E 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 12.12
Critical Limits:	NTU: > 1.0 NTU (for more than 3 minutes)	Duty Operator to notify Duty Supervisor and ADC Compliance Officer to implement Contingency Plan 12.12.

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	Inside treatment plant
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:	40 mJ/cm^2	No correction currently possible.
Action Limits:	*UV Warning* alarm	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 12.7.
Critical Limits:	*UV System Fault* alarm	Duty Operator to notify Duty Supervisor and ADC Compliance Officer to implement Contingency Plan 12.7.

Note: The UV dose is not indicated explicitly on SCADA. The UV reactor monitors treatment parameters and calculates dose, and alarms are configured to indicate treatment insufficiency.

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 - Plant

Process objectives:

- Provides a **residual disinfection Critical Control Point** to inactivate bacterial, viral and most protozoal pathogens that may have entered upstream or may enter downstream of the 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 > 1.2 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 12.7 (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
When	ADC monthly ACL twice weekly
Where	ADC staff: Mt Somers has one zone sample tap, located on Tramway Road. ACL operators: Sampling bollard 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 Environmental Monitoring Officer / ACL Operator to contact ADC Compliance Officer. Contingency plan 12.6 (over-chlorination) or contingency plan 12.7 (inadequate disinfection) is to be followed.