Montalto Water Supply

Water Safety Plan

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Version 2.1: April 2019

Authorised by: _____

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Document Control

Version No	Description	By	Authorised	Approval Date
V1.0	Water Safety Plan 2016	MG	AG	Not Approved
V2.0	Water Safety Plan 2017	MG	AG	30 November 2017
V2.1	Minor review following implementation visit	CS	AG	22 May 2019

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1. Background

Ashburton District Council (ADC) own and operate the Montalto Drinking Water Supply. Under the Health Act 1956 (the Act) water suppliers have a duty to prepare and implement Water Safety Plans (WSP) [Section 69Z].

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

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

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

2. Water Quality Standards and Compliance

2.1. Water Quality Standards

The water quality standards, which specify the maximum acceptable values (MAVs) at which the risk of disease or illness from drinking the water is negligible, will follow those set out in Section 2 of the *Drinking-water Standards for New Zealand* 2005 (2018).

2.2. Compliance Criteria

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

1. Meet the relevant criteria for large, medium, minor, small or neighbourhood drinking-water supplies, as set out in the *Drinking-water Standards for New Zealand*, sections 4, 5, 7, 8 and 9

2. Choose to use section 10 of the *Drinking-water Standards for New Zealand* (Small water supplies, alternative criteria), and follow that water safety plan approach, or

3. Use the *Rural Agricultural Drinking-water Supply Guideline 2015* to develop and implement an approved water safety plan.

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

3. Implementation, Review and Reporting

3.1. 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.

3.2. 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.

3.3. Duration of the Plan

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

3.4. 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.

3.5. Links to other Quality Systems

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

4. Supply Details

Supply	
Supply Name	*Montalto*
DWO Community Code	*MON001*
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	*90 (Census 2013)*
Supply Grading	*Uu*
Source	
Source Name	*Montalto Intake Weirs (Weir A & Weir B)*
Location	*Hinds Gorge*
Map Reference of Source	*Weir A NZTM 1458250.010 easting, 5156673.106 northing* *Weir B NZTM 1458220.039 easting, 5156483.117 northing*
Type of Source	*Surface Water*
Depth of Bore	*NA – 0.0m intake weirs*
Consent Number	*CRC052628*
Consent Expires	*04 August 2045*
Maximum Consented water take:	*29 l/s, 1195m^3/ day 401,500 m^3 per annum*
Treatment Plant	
Treatment Plant Name	*Montalto*
Treatment Plant DWO Code	*TP00331*
Location	*Chapmans Road, Hinds Gorge*
Map Reference	*NZTM 1458550.482 easting, 5154941.822 northing*
Treatment Processes	*Chlorine Disinfection and UV Disinfection*

Distribution	
Distribution Zone Name	*Montalto*
Distribution Zone DWO Code	*MON001MO*
Distribution Zone Population	*90 (Census 2013)*
Regulatory Compliance	
Standards compliance assessed against	*DWSNZ (revised 2008)*
Laboratory undertaking analyses	*Ashburton District Council Laboratory (Bacteriological monitoring)* *Citilab (Chemical Monitoring)*
Secure bore water	*No (surface water supply)*
Bacterial compliance criteria used for water leaving the treatment plant	*Criterion 1*
Bacterial compliance for water leaving the treatment plant has been achieved for the last 4 quarters.	*No*
Protozoa log removal requirement required for the supply	*3 Log credits (Section 10)*
Protozoa treatment process	*No protozoa treatment (Non-compliant UV installed)*
Protozoa compliance for water leaving the treatment plant has been achieved for the last 4 quarters.	*No*
Compliance criteria used for water in the distribution zone.	*Criterion 6A*
Bacteria compliance for water in the distribution zone has been achieved for the last 4 quarters.	*Yes*
P2 determinands allocated to supply	*None*
Chemical compliance achieved for the last 4 quarters.	*Yes*
Cyanobacteria identified in the supply	*No*
Cyanobacterial compliance has been achieved for the last 4 quarters.	*Yes*
Identify any transgressions that have occurred in the last 4 quarters	*One. E.coli transgression Treatment Plant August 2017*

5. 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

6. 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.

6.1. System Description

The water supply has been described and a schematic diagram prepared to illustrate the key elements of the supply (section 7). Critical points and barriers to contamination are also illustrated (Sections 8 and 9).

6.2. Consultation

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

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

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

Following an implementation visit in February 2019, a number of minor changes have been made to this document, to form a new version 2.1. Where relevant, these have been discussed directly with the operators (ACL).

6.3. Risk Assessment

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

Risk tables have been prepared to summarise:

a) What could happen that may cause drinking water to become unsafe,

b) What preventative measures are in place to prevent this from occurring and whether this is sufficient,

c) Checking the preventative measures – what to check and upon checking, what are the signs that action is needed

d) Corrective actions required.

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

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

Table 1, Table 2 and Table 3 detail the criteria used and their definitions.

Table 1 - Likelihood Scale

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

Table 2 - Consequence Scale

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

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

Table 3 - Risk Level Allocation Table

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

Risk tables have been prepared to summarise:

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.

6.4. Improvement Schedule

An improvement schedule (section11) has been derived from the risk tables and is prioritised according to the assessed level of public health risk associated with hazards that are not adequately controlled at present.

Funding for the improvements, where required, has already been approved by Council and is detailed and published in the 2018 – 2028 Long Term Plan.

6.5. 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.

7. Montalto Water Supply - General Description

7.1. Source – History

In the late 1950s and early 1960s, a water supply for the Montalto area was mooted and constructed. Water was initially sourced from a swampy area on the Tarbottons' farm and collected in a rectangular open topped reservoir. It is understood that water quality and quantity became a problem for the supply. To supplement the swamp a pump station and rising main was constructed from the Rangitata Diversion Race (RDR) to feed into the rectangular open topped reservoir. This pump is not in operation anymore.

Figure 1 - Swamp catchment area of the original water scheme

Eventually, due to water quality issues the swamp source was abandoned and the rising main was re-routed around the Tarbotton open topped rectangular reservoir to supply a "new" service reservoir. The open topped reservoir was disconnected from the supply.

A new intake was formed on Chapmans Creek. Water was piped to a service reservoir at the current Water treatment Plant (WTP) site on Chapmans Road.

The original RDR source was still used for emergency conditions to supplement the Chapmans Creek source. The Chapmans Creek source produced high turbidity water and reduced volumes of water during dry summer periods. Consequently, it was abandoned after the Three Forks Intake on the Hinds River was put into operation.

Figure 2 - original water scheme rectangular open topped reservoir – Tarbottons property – no longer in use.

7.2. Montalto Water Supply Process Diagram

The diagram below illustrates the Montalto water supply from source to reticulation.

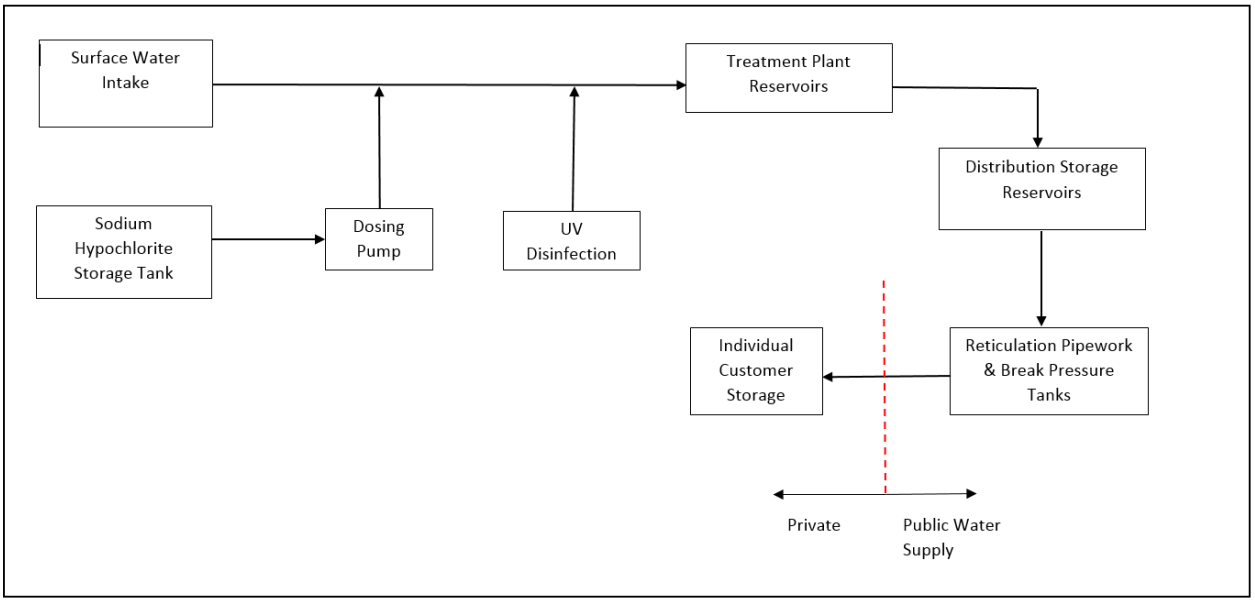


Figure 3 - Montalto Water Supply Process Diagram

7.3. Source

The Three Forks Intake is now the source for the Montalto Water Supply. The intake structures (constructed in the mid 1970s) are situated on the south branch of the Hinds River, named Weir A, and on an unnamed tributary, Weir B. In both cases, the catchments for the intakes are rugged hill country with some sheep and beef grazing over them.

Figure 4 - Intake structure on the Hinds River, south branch – Weir A

Figure 5 – Intake structure on the unnamed tributary – Weir B

Figure 6 – View up the Weir A catchment

Figure 7 – View up the Weir B catchment

Both streams have been dammed with similar concrete structures. The water flows over a stainless steel mesh and into a channel, leaving the large debris behind. The channel is connected to a concrete grit chamber on the side of the intake. In normal flow, grit is deposited into the grit chamber and the water flows into the outlet pipe, which has a screen attached to it. A washout arrangement is provided for in the concrete structure.

7.4. Raw Water Trunkmain

There is one raw water trunkmain, a 125mm dia BZ uPVC pipe (Class B uPVC pipe with Z type of rubber ring joints), which was laid in the mid to late 1970s. The raw water trunkmain is principally laid in an old stockwater race and is not easily identifiable on the ground. There are a number of washout points along the pipe and an air valve. The raw water pipeline connects the intake weirs to the Water treatment Plant, with an ABB MagMaster electromagnetic flowmeter measuring the inflow.

Figure 8 – Raw water trunkmain route (looking from intake access track to treatment plant)

7.5. Water Treatment Plant

The Water Treatment Plant (WTP) is situated adjacent to two 23m^3 service reservoirs at the top of Chapmans Road, along a gravel farm track. The whole site is fenced with a standard five strand fence. The building itself is of a wooden construction and access is secured via padlocks.

Inside the WTP building there is the process equipment – an Ultraviolet Irradiation Disinfection unit, chemical dosing pump and a sodium hypochlorite storage container. There are no pumps at Montalto WTP as all flows are gravity fed. There is also a manual backup generator, situated in a locked container outside of the building but within the WTP grounds.

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

A raw water turbidity meter was installed in July 2017 (part of a now-removed filter trial).

A trial filter is currently installed at the plant. This filter takes a small portion of the flow, treats it and sends it to waste. This is not part of the main treatment process, and exists solely to test different filter types and pore sizes.

Figure 9 – Treatment shed and storage reservoirs

Figure 10 – UV unit within treatment plant

Figure 11 – Chlorine dosing

7.6. Reservoirs

There are a large number of service reservoirs located within the reticulation which have a cumulative capacity of 373m^3. This storage is not sufficient to provide emergency storage for the current average demand of ~ 1000m^3 / day.

7.6.1. WTP Reservoirs

There are two 23m^3 capacity reservoirs at the WTP, hydraulically balanced. One tank can be isolated from the other if necessary, for cleaning / maintenance purposes, whilst still allowing the other reservoir to remain functional. The covers are secured with locks. There is no level measurement for the tanks nor any flow meters for the outflow. The tanks would appear to be in good condition but would benefit from an in depth survey (see Improvements section).

7.6.2. Chapmans reservoir

There are two reservoirs situated at the junction of Chapmans Road and Hinds Gorge Road inside a farm boundary. These reservoirs were constructed in the mid 1970s and have a combined capacity of approximately 100m^3.

The Chapmans reservoirs are serviced by two water mains from the WTP. The water mains interconnect just prior to the reservoirs and provide a 100mm dia inlet pipe through a float valve. There is no level measurement for the tanks nor any flow meters for the inflow and out flow. The tanks are in reasonable condition, but the larger concrete reservoir is showing signs of leaks and due to the lid having a gap underneath, covered by wire mesh, requires monitoring to ensure it is free of outside influences. These tanks are intended to be repaired or renewed in the near future (see Improvements section).

Figure 12 – Large 70000L Reservoir on Chapmans Road

Figure 13 – Smaller reservoir connected to larger 70000L Reservoir on Chapmans Road

7.6.3. Tarbotton Reservoir

The Tarbotton Reservoir is adjacent to the original 400m^3 open topped rectangular reservoir. It was built when the Chapmans Creek source was installed and the RDR source was being used in an emergency. The total capacity is approximately 70m^3. The covers are secured with locks. The reservoir is serviced from an 80mm dia AC falling main from the WTP before the water is reticulated to the rest of the scheme through a 125mm dia pipeline. There is no level measurement for the reservoir nor any flow meters for the inflow and outflow. The reservoir would appear to be in good condition but would benefit from an in depth survey (see Improvements section).

7.6.4. Break Pressure Tanks

There are a number of 30m^3 break pressure tanks installed, to replace pressure reducing valves (PRVs). The PRVs had originally been installed in the scheme to reduce the pressure to the lower properties. There are six break pressure tanks installed with a combined capacity of 180m^3. There is no level measurement for the tanks nor any flow meters for the inflow and outflow. These tanks would benefit from an in depth survey (see Improvements section).

7.6.5. Other Private Reservoirs

There are a number of other reservoirs used in the scheme but they are all private storage systems servicing individual properties. They are of varying capacities and their storage capacity has not been included in the overall storage capacity of the scheme. The private individuals who own these

tanks have responsibility for their maintenance and upkeep, however ADC could assist with providing information and education as to how this should be done.

7.7. Treated Water Trunkmains

Two falling mains transfer water from the WTP to the Chapmans and Tarbotton reservoirs. The original main, laid when the Chapmans creek source was constructed, is an 80mm dia AC pipe capable of a flow of 590 l/min (5.16 l/sec). This pipe initially flowed into the Tarbotton reservoir only. The second main, laid at a later date, probably in the mid 1970s, is a 80mm dia BZ and CZ uPVC pipe capable of providing flowrate of 8.3 l/sec. The total maximum flow down these two pipes is 13.46 l/sec.

7.7.1. Reticulation

There is a water quality sampling point adjacent to the Chapmans reservoir however this is not the point used by the sampling program, as it is not far from the WTP. Rather it gets used for general quality checks. The main sampling point is located at an extremity of the reticulation on Montalto Road at the bridge where it crosses the RDR. This is a secured sampling point.

The scheme has had a water reticulation since the beginning of the 1960s with various extensions being added over time. Areas of the reticulation have undergone pipe renewals, with the latest being in 2017. The main pipelines from the Chapmans and Tarbotton reservoirs are 125mm dia and 100mm dia and for servicing the farm properties 50mm dia pipe was used. The reticulation is predominantly 50mm diameter.

In 2002, a survey found that there was a total of 235 connections for 37 houses and 525 troughs. However, a further report around about the same time indicated that there were 48 house connections and 788 stock trough connections. These high numbers and varying numbers make management of the water supply scheme difficult. It is also understood that most farms have troughs directly connected to the scheme reticulation for their stockwater needs. This could be a source of contamination should backflow prevention not be present. Also, due to the rural nature of the supply and the area it covers, unlimited access to the reticulation is possible, which could cause contamination issues as well as loss of flow / pressure to other houses.

This is being addressed over time through the pipeline renewal programme, whereby all connections identified as part of the renewals are being reinstated with check valves as standard.

There are at least three known “filling points” which farmers use to fill sprayers etc. These are isolated with gate valves only with no means of backflow prevention. There is also at least one known fire hydrant on the scheme on Montalto Road.

Due to the known outstanding issues with the Montalto reticulation, a project is programmed for 2019/20 which will reconsider the nature of the scheme. The principal aim is to answer the question of whether it is feasible and practical to realign the pipework to create a single independent point of supply for each property, preferably in the road reserve, similar to the way the Dromore scheme is configured.

This would bring many benefits, but may be extremely expensive to implement and so consultation with the community will be vital.

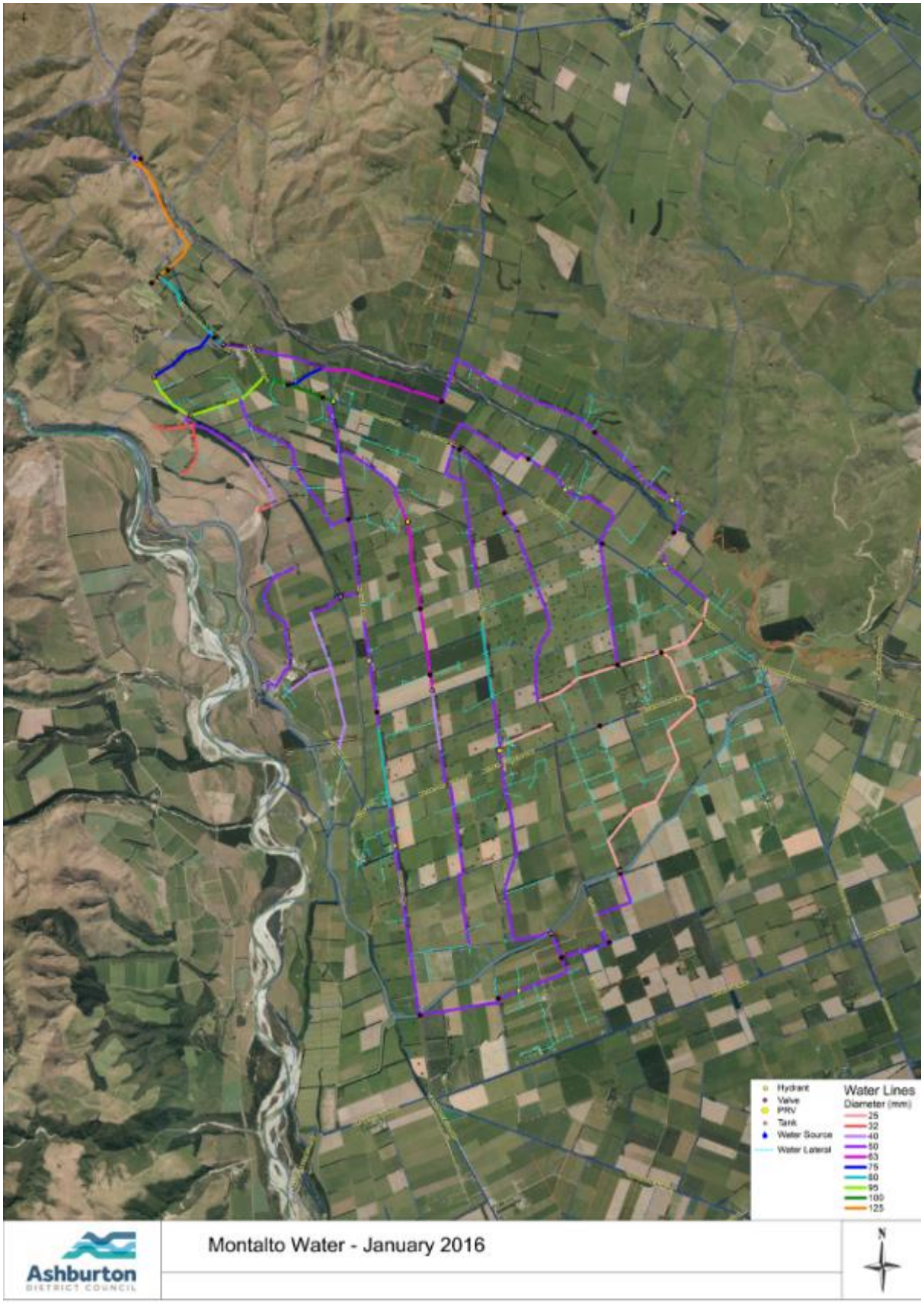


Figure 14 - Water Supply Distribution Map

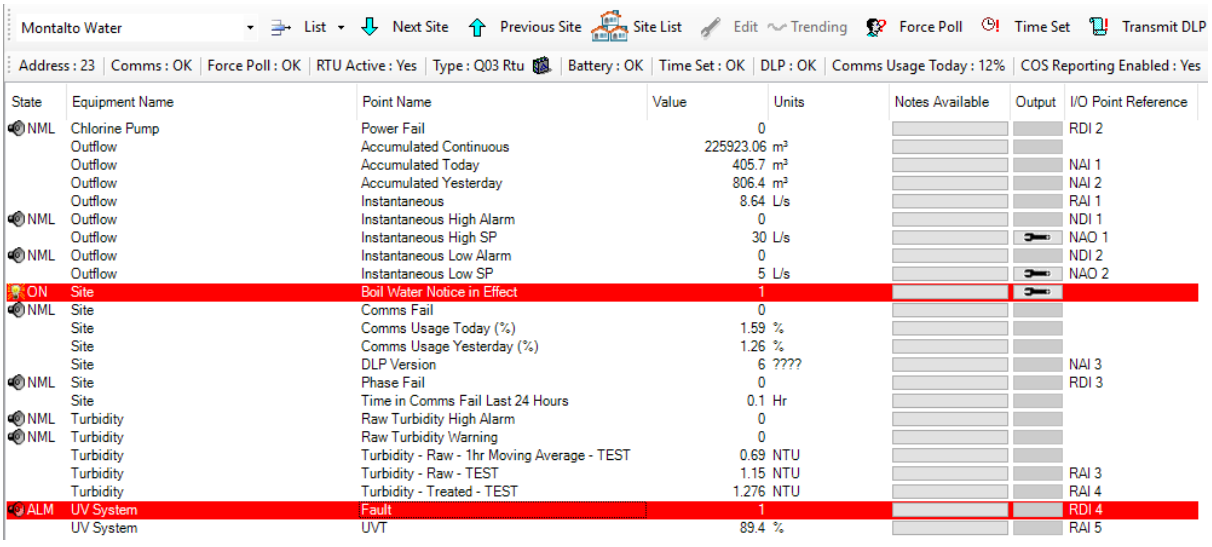
7.8. Monitoring and Alarms

Water quality monitoring is carried out by the Ashburton District Council Service Delivery staff in accordance with the Drinking Water Standards for New Zealand 2005 (revised 2018) (DWSNZ). Raw and treated water can be sampled at the treatment plant and. There is a water quality sampling point adjacent to the Chapmans reservoir (treated water) however this is not the point used by the sampling program, as it is not far from the WTP. Rather it gets used for general quality checks. The main sampling point is located at an extremity of the reticulation on Montalto Road at the bridge where it crosses the RDR. This is a secured sampling point.

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

Montalto is connected to the district wide telemetry system. SCADA is used to report site power failure, chlorine pump power failure, UV system fault, UVT, Turbidity, high instantaneous outflow and site communications fail to the operator by alarms.

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



State	Equipment Name	Point Name	Value	Units	Notes Available	Output	I/O Point Reference
NML	Chlorine Pump	Power Fail	0				RDI 2
	Outflow	Accumulated Continuous	225923.06	m³			
	Outflow	Accumulated Today	405.7	m³			NAI 1
	Outflow	Accumulated Yesterday	806.4	m³			NAI 2
	Outflow	Instantaneous	8.64	L/s			RAI 1
NML	Outflow	Instantaneous High Alarm	0				NDI 1
	Outflow	Instantaneous High SP	30	L/s			NAO 1
NML	Outflow	Instantaneous Low Alarm	0				NDI 2
	Outflow	Instantaneous Low SP	5	L/s			NAO 2
ON	Site	Boil Water Notice in Effect	1				
NML	Site	Comms Fail	0				
	Site	Comms Usage Today (%)	1.59	%			
	Site	Comms Usage Yesterday (%)	1.26	%			
	Site	DLP Version	6	????			NAI 3
NML	Site	Phase Fail	0				RDI 3
	Site	Time in Comms Fail Last 24 Hours	0.1	Hr			
NML	Turbidity	Raw Turbidity High Alarm	0				
NML	Turbidity	Raw Turbidity Warning	0				
	Turbidity	Turbidity - Raw - 1hr Moving Average - TEST	0.69	NTU			
	Turbidity	Turbidity - Raw - TEST	1.15	NTU			RAI 3
	Turbidity	Turbidity - Treated - TEST	1.276	NTU			RAI 4
ALM	UV System	Fault	1				RDI 4
	UV System	UVT	89.4	%			RAI 5

Figure 15 - Montalto Water Supply Telemetry Screenshot

7.9. Maintenance and Administration

Montalto 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.

7.10. Permanent Boil Water Notice

In March 2018 a permanent boil water notice was issued for the Montalto water supply. This followed a number of individual notices issued, including E.Coli detections. The intention is to lift this when the upgrades are completed.

8. Critical Points for Hazard Management

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

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

Table 4 - Critical points where hazards can be eliminated, minimised or isolated

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

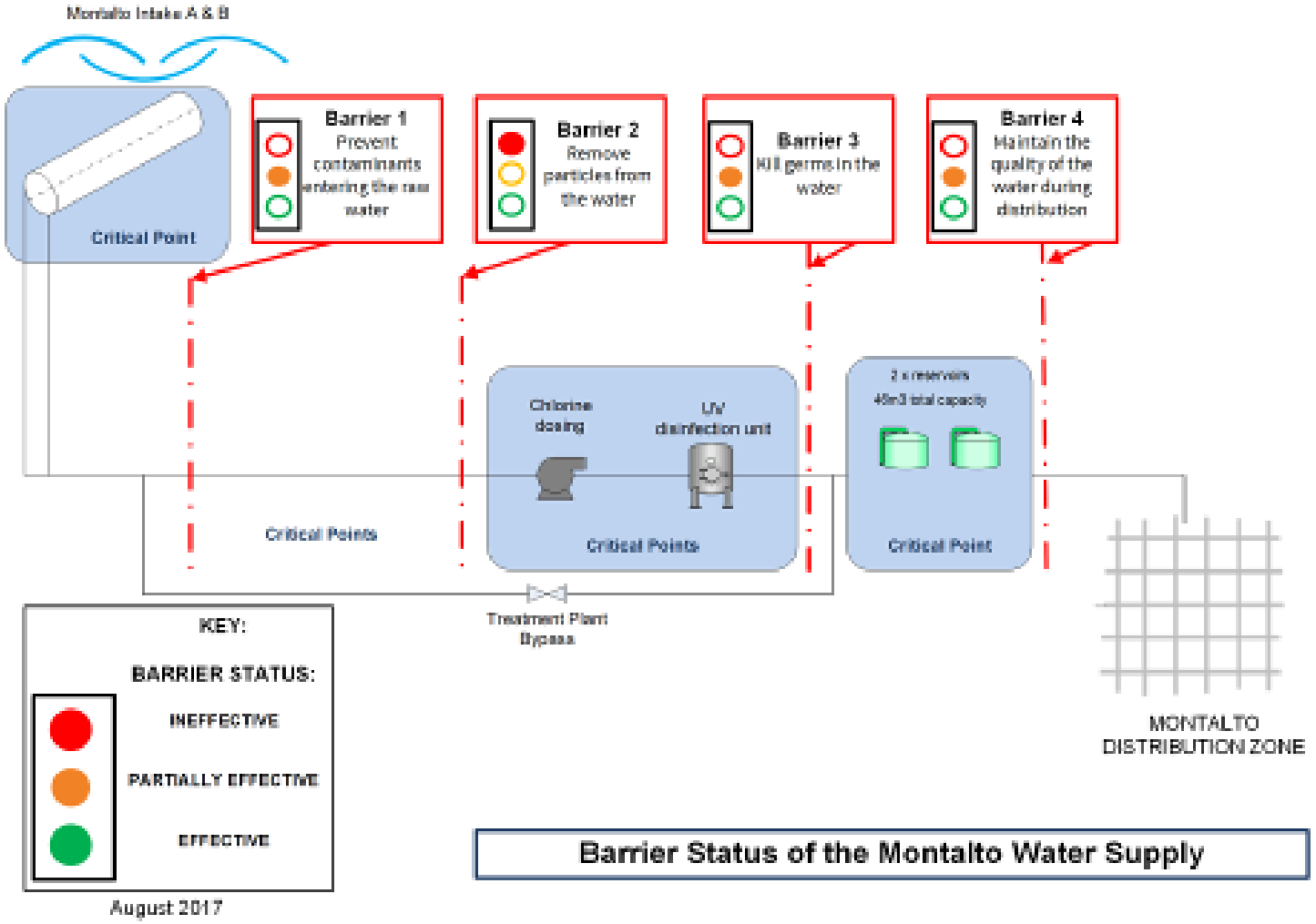


Figure 16 - Montalto Water Supply Schematic and Barriers

9. Barriers to Contamination

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

9.1. Prevent contaminants from entering the raw water

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

"The submitted survey report detailed that the water for the Montalto drinking-water supply is sourced from two concrete weirs, Montalto A on the South Branch of the Hinds River and Montalto B from an un-named tributary of the South branch of the Hinds River.

Crown conservation land and agricultural activities (around a 50-50 spilt) are the main sources of land used in the Montalto catchment. Faecal contamination from recreational activities, feral animals and other land use activities are all considered to be minimal in context. While current stock have direct access to waterways, water contamination mitigation measures such as riparian strip management have been proposed for the land connected to the Tenahaun Station. The water quality monitoring results from January 2017 provided also do not indicate any chemical determinands are present at levels of concern.

Following assessment of the information provided it is considered in accordance with table 10.1 from the DWSNZ, that a ***bacterial and 3-log protozoal treatment*** *requirement is appropriate for the Montalto drinking water supply"*

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

9.2. Remove particles from the water

The surface watercourse is subject to periods of high turbidity following rainfall in the catchment. Whilst the intake structure – screen and grit chamber – provide some level of filtration it is not really deemed adequate. The turbidity of the water reaching the plant in these high rainfall periods can be high and "boil water notices" have been issued.

A turbidity instrument to measure the raw water turbidity was installed in July 2017, as part of a filter trail, along with a treated water turbidity instrument. Data between 01/07/2017 and 15/08/2017 show that the "normal" turbidity value is less than 0.5 NTU. However, during heavy rain events, this raw water NTU has gone higher than 100 NTU (one off event), but typically has reached 20 NTU. As there is currently no filtration at Montalto, these high turbidity events pose a risk of contamination.

The two turbidity meters are classed as test instruments at the moment, as part of trials being undertaken. They do not yet form part of the operation of the plant.

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

9.3. Kill germs in the water

The treatment plant uses chlorination and a UV reactor to disinfect the water. The UV disinfection provides an effective barrier for the inactivation of protozoa. That being said, the current UV unit was installed in 1994 and is not currently certified according to the requirements of NZDWS.

Liquid sodium hypochlorite solution is injected into the water main upstream of the UV reactor prior to delivery into the storage tanks. The chlorine dosing pumps operate on a fixed dosing rate and are adjusted by the plant operators to match high turbidity events.

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

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

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

9.4. Maintain the quality of the water during distribution

9.4.1. Disinfection

The water supplied is dosed with sodium hypochlorite to ensure there is a residual available to protect against microbiological contamination throughout the system. The FAC levels in the water are tested by ADC staff weekly post-treatment and monthly at the sample point in the distribution zone. The ACL Plant Operator also carries out testing of FAC in the distribution zone.

ADC Sampling Officer undertakes FAC, pH and turbidity samples as part of the *E.coli* monitoring program. Three *E. coli* samples per quarter are required from the distribution zone. The samples must be taken with a maximum of 45 days between samples and cover at least 2 days of the week. Immediate action is required if a positive *E. coli* test result occurs, see Contingency Plan 10.5.

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

9.4.2. Backflow and other issues

Probably due to the history, size and rural nature of the Montalto distribution, there are an unknown and uncontrolled number of connections (see improvements schedule). In accordance with ADC's Backflow Prevention Policy (2015) and Service Connection Procedure, all connections (existing or new) on new pipeline replacements are to include toby boxes and manifolds for backflow prevention. Similarly, any new service connections on the scheme are to be fitted in accordance with this policy and procedure. Whilst this caters for connections going forward, there are still rumoured to be lots of connections made by the local community (not trained in water hygiene techniques). Addressing these existing connections is difficult but not impossible. A program of works will progress to carry out formal location and identification of these connections, with appropriate backflow prevention devices then being installed accordingly. It is anticipated that this exercise will take some time therefore will be carried out progressively throughout the scheme.

Potential backflow issues may occur from poor installation at stock troughs and compounded by the fact that the main distribution lines often flow through property to property, rather than properties having lateral connections off the main line. These connections will be assessed and remedied at the same time as the un-accounted for connection program.

The access control at the break pressure / storage tanks will also need to be addressed. Additionally, the break pressure / storage tanks will require to have backflow preventers fitted. The existing filling points also do not have backflow preventers fitted, which will be rectified.

9.4.3. Reservoir

There are two 23m^3 capacity reservoirs at the WTP, hydraulically balanced. One tank can be isolated from the other if necessary, for cleaning / maintenance purposes, whilst still allowing the other reservoir to remain functional. The covers are secured with locks. There is no level measurement for the tanks nor any flow meters for the out flow. The tanks would appear to be in good condition but would benefit from an in depth survey (see Improvements section).

9.4.4. Distribution Reservoirs / Break Pressure Tanks

As described, these tanks provide additional storage and pressure breaks throughout the distribution. They would benefit from a condition assessment and also their access needs to be restricted to trained personnel.

9.4.5. Maintenance and Training

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

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

9.5. General

Staff Training

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

10. Risk Tables

10.1. Risk Assessment Worksheet – Catchment and Intake

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

The most important preventive measures are:

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

Table 5 - Risk Assessment Worksheet – Catchment and Intake

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)?* *What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
C1	Bacterial or protozoal contamination in catchment	Unprotected catchment surface water – humans, livestock, septic tanks, agricultural activities, surface runoff, etc.	No	Raw water E.coli	Some parts of the catchment are fenced from farming stock. Chlorine and UV disinfection used to treat water. Montalto now included in the annual basic water chemistry testing.	No	Unlikely	Medium	Medium	Ongoing liaison with adjacent landowners to raise/maintain awareness of catchment protection. Encourage best practice agricultural activities and riparian management.
C2	Chemical contamination in catchment	Unprotected catchment surface water – agrichemicals	No	No P2s have been formally identified.	Some parts of the catchment are fenced from farming stock.	Partial	Unlikely	Medium	Medium	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 a Critical Control Point (CCP)?* *What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level,** **Urgent Attention Required?**	**Additional Measures to Control Risk Event**
		, surface runoff, etc.			Community drinking water supply protection zone under LWRP Montalto now included in the annual basic water chemistry testing.					Ongoing liaison with adjacent landowners to raise/maintain awareness of catchment protection.
C3	Contamination of source water	Contaminant entry via intake structure.	No		Intake structure is inspected monthly.	Partial	Unlikely	Medium	Medium	
C4	Contamination of source water	Cyanobacteria presence in the catchment	No		Water source and is visited monthly along with intake structure	Partial	Rare	Medium	Medium	Formally train operators to identify cyanobacteria growth.

10.2. Risk Assessment Worksheet – Surface Water Abstraction

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

The most important preventive measures are:

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

Table 6 - Risk Assessment Worksheet – Surface Water Abstraction

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)?* *What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level,** **Urgent Attention Required?**	**Additional Measures to Control Risk Event**
C5	Insufficient water available	Drought, low river levels.	No	Intake level	Permanent hosing ban in place. Some distribution storage and property owner storage (all totalling approx. 373m^3) Regular checks of the intake	Partial	Unusual	Minor	Minor	Develop a Water Conservation Plan to address increased demand management. Develop site-specific Emergency Response Plan and implement if water supply cannot be maintained.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)?* *What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level,** **Urgent Attention Required?**	**Additional Measures to Control Risk Event**
C6	Insufficient water available	Damage to intake structures – natural hazards, e.g. flooding, earthquakes.	No		Regular inspection and maintenance of intake structure Telemetric alarm for low flows from intake.	No	Unusual	Minor	Medium	Investigate resilience of plant to natural hazards via an Issues and Options report. Develop site-specific Emergency Response Plan and implement if water supply cannot be maintained.
C7	Insufficient water available	Damage to intake structures – vandalism.	No		Intake structure is not situated in a location prone to vandalism.	Partial	Rare	Minor	Low	

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)?* *What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level,** **Urgent Attention Required?**	**Additional Measures to Control Risk Event**
C8	Insufficient water available	Intake failure – deterioration of the weir structures and/or the supply pipelines.	No		Regular inspections of the intakes.	No	Unusual	Minor	Medium	Review and maintain Activity Management Plans and associated asset renewal programmes to minimise failures.

10.3. Risk Assessment Worksheet – Chlorine Disinfection

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

The most important preventive measures are:

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

Table 7 - Risk Assessment Worksheet – Chlorine Disinfection

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

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

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)?* *What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level,** **Urgent Attention Required?**	**Additional Measures to Control Risk Event**
										pumps and associated telemetry signals. Develop a schedule and carry out end to end testing of critical alarms and signals
T4	Over-chlorination (too much free available chlorine)	Dosing pump or control system malfunction.	Yes	Free chlorine	Regular FAC sampling undertaken by ADC staff.	Partially	Quite common	Minor	Medium	Install an automatically controlled chlorine dosing system – analyser, dosing pumps and associated telemetry signals. Develop a schedule and carry out end to end testing of critical alarms and signals
T5	Over-chlorination	Incorrect dose rate or	Yes	Free chlorine	Sodium hypochlorite	Partially	Unlikely	Minor	Medium	Install an automatically controlled chlorine dosing

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)?* *What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level,** **Urgent Attention Required?**	**Additional Measures to Control Risk Event**
	(too much free available chlorine)	solution strength too high.			solution delivered by reputable supplier. Written instructions for refilling the chlorine solution are on site.					system – analyser, dosing pumps and associated telemetry signals. Develop a schedule and carry out end to end testing of critical alarms and signals
T6	Failure to remove chemical contaminants from raw water	Treatment system inadequate.	No	No P2s have been formally identified.	No known chemicals in source water (i.e. no official P2 determinands). Montalto source water in	Yes	Unusual	Medium	Medium	

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

10.4. Risk Assessment Worksheet – Ultraviolet Disinfection

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

The most important preventive measures are:

- regularly maintain the unit to make sure enough UV light passes into the water
- use a sensor to measure the UV irradiation
- ensure that the water quality is of a sufficient standard in order for the UV irradiation to be effective

Table 8 - Risk Assessment Worksheet – Ultraviolet Irradiation Disinfection

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

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)?* *What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level,** **Urgent Attention Required?**	**Additional Measures to Control Risk Event**
		system malfunction, or power supply interruption.			manufacturer's recommendations. Power failure SCADA alarm. Manual UV intensity recording and logging (twice weekly).					Develop a schedule and carry out end to end testing of critical alarms and signals
T9	Inadequate protozoa removal/inactivation	High turbidity (low UVT).	No		On-line UVT analyser installed, connected to telemetry.	No	Quite common	Minor	Medium	Install a new, fully compliant UV unit. Make current installed trial raw water turbidimeter part of the plant process

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

10.5. Risk Assessment Worksheet – Storage and Distribution

The event creating the greatest risks involved in treated water storage for Montalto Water Supply is **contamination getting into the reservoir**.

The most important preventive measures are:

- restrict access to the reservoir to reduce the chances of contamination
- carry out regular inspections for signs of structural deterioration or signs that the storage has been contaminated
- make sure the facilities are designed to reduce the chances of contamination getting in, and that the construction materials will not contaminate the water

Table 9 - Risk Assessment Worksheet – Storage & Distribution

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)?* *What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
S1	Stored water quality deterioration	Inadequate reservoir turnover	No		Less than one day's storage in reservoir.	Partial	Unusual	Minor	Medium	Install level sensors on the storage tanks at the plant and connect to telemetry Install level sensors / indicators at storage tanks throughout the retic also.
S2	Introduction of contaminants into the distribution system	Contamination via storage reservoir – bird/vermin entry, roof	No		Reservoirs covered and locked.	Partial	Unusual	Medium	Medium	Carry out a thorough survey of all reservoirs throughout the distribution to

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)?* *What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level,** **Urgent Attention Required?**	**Additional Measures to Control Risk Event**
		runoff, unauthorised access.			External visual inspection weekly (Plant). Chlorine residual maintained in system.					check that access is restricted, cannot be accessed by animals, is secure and that the structure is sound. Replace locks on any tanks in order to restrict access. Add regular reservoir inspections to the maintenance program.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)?* *What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level,** **Urgent Attention Required?**	**Additional Measures to Control Risk Event**
S3	Introduction of contaminants into the distribution system	Backflow from customer connections.	No		Chlorine residual maintained in system. As per ADC's Backflow Prevention Policy (2015) and Service Connection procedure, all connections (existing or new) on new pipeline replacements are to include toby boxes and manifolds with backflow prevention	Partial	Likely	Minor	Medium	Install / check backflow preventers on the known filling points on the reticulation Install (if required) backflow prevention devices on the break pressure / storage tanks Implement a program of works to formerly locate and identify all connections (including un-accounted for

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

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)?* *What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level,** **Urgent Attention Required?**	**Additional Measures to Control Risk Event**
										record, policy and procedure.
S5	Introduction of contaminants into the distribution system	Pipe materials, age and condition, plumbosolvency.	No		Customers are notified of plumbosolvency twice per year as required by DWSNZ. Activity Management 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 a Critical Control Point (CCP)?* *What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level,** **Urgent Attention Required?**	**Additional Measures to Control Risk Event**
S6	Insufficient water	Reservoir or water main failure.	No		The reservoirs are inspected weekly.	Partial	Unusual	Medium	Medium	Install level sensors (and telemetry alarms where appropriate) on the storage tanks at the plant and throughout the distribution.
S7	Insufficient water	Vandalism of reservoir	No		Reservoir sites are not situated in locations prone to vandalism. Reservoirs are located in fenced area.	Partial	Unusual	Medium	Medium	

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)?* *What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level,** **Urgent Attention Required?**	**Additional Measures to Control Risk Event**
S8	Insufficient water available	Catastrophic failure, e.g. seismic activity damaging equipment.	No		Reservoir, treatment plant, and associated equipment inspected following a significant earthquake. Manual standby generator onsite to maintain power supply.	Partial	Unusual	Medium	Medium	Investigate resilience of plant to natural hazards via an Issues and Options report. Develop site-specific Emergency Response Plan and implement if drinking water quality standards cannot be met.

10.6. Risk Assessment Worksheet – Other

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

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

The most important preventive measures are:

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

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

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

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

Table 10 - Risk Assessment Worksheet – Other

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

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

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)?* *What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP ?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled ? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level,** **Urgent Attention Required ?**	**Additional Measures to Control Risk Event**
					permanently on site. An operations log is kept on site. Plant records are copied and filed.					inspection/monitoring tasks. Ensure all plant records, manuals, drawings, procedures and instructions are up to date and available at the plant. Develop and maintain Operation and Maintenance Manual.

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)?* *What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level,** **Urgent Attention Required?**	**Additional Measures to Control Risk Event**
O3	System does not perform as intended	Inadequate skills or training.	No		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. Identify staff training needs and provide training.
O4	System damaged or contaminated by construction	Inadequate controls on construction and maintenance work.	No		All maintenance is undertaken by contractor's trained/authorised staff.	Yes				

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

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)?* *What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP ?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled ? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level,** **Urgent Attention Required ?**	**Additional Measures to Control Risk Event**
	e/ emergency works				these use of these.					the 2021 Long Term Plan.

11. Improvements

Comparison of the information in the Risk Information Table with the actual supply, shows the following areas that would benefit from some interventions.

It is important to place these improvements in the wider context. ADC currently has two projects underway which will impact significantly on the operations of this plant and the wider water supply activity:

- A new Utility Operations and Maintenance Contract is being developed. We anticipate this having a commencement date of 1 July 2020. This means that many of the improvements related to training, operational procedures and so on can be most effectively implemented through explicit requirements or provisions in the new contract. This particularly applies to those improvements which come with a significant, ongoing resource requirement not currently available under this contract without diverting resourcing from other tasks.
- Upgrades and improvements for a number of water supplies, including Montalto, are currently in the process of being investigated and designed by ADC's engineering service provider. There is budgetary provision in place to carry out capital works required, and the requirement on the service provider is to design a treatment system that will provide the level of bacterial and protozoal treatment required for each scheme.

  We do not have, at the time of writing, a detailed description of the future treatment system, but the improvement schedule does include the addition of filtration and UV disinfection because these are the expected upgrade route, but does not include any pre-treatment of condition options such as raw water storage or selective abstraction, which would need to be investigated and put into the context of the whole treatment solution before confirmation. When the upgrade is completed, this plan will be rewritten to reflect the new status quo.

11.1. Catchment and Intake

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

Action needed: Ongoing liaison with adjacent landowners to raise / maintain awareness of catchment protection. Encourage best practice agricultural activities and riparian management.

The lids for the grit chamber are too flimsy and a tripod cannot be used for access during any confined spaces work. This could lead to possible contamination issues if work cannot be carried out in the chamber. However, routine access is currently not required to these areas and they have been secured in the meantime. This item may be addressed fully as part of any future intake upgrades.

11.2. Treatment

11.2.1. Surface Water Abstraction

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

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

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

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

While cyanobacteria growth is regarded as a very low risk for this supply, a further step would be to ensure that the operators are trained to spot this risk developing.

Action needed Ensure the operators are trained to spot cyanobacteria growth.

11.2.2. Raw water turbidity measurement and control process

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

Action needed: Ensure turbidity is fully incorporated into any upgrade of the plant and integrated into the everyday operation of the plant, including operation and maintenance and control processes.

11.2.3. Filtration

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

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

11.2.4. Chlorine disinfection

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

Action needed: Install an automatically controlled chlorine dosing system – analyser, dosing pumps and associated telemetry signals. The chlorine dosing system will include pH compensation. Install a low level sensor on the chlorine storage tank, which would include an alarm to telemetry. Develop a schedule and carry out end to end testing of critical alarms and signals

11.2.5. UV Irradiation disinfection

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

Action needed: Install a new, fully compliant, UV unit. Develop a schedule and carry out end to end testing of critical alarms and signals.

11.2.6. Plant Construction and Operation

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

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

There is a risk that there could be an inability to access some sites for operation / maintenance / emergency works when there is a flood/slip/bridge washout/snow fall or other hazard which prevents vehicular access.

Action needed: Assess access track condition and consider any improvements in the 2021 Long Term Plan.

11.3. Storage & Distribution

11.3.1. Post-treatment Storage

There are two 23m^3 storage reservoirs at the treatment plant but they currently do not have any level indicators. These would be useful in alerting staff to issues relating to not having enough water available to meet demand.

Action needed: Install level sensors on the storage tanks at the treatment works and add to telemetry, along with appropriate alarms.

During an implementation visit in February 2019 concerns were identified with the Chapmans Road reservoirs. The reservoirs undergo regular inspections, but issues were noted, including small but established leaks from the larger reservoir, concerns about the soundness of the protection provided by the metal wire under the lip, and birds roosting on the steel supporting hoops.

Action needed: In the short term, the metal wire mesh has been repaired and secured. In the slightly longer term prices are being sought to effect lasting repairs to the tank walls, or to demolish and replace the tanks with new, lockable plastic tanks in the same location. While there is no current budget in place specifically for this work, it is likely to be completed as part of the overall treatment upgrade project.

To reduce the risk of contamination it is imperative that access to service reservoirs is restricted to those suitably trained in water hygiene principles and practices. These storage facilities are also quite old so the structural integrity should also be examined.

Action needed: Carry out an initial survey of the storage tanks throughout the supply to check that access is restricted, cannot be accessed by animals, is secure and that the structure is sound. Replace locks on any tanks in order to restrict access. Add regular in-depth tank inspections to the maintenance program.

11.3.2. Operation & Structure

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

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

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

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

11.3.3. Backflow Prevention

A major area of concern throughout the reticulation is the lack of appropriate backflow prevention devices installed. The water supply is 50+ years old, and there are a large number of connections to the scheme, many poorly-documented. Many of these connections have been carried out without the knowledge of the Water Supply Provider. Many of these connections will be within the private property of the farm owner. There is a large risk that contaminants can be drawn back into the mains.

Action needed: An investigation is programmed for 2019/20 to investigate the concept of reforming the scheme and creating (and defining) a single point of supply for each property with appropriate backflow prevention. Inspect the break pressure / storage tanks and install (if necessary) backflow prevention devices. Install backflow preventers on the filling points. Add annual inspections of the backflow prevention devices to the operations and maintenance procedures.

11.4. General

11.4.1. Staff Training

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

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

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

11.5. Improvements Schedule

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

ACL = Ashburton Contracting Limited (Water Supply Operator)

Table 11 - Improvements Schedule

Montalto Water Supply Improvement Schedule							
Priority	**Risk Level**	**Water Supply Area**	**Reference to Risk Table**	**Details of Proposed Works**	**Person Responsible**	**Expected Cost**	**Intended date of Completion**
LOW	MEDIUM	Catchment and intake	C1,C2	Ongoing liaison with adjacent landowners to raise/maintain awareness of catchment protection.	AM	Administration costs +staff time	01/01/2021
LOW	MEDIUM	Catchment and intake	C1,C2	Encourage best practice agricultural activities and riparian management.	AM	Administration costs +staff time	01/01/2021
LOW	MEDIUM	Catchment and intake	C5	Develop Water Conservation Plan to address demand management.	AM	Staff time	01/01/2021
LOW	MEDIUM	Catchment and intake, storage and distribution	C5,C6,S8	Develop site-specific Emergency Response Plan and implement if water supply cannot be maintained	AM	Staff time	01/01/2021
LOW	MEDIUM	Catchment and intake, storage and distribution	C6,S8	Produce an Issues and Options Report to assess the resilience of the plant to natural hazards.	AM	$5,000 – $10,000 +staff time	01/01/2021

Montalto Water Supply Improvement Schedule							
Priority	**Risk Level**	**Water Supply Area**	**Reference to Risk Table**	**Details of Proposed Works**	**Person Responsible**	**Expected Cost**	**Intended date of Completion**
~~LOW~~	~~MEDIUM~~	~~Catchment and intake~~	~~C6~~	~~Implementation of telemetric alarm for low flows from intake~~	~~AM~~	~~$5,000 + staff time~~	~~01/01/2021~~ Completed
LOW	MEDIUM	Catchment and intake, storage and distribution, other	C8, S5, O2	Review and maintain Activity Management Plans and associated asset renewal programmes to minimise failures, and / or deterioration, and to plan for regular maintenance and inspection / monitoring tasks	AM	Staff time	01/01/2021
~~MEDIUM~~	~~MEDIUM~~	~~Catchment and intake, storage and distribution~~	~~T3~~	~~Raw water turbidity measurement and control processes~~	~~ADC & ACL~~	~~Staff time~~	~~31/12/2017~~ Completed
LOW	MEDIUM	Catchment and intake	C4	Ensure operators are trained to spot cyanobacterial growth	AM	Staff time	30/6/2020
~~HIGH~~	~~MEDIUM~~	~~Treatment, other~~	~~T7,T9~~	~~Install on-line UVT analyser to assess raw water UVT levels~~	~~AM~~	~~$15,000 - $20,000 + Staff time~~	~~01/01/2018~~ Completed
HIGH	MEDIUM	Treatment		Install filtration system to remove crypto and giardia	AM	$30,000+, plus staff time	30/6/2020
HIGH	MEDIUM	Treatment	T1,T2,T3,T4, T5	Install an automatically controlled chlorine dosing system – analyser, dosing pumps and associated telemetry signals	AM	$15,000 - 20,000 + Staff time	30/6/2020

Montalto Water Supply Improvement Schedule							
Priority	**Risk Level**	**Water Supply Area**	**Reference to Risk Table**	**Details of Proposed Works**	**Person Responsible**	**Expected Cost**	**Intended date of Completion**
HIGH	MEDIUM	Treatment	T1,T2,T3,T4, T5,T7,T8,T9	Develop a schedule and carry out end to end telemetry testing of critical alarms and signals	AM	$10,000 - 20,000 + Staff time	30/6/2020
HIGH	MEDIUM	Treatment	T2	Install a low level sensor on the chlorine storage tank. Alarmed to telemetry.	AM	$5,000 + staff time	30/6/2020
~~HIGH~~	~~MEDIUM~~	~~Treatment~~	~~T5~~	~~Clear written instructions on how to prepare and re-fill the chlorine solution storage tank should be available on site~~	~~ACL~~	~~Staff time~~	~~01/01/2018~~ Completed
HIGH	MEDIUM	Treatment	T7,T8,T9	Install a new, fully compliant, UV unit	AM	$30,000+, plus Staff time	30/6/2020
MEDIUM	MEDIUM	Storage and distribution	S1,S6	Install level sensors on the storage tanks at the plant	ACL	$1,000	30/6/2020
MEDIUM	MEDIUM	Storage and distribution	S1,S6	Install level sensors / indicators at storage tanks throughout the reticulation	ACL	$5,000	30/6/2021
MEDIUM	MEDIUM	Storage and distribution	S2	Carry out an initial thorough survey of the storage tanks throughout the supply to check that access is restricted, cannot be accessed by animals, is secure and that the structure is sound	AM	$1,000 - $2,000, plus staff time	30/6/2021
MEDIUM	MEDIUM	Storage and distribution		Repair or replace the Chapmans Road reservoirs to reduce risk of contamination caused by leaks or possible ingress under the lid.	AM	$10,000 - $20,000, plus staff time	30/6/2020

Montalto Water Supply Improvement Schedule							
Priority	**Risk Level**	**Water Supply Area**	**Reference to Risk Table**	**Details of Proposed Works**	**Person Responsible**	**Expected Cost**	**Intended date of Completion**
MEDIUM	MEDIUM	Storage and distribution	S2	Replace locks on any tanks in order to restrict access	AM	$250+ Staff time	30/6/2021
MEDIUM	MEDIUM	Storage and distribution	S2	Add regular tank inspections to the maintenance program	AM	Staff time	30/6/2020
MEDIUM	MEDIUM	Storage and distribution	S3	Implement a program of works to formally locate and identify all connections on the scheme	AM	$15,000 +Staff time	01/01/2022
MEDIUM	MEDIUM	Storage and distribution	S3	Inspect break pressure tanks / storage tanks and install back flow prevention devices (if necessary)	AM	$10,000 +Staff time	30/6/2021
MEDIUM	MEDIUM	Storage and distribution	S3	Install / check backflow preventers on known filling points within the reticulation	AM	$5,000 +Staff time	30/6/2021
MEDIUM	MEDIUM	Storage and distribution	S2	Add annual inspections of the backflow prevention devices to the operations and maintenance procedures.	AM	Staff time	30/6/2021
MEDIUM	MEDIUM	Storage and distribution, other	S4,O3	Identify and record any staff training needs	AM/ACL	Staff time	30/6/2020
MEDIUM	MEDIUM	Storage and distribution	S4	Re-audit current practices and procedures	AM	Staff time	30/6/2020
MEDIUM	MEDIUM	Storage and distribution	S4	Produce an updated training record, policy and procedure.	AM/ACL	Staff time	30/6/2020

Montalto Water Supply Improvement Schedule							
Priority	**Risk Level**	**Water Supply Area**	**Reference to Risk Table**	**Details of Proposed Works**	**Person Responsible**	**Expected Cost**	**Intended date of Completion**
MEDIUM	MEDIUM	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	30/6/2020
LOW	MEDIUM	Other	O5	Assess access track condition and consider any improvements in the 2021 Long Term Plan	AM	Staff time	01/01/2021

12. Contingency Plans

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

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

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

Please note that, due to the permanent boil water notice currently in place for this scheme, these contingency plans differ slightly from those at the rest of the schemes. The permanent notice is in place because the scheme is relatively frequently in a situation where treatment efficacy cannot be guaranteed, and so routine precautions need to be taken by customers.

12.1. Insufficient Source Water Available

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

12.2. Microbiological Contamination of Source Water

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

12.3. Chemical Contamination of Source Water

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

12.4. E. coli Transgression in Water leaving the Treatment Plant

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

12.5. Over Disinfection

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

12.6. Inadequate Disinfection

Indicators	Monitoring shows low FAC
Actions	Identify cause of issue and rectify problem as quickly as possible Notify DWA of situation and actions taken. Consider provision of emergency treatment equipment or alternative water supply (e.g. tankers) Manually dose reservoirs with chlorine if required Keep customers informed and advise once regular service is restored
Responsibility	Assets Manager

12.7. E. coli Transgression in Water in the Distribution Zone

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

12.8. Chemical Contamination of Water in Distribution Zone

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

12.9. Insufficient Water Available in the Distribution Zone

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

12.10. Insufficient Water Available due to Unplanned Shutdown

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

12.11. Raw Water Turbidity Value High

Indicators	Raw water turbidity value on SCADA is >2.5 NTU
Actions	If E.coli is detected, follow contingency plan 12.4 (treatment plant) or 12.7 (distribution system) Monitor the turbidity value on SCADA Consider provision of emergency treatment equipment or alternative water supply (e.g. tankers) Keep customers informed and advise once regular service is restored
Responsibility	Assets Manager

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

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

13. Critical Control Points

13.1. Chlorine Disinfection - Primary

Process objectives:

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

Operational monitoring of control process:	
What	Free available chlorine (FAC) concentration in mg/L
When	Twice Weekly (short-term[1])
Where	At the tagged sampling point inside the treatment plant, "Plant Montalto Water TP00331"
How	Hand-held pocket Colorimeter with vendor-supplied reagents (short-term[2])
Who	ACL Operator
Records	Log-book (short-term[3])

Process performance criteria at the operational monitoring point:		**Correction if operating criteria are not met:**
Target Range:	FAC: 1.5 - 2.5 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: < 1.5 mg/L (upon inspection) > 2.5 mg/L (upon inspection)	Duty Operator to respond by adjusting dosing to within target limits. Duty Operator to notify Duty Supervisor
Critical Limits:	FAC: < 1.0 mg/L (upon inspection) > 3.0 mg/L (upon inspection)	Duty Operator to respond by adjusting dosing to within target limits. Duty Operator to notify Duty Supervisor. Duty Supervisor to contact ADC Compliance Officer. Contingency plan 12.5 (over disinfection) or contingency plan 12.6 (inadequate disinfection) is to be followed.

Supporting programs:

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

Notes:

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

13.2. Chlorine Disinfection - Reticulation

Process objectives:

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

Operational monitoring of control process:	
What	Free available chlorine (FAC) concentration in mg/L
When	ADC Monthly (short-term[1]) ACL Twice Weekly
Where	ADC staff: The Montalto zone sample tap is located inside a locked bollard on the side of the road at the bridge where the Rangitata Diversion Race crosses the road at Montalto Road. ACL operators: Chapmans Road reservoir and sampling bollard as above
How	Hand-held pocket Colorimeter with vendor-supplied reagents (short-term[2])
Who	ADC Sampling Officer and ACL Operator
Records	ACL: Log-book (short-term[3]) ADC: WaterOutlook

Process performance criteria at the operational monitoring point:		**Correction if operating criteria are not met:**
Target Range:	FAC: 0.2 – 2.0 mg/L	Operator to adjust dosing system to achieve target range if noticed to be outside of target range during routine checking procedures
Critical Limits:	FAC: < 0.2 mg/L (upon inspection) > 2.0 mg/L (upon inspection)	ADC Sampling Officer / ACL Operator to contact ADC Compliance Officer. Contingency plan 12.5 (over disinfection) or contingency plan 12.6 (inadequate disinfection) is to be followed.

Supporting programs:

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

Notes:

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

14. Section 10 Compliance

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

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

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

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

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

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

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

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

There are no chemical determinands of concern in the source water for the Montalto scheme, and early disinfection byproduct testing has also not identified any chemicals of concern. This is monitored regularly, including through annual basic water chemistry testing. As such, the scheme is deemed to have appropriate chemical treatment.

For microbial treatment, the catchment assessment identified the supply as requiring ***bacterial and 3-log protozoal treatment,*** in accordance with table 10.1 of Section 10.
Bacterial treatment is provided by dosing with sodium hypochlorite, and supported by an E. coli monitoring programme. This is generally effective, but during periods of very high rainfall or dirty water

there have been detections of E. coli, and therefore this treatment process cannot be regarded as fully effective in all circumstances.
The planned treatment upgrade is being actively investigated and designed, but has yet to reach the final designed stage, but is likely to include filtration followed by UV disinfection. There may be additional pre-treatment factors, but this has not be determined. When the upgrade is complete, it will provide adequate bacterial and protozoal treatment.

At the time of submission of this WSP the existing treatment process cannot demonstrate 3-log protozoal removal so will therefore be non-compliant. However although the supply is not currently there, it is something that the supply is actively working towards.

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

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

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

With regard to protozoal monitoring, Section 10.4.3 specified that monitoring of protozoa is not required. As a surrogate, inspection and monitoring of the source protection, abstraction and treatment practices and the network protection is required.

The operational requirements that need to be monitored to demonstrate protozoal compliance are dependent on the water treatment process being used. The monitoring programme adopted must be given in the WSP. It is intended, as part of the upgrade, to extend and improve the SCADA monitoring of key parameters and instruments, especially given the remoteness of the site.

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

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

14.5. Summary

In its current form, the water supply does not comply with any aspect of the DWSNZ for protozoa. With the analysis of the Barriers to Contamination and the Risk Tables, an Improvement Schedule has been identified. This Improvement Schedule will be implemented over the coming years, with the higher risk initiatives happening first. The treatment plant upgrade will address the shortcomings on the protozoal

treatment and compliance. When the upgrade is being completed, the Contingency Plan and CCP will be developed for the protozoal treatment. Until then, the primary process control points will be chlorination and turbidity.

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