Ashburton District Council

Ashburton Water Supply

Water Safety Plan

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Water Safety Plan

Version 3.0: January 2019

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Document Control

Version	Description	Authorised	Approval Date
V1.0	PHRMP Ashburton March 2013	AG	19 March 2013
V2.0	Water Safety Plan 2018	AG	May 2018
V3.0	WSP Minor Review - Improved CCPs and revised timeframes	CS	January 2019

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1 Background

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

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

The purpose of a Water Safety Plan is to identify the public health risks associated with a drinking water supply. A Water Safety Plan includes a list of what could go wrong with a supply and what measures can be put in place to prevent or eliminate risk to public health. This WSP has been prepared with input from ADC (Water Supply Owner) staff members and from ACL (Water Supply Operator) staff members.

2 Implementation, Review and Reporting

2.1 Implementation of the Plan

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

2.2 Reviewing Plan Performance

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

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

2.3 Duration of the Plan

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

2.4 Revision and Re-approval of the Plan

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

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

2.5 Links to other Quality Systems

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

3 Supply Details

Supply	
Supply Name	*Ashburton*
DWO Community Code	*ASH003*
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	*18,500 (Census 2013)*
Supply Grading	*Ub*
Source	
Source Name	*Argyle Park Bore #1 G01546* *Argyle Park Bore #2 G01547* *Ashburton Domain Bore #5 G01545* *Ashburton Domain Bore #6 G01917* *Ashburton Domain Bore #7 G01963* *Bridge Street Bore #1 G01682* *Bridge Street Bore #2 G01683* *Tinwald Bore G02002*
Location	*Ashburton Argyle Park* *Ashburton Domain* *Ashburton Bridge Street Sports Ground* *Ashburton Tinwald Domain*
Map Reference of Source	*Argyle Park Bore #1 NZTM 1498931 easting 5140512 northing* *Argyle Park Bore #2 NZTM 1498710 easting 5140734 northing* *Ashburton Domain Bore #5 NZTM 1499826 easting 5138483 northing* *Ashburton Domain Bore #6 NZTM 1499850 easting 5138937 northing* *Ashburton Domain Bore #7 NZTM 1499787 easting 5138725 northing* *Bridge Street Bore #1 NZTM 1500958 easting 5138354 northing* *Bridge Street Bore #2 NZTM 1501095 easting 5138263 northing* *Tinwald Bore NZTM 1495535 easting 5136160 northing*
Type of Source	*Groundwater*

Depth of Bore	*Argyle Park Bore #1* 118.0m *Argyle Park Bore #2* 119.4m *Ashburton Domain Bore #5* 96.6m *Ashburton Domain Bore #6* 90.7m *Ashburton Domain Bore #7* 125.9m *Bridge Street Bore #1* 99.2m *Bridge Street Bore #2* 95.5m *Tinwald Bore* 73.6m
Consent Number	*CRC050225.1* *CRC051262.1*
Consent Expires	*26 November 2039 (Both Consents)*
Maximum Consented water take:	*Combined limits for both consents:* *630 l/s* *25,000m^3/day* *5,300,000m^3 per annum*
Treatment Plant	
Treatment Plant Name & DWO Codes	*Argyle Park Treatment Plant* TP02509 *Domain Treatment Plant* TP00334 *Bridge Street Treatment Plant* TP02701 *Tinwald Treatment Plant* TP03067
Location	*Argyle Park Plant: Argyle Park Middle Rd Allenton* *Plant building is on road side opposite Bathurst Rd intersection* *Domain Plant: Ashburton Domain West Street* *Plant building is in NE corner of Domain near SH1/Walnut Ave intersection* *Bridge Street Plant: Bridge Street Sports Ground, Netherby* *Plant building is on road side section of grounds number 36 Bridge Street* *Tinwald Plant: Tinwald Domain Maronan Road* *Plant building is located in compound in NE corner of Domain. Access is via the Plains Museum*
Map Reference	*Argyle Park Treatment Plant* NZTM 1498964 easting 5140502 northing *Domain Treatment Plant* NZTM 1500031 easting 5138718 northing *Bridge Street Treatment Plant* NZTM 1500940 easting 5138372 northing *Tinwald Treatment Plant* NZTM 1495539 easting 5136149 northing
Treatment Processes	*Argyle Park Treatment Plant* Chlorination. pH correction (lime) *Domain Treatment Plant* Chlorination. pH correction (lime) *Bridge Street Treatment Plant* Chlorination. pH correction (lime) *Tinwald Treatment Plant* Chlorination. pH correction (soda ash)

Distribution	
Distribution Zone Name	*Ashburton*
Distribution Zone DWO Code	*ASH003AS*
Distribution Zone Population	*18,500 (Census 2013)*
Regulatory Compliance	
Standards compliance assessed against	*DWSNZ (revised 2008)*
Laboratory undertaking analyses	*Ashburton District Council Laboratory (Bacteriological monitoring)* *Citilab, Hill Laboratories & Eurofins (Chemical Monitoring)*
Secure bore water	*No.* *Was Secure groundwater. All bores compliant with Bore Water Security criteria 1 & 3, however criterion 2 (wellhead sanitary security) not currently met by all bores*
Bacterial compliance criteria used for water leaving the treatment plant	*Criterion 1*
Bacterial compliance for water leaving the treatment plant has been achieved for the last 4 quarters.	*Yes*
Protozoa log removal requirement required for the supply	*Not formally assigned (was Secure groundwater)*
Protozoa treatment process	*None. No protozoa treatment (was Secure groundwater)*
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	*Nitrate (assigned to Tinwald treatment plant only)*
Chemical compliance achieved for the last 4 quarters.	*Yes*
Cyanobacteria identified in the supply	*No*
Cyano bacterial compliance has been achieved for the last 4 quarters.	*Yes*
Identify any transgressions that have occurred in the last 4 quarters	*Supply has been protozoa non-compliant since 14/02/2018 when Secure Groundwater Status was revoked from some bores due to non-compliance with Bore Water Security criterion 2 (wellhead sanitary security)*

3.1 Contact Information

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

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

4 Methodology

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

4.1 System Description

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

4.2 Consultation

Version 2.0 of this plan was prepared in March and April 2018 in consultation with Ashburton District Council water supply management and operational staff and in accordance with existing documentation. This version is a minor update only.

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.

4.3 Risk Assessment

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

Risk tables have been prepared to summarise:

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

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

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

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

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 1: Likelihood Scale

Table 1 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)	

Table 2: Consequence Scale

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 2 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

Table 3: Risk Level Allocation Table

Risk tables have been prepared to summarise:

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

4.4 Improvement Schedule

An improvement schedule (section 9) 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 major improvements has been included in the draft 2018 – 2028 Long Term Plan. The final plan will not be adopted until 30th June 2018 but it is not expected that any changes will be made to any projects and funding related to this Water Safety Plan.

4.5 Contingency Plans

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

5 Ashburton Water Supply – General Description

5.1 Introduction

Ashburton District Council (ADC) owns the Ashburton Water Supply, which serves a population of approximately 18,500 residents. Ashburton Contracting Limited (ACL) currently has the contract to operate and maintain the water supply.

The water supply comprises four independent headworks sites (source and treatment) located within the town. Three sites are located on the north side of the Ashburton River and one on the south side.
At each site, groundwater is abstracted and pumped directly to the distribution zone via a treatment plant where sodium hypochlorite is dosed to introduce a disinfection residual. Lime and soda ash are dosed for pH correction – lime is used at Argyle Park, Bridge St and Domain water treatment plants, and soda ash is used at the Tinwald plant. There is no storage. The water supply has intentionally been designed to provide a high level of redundancy (eight deep bores) to manage supply risks.

5.2 Ashburton Water Supply Process Diagram

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

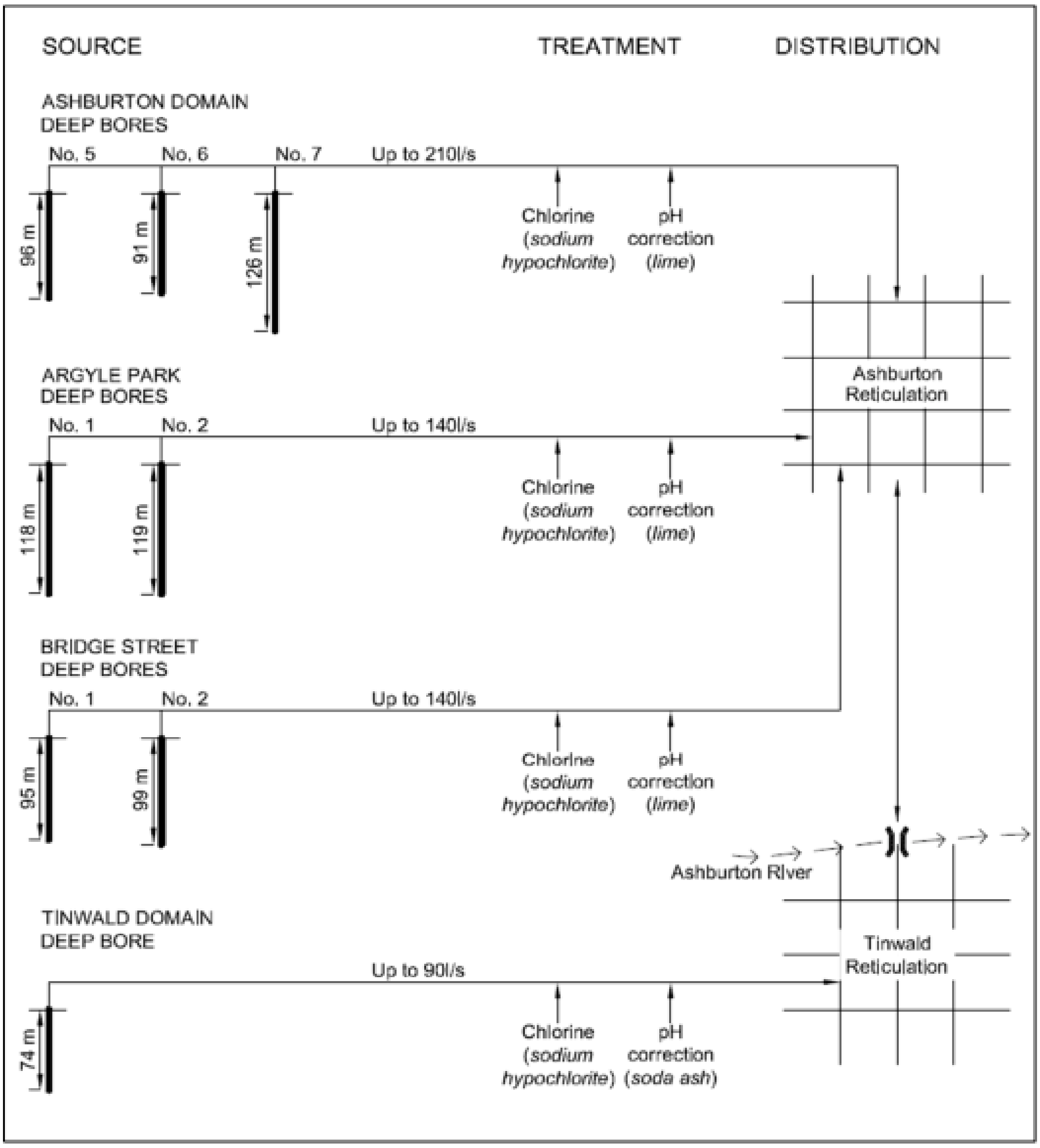

Figure 1: Ashburton Water Supply Process Diagram

5.3 Source & Treatment

The water sources for Ashburton water supply is groundwater from eight deep bores.

The eight deep bores range from 74m deep to 124m deep. Until 14th February 2018, all 8 bores had “Secure” status as defined in DWSNZ 2005 (2008). This “Secure” status was revoked on 14th February 2018 following a report into the condition of the sanitary seals of the Argyle 1 & 2, Bridge St 1 & 2 and Domain 5 bores. The report indicated that these bores did not meet the necessary requirements and thus were no longer deemed to provide sanitary security of the bores. Please see notes in the Critical Points for Hazard Management, the Risk Tables and the Improvements Schedule regarding actions to regain this “Secure” status.

The bore pumps supply water directly to the distribution (via treatment plants, described below). There is no storage. Each site can be operated independently and surplus source capacity is provided so that water supply can be maintained even if a bore or headworks site is inoperable for any reason.

	
Domain Bore 5	Domain Bore 6
	
Domain Bore 7	Tinwald
	
Argyle Park 1	Argyle Park 2
	
Bridge St 1	Bridge St 2

Table 4: Ashburton Water Supply Bore Headworks Photographs

Details of all the individual bores and the treatment plants are provided in the following pages. The bores are fitted with double check valves for backflow prevention. Level sensors are installed to monitor the water level in the bore, and the pumps are fitted with low level alarms. All of the bore pumps are controlled by variable speed drives. All of the bore pumps are controlled by a central PLC system. All of the bores are linked via cellular communications and the control of the speed of the pumps, and when they come, on is a combination of pressure and flow registered across the township. Depending upon demand, all eight pumps might be running in the height of summer, or just two or three during the winter night time.

Treatment consists of chlorination via dosing with liquid sodium hypochlorite and pH correction via lime or soda ash dosing:

PLANT	SODIUM HYPOCHLORITE STRENGTH	CHLORINE STORAGE TANK SIZE	CHLORINE ANALYSER	pH CORRECTION METHOD	pH ANALYSER
Bridge Street	1%	5250 L	Yes	Lime	Yes
Argyle Park	1%	5250 L	Yes	Lime	Yes
Domain	1%	2500 L	Yes	Lime	Yes
Tinwald	1%	3000 L	Yes	Soda ash	Yes

Table 5: Ashburton Water Supply Treatment

The addition of the lime and soda ash into the water supply is not a requirement under DWSNZ 2005 (2008), rather it is included to improve the water chemistry so that the agressivity/corrosivity of the water is reduced. This is done for asset management purposes, to extend the remaining life of the asbestos cement pipe, which makes up a high proportion of the distribution network.

Electromagnetic flowmeters are installed post treatment, prior to the water entering the reticulation. These meters, along with pressure sensors fitted in the line coming from the bore, form part of the centralised bore pump control system. In addition to the other sites, Argyle Park is fitted with reticulation booster pumps (duty/standby). This is to provide additional pressure for the Allenton Pressure Zone, an isolated section of the general Ashburton distribution network.

All treatment is housed in secure buildings. Automatic backup generators are installed and operational on all sites apart from Tinwald. The infrastructure is in place at Tinwald, but there is no generator installed (see improvements section). All the generators are installed in locked enclosures and are regularly tested.

5.3.1 General Site Photos

Figure 2: Argyle Park Treatment Building

Figure 3: Argyle Park Bore 1 & Bore 2 Sample Bollards

Figure 4: Argyle Park Chlorine & pH Analyser

Figure 5: Argyle Park Chlorine dosing pump and equipment; lime hopper

Figure 6: Argyle Park Bore 1 Control Panel (inside main treatment building)

Figure 7: Argyle Park Bore 2 Control Unit (located separately from the main building)

Figure 8: Argyle Park Booster Pumps for Allenton Pressure Zone

Figure 9: Argyle Park Generator

Figure 10: Bridge Street Treatment Building

Figure 11: Bridge Street Bore 1 & Bore 2 Sample Bollards

Figure 12: Bridge Street Chlorine & pH Analyser

Figure 13: Bridge Street Chlorine dosing pump; lime hopper

Figure 14: Bridge Street Bore 1 Control Panel (inside main treatment building)

Figure 15: Bridge Street Bore 2 Control Unit (located separately from the main building)

Figure 16: Bridge Street Generator

Figure 17: Domain Treatment Building

Figure 18: Domain 5 & 6 Sample Bollards

Figure 19: Domain 7 Sample Bollard

Figure 20: Domain Chlorine & pH Analyser

Figure 21: Domain Chlorine dosing pump and equipment; lime hopper

Figure 22: Domain Control Panel (inside main treatment building)

Figure 23: Domain 5 Control Unit (located separately from the main building)

Figure 24: Tinwald Treatment Building and bore headworks

Figure 25: Tinwald Bore Sample Bollard

Figure 26: Tinwald Bore Headworks

Figure 27: Tinwald Chlorine & pH Analyser

Figure 28: Tinwald Chlorine dosing pump and equipment; soda ash tank

Figure 29: Tinwald Control Panel; Bore Pump Variable Speed Drive

Figure 30: Tinwald Generator Pad (see improvements section for generator comments)

Figure 31: Ashburton Water Supply – Headworks Locations

5.4 Standby Power

Continuity of water supply from a site is dependent on the continuity of power supply to operate the bore pumps and treatment processes. Each of Argyle Park, Bridge Street and Domain have a permanent diesel generator that will start automatically following a power supply failure. This backup power supply is sufficient to operate one deep bore and associated treatment systems at each site. The Tinwald bore currently has no generator, however installation of one is programmed in the Long Term Plan 2018-28. A pad and emergency point is provided at Tinwald and a mobile generator could therefore be utilised in an emergency. Loss of power to four independent sites is unlikely, but in the event of a widespread power failure it is possible to maintain supply for annual average daily usage.

5.5 Storage

There is no above ground storage. Operation of the water supply is reliant on the ability to abstract water from aquifer storage. The associated risks are addressed by a) the distributed nature of the supply, b) redundancy, in terms of the number of bores and pumps, and c) provision of standby power generation capacity.

5.6 Reticulation

The reticulation comprises mainly asbestos cement pipes installed up to about 1980, and PVC pipes subsequent to this time. ADC has an active pipeline replacement programme, detailed in the Long Term Plan 2015-25, continuing into the Long Term Plan for 2018 – 2028. Older cast iron pipe and AC pipe are still in use but are progressively being replaced.

Plans detailing the reticulation are provided below. Areas include the Ashburton suburbs, Tinwald, Lake Hood and the Ashburton Business Estate.

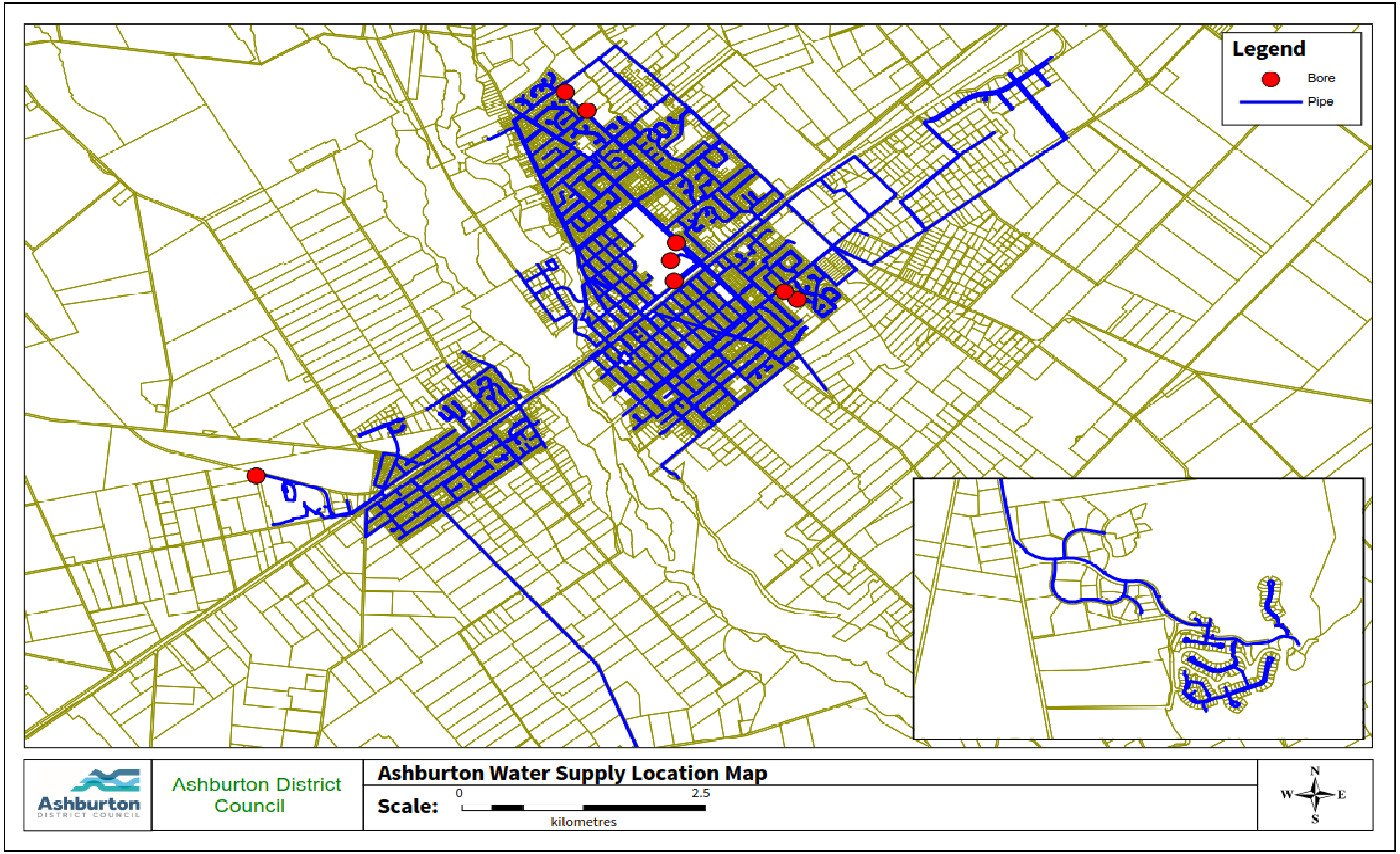

Figure 32 : Ashburton Water Supply Distribution Map

5.7 Monitoring

Water quality monitoring is carried out by Ashburton District Council Service Delivery staff in accordance with the Drinking Water Standards for New Zealand 2005 (revised 2008) (DWSNZ). Raw and treated water can be sampled at all the treatment plants. Five monitoring points provide representative sampling of the water in the distribution zone. These sampling points are located at:

- The corner of Farm Rd and Harrison St
- The corner of Crown Grant Rd and McNally St
- The southeastern end of the reticulation on the corner of Suffolk St and Trevors Rd
- On Maronan Road in Tinwald, outside the Tinwald Domain.
- On Lake Hood Drive (formerly named Huntingdon Avenue) at Lake Hood, opposite the Lake House boat harbour.

22 *E. coli* samples are required per quarter for a population of between 15,000 and 20,000. No detections of *E. coli* are permitted. This sampling requirement is population-dependent and may require amending if reticulation system extensions occur and the population increases to more than 20,001.

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

Sampling rotates around the five sites in order to give a representation of the water in the reticulation. Distribution zone sampling sites will need revising when new developments are connected to the scheme to ensure they are still representative.

SCADA Signal List

All of the headworks and associated treatment plants are connected to the district-wide SCADA system.

The following tables detail the alarms and signals recorded:

Argyle Park					
State	Equipment Name	Point Name	Value	Units	I/O Point Reference
	Allenton Booster	Instantaneous Flow	15.6	l/s	RAI 19
NML	Allenton Booster	Pump 1 Fault	0		RDI 34
	Allenton Booster	Pump 1 Pressure	3.4	bar	RAI 20
OFF	Allenton Booster	Pump 1 Run	0		RDI 33
	Allenton Booster	Pump 1 Speed	0	Hz	RAI 21
NML	Allenton Booster	Pump 2 Fault	0		RDI 36
ON	Allenton Booster	Pump 2 Run	1		RDI 35
	Allenton Booster	Pump 2 Speed	25.2	Hz	RAI 22
NML	Allenton Booster	Suction Pressure Fault	0		RDI 37
	Allenton Booster	Total Flow Last Week	2177	m^3	NAI 5
	Allenton Booster	Total Flow Today	801	m^3	NAI 4
	Allenton Booster	Total Flow Yesterday	1376	m^3	NAI 6
	Bore 1	Level	40	m BGL	RAI 3
NML	Bore 1	Low Water	0		RDI 3
	Bore 1	Pressure	308.9	kPa	RAI 2
NML	Bore 1	Pump Fault	0		RDI 2
OFF	Bore 1	Pump Run	0		RDI 1
	Bore 1	Pump Speed	0	Hz	RAI 1
	Bore 1	Pump Temperature	99.3	????	RAI 5
OFF	Bore 1	Shutdown Selected	0		RDI 4
	Bore 2	Level	19	m BGL	RAI 15
NML	Bore 2	Low Water	0		RDI 27
	Bore 2	Pressure	260.7	kPa	RAI 14
NML	Bore 2	Pump Fault	0		RDI 26
ON	Bore 2	Pump Run	1		RDI 25
	Bore 2	Pump Speed	34.4	Hz	RAI 13
	Bore 2	Pump Temperature	16.4	°C	RAI 16

OFF	Bore 2	Shutdown Active	0		RDI 28
	Bore Flow	Daily Quantity	2138	m³	NAI 1
	Bore Flow	Instantaneous Flow	29.1	l/s	RAI 4
	Bore Flow	Weekly Quantity	7267	m³	NAI 2
	Bore Flow	Yesterday Quantity	5129	m³	NAI 3
	Chlorine	Residual	0.523	mg/L	RAI 7
NML	Chlorine	Residual High Alarm	0		NDI 5
NML	Chlorine	Residual High Plant Shutdown	0		
	Chlorine	Residual High Setpoint	1.5	mg/l	NAO 2
NML	Chlorine	Residual Low Alarm	0		NDI 6
	Chlorine	Residual Low Setpoint	0.25	mg/l	NAO 3
	pH Analyser	pH	7.38	pH	RAI 8
NML	pH Analyser	pH High Alarm	0		NDI 7
NML	pH Analyser	pH High Plant Shutdown	0		RDI 10
	pH Analyser	pH High Setpoint	8	pH	NAO 4
NML	pH Analyser	pH Low Alarm	0		NDI 8
	pH Analyser	pH Low Setpoint	7	pH	NAO 5
NML	Site	485 Bus Comms Fail	0		NDI 3
NML	Site	Battery Low	0		
NML	Site	Comms Fail	0		
	Site	Comms Usage Today (%)	2.64	%	
	Site	Comms Usage Yesterday (%)	2.36	%	
NML	Site	Generator Fault	0		RDI 7
ON	Site	Generator in Auto	1		RDI 5
NML	Site	Generator on Load	0		RDI 6
NML	Site	Generator Run	0		RDI 8
	Site	Last Comms	14/03/2018 14:28		
	Site	Shutdown System	0		RDO 1
	Site	Time in Comms Fail Last 24 Hours	0	Hr	
NML	Treatment	Chlorine Dosing Pump Fail	0		RDI 13
ON	Treatment	Chlorine Dosing Pump Run	1		RDI 20
	Treatment	Chlorine Tank Level (%)	89.7	%	RAI 6
NML	Treatment	Chlorine Tank Low Level Pump Stop	0		RDI 18
NML	Treatment	Chlorine Tank Low Level Alarm	0		NDI 4
	Treatment	Chlorine Tank Reorder Chlorine Level	12	%	NAO 1
ON	Treatment	Lime Auger Run	1		RDI 21
NML	Treatment	Lime Dosing Pump Fail	0		RDI 14
ON	Treatment	Lime Dosing Pump Run	1		RDI 22
NML	Treatment	Lime Hopper Low Level Alarm	0		RDI 19
NML	Treatment	Lime Hopper Pit Flood	0		RDI 15

NML	Treatment	Lime Solution Tank High or Low Level Alarm	0		RDI 16
NML	Treatment	Lime Solution Tank Low Low Level Alarm	0		RDI 17

Bridge Street					
State	Equipment Name	Point Name	Value	Units	I/O Point Reference
	Site	Comms Usage Today (%)	2.02	%	
	Site	Last Comms	14/03/2018 14:30		
NML	Site	Battery Low	0		
NML	Site	Comms Fail	0		
	Site	Comms Usage Yesterday (%)	2.07	%	
NML	Site	Generator Fault	0		RDI 7
NML	Site	Generator Run	0		RDI 6
NML	Site	Shutdown System	0		RDO 1
	Site	System Flow	52.7	l/s	RAI 5
	Site	Time in Comms Fail Last 24 Hours	0	Hr	
	Bore 1	Bore Level	0	M	RAI 3
NML	Bore 1	Low Water	0		RDI 3
	Bore 1	Pressure	437.9	kPa	RAI 2
NML	Bore 1	Pump Fault	0		RDI 2
OFF	Bore 1	Pump Run	0		RDI 1
	Bore 1	Pump Speed	0	Hz	RAI 1
	Bore 1	Pump Temperature	12	deg C	RAI 4
OFF	Bore 1	Shutdown Selected	0		RDI 4
	Chlorine	Residual	0.592	mg/l	RAI 7
NML	Chlorine	Residual High Alarm	0		NDI 3
NML	Chlorine	Residual High Plant Shutdown	0		RDI 20
	Chlorine	Residual High Setpoint	1.5	mg/l	NAO 2
NML	Chlorine	Residual Low Alarm	0		NDI 4
	Chlorine	Residual Low Setpoint	0.25	mg/l	NAO 3
	pH Analyser	pH	7.48	pH	RAI 8
NML	pH Analyser	pH High Alarm	0		NDI 5
NML	pH Analyser	pH High Plant Shutdown	0		RDI 21
	pH Analyser	pH High Setpoint	8	pH	NAO 4
NML	pH Analyser	pH Low Alarm	0		NDI 6
	pH Analyser	pH Low Setpoint	7	pH	NAO 5
	Totalised	Daily Quantity	2984	m3	NAI 1

	Flow				
	Totalised Flow	Weekly Quantity	14520	m3	NAI 2
	Totalised Flow	Yesterday Quantity	4943	m3	NAI 3
NML	Treatment	Chlorine Dosing Pump Fail	0		RDI 9
ON	Treatment	Chlorine Dosing Pump Run	1		RDI 16
	Treatment	Chlorine Tank Level (%)	72.9	%	RAI 6
NML	Treatment	Chlorine Tank Low Level Pump Stop	0		RDI 14
NML	Treatment	Chlorine Tank Low Level Alarm	0		NDI 1
	Treatment	Chlorine Tank Reorder Chlorine Level	20	%	NAO 1
OFF	Treatment	Lime Auger Run	0		RDI 17
NML	Treatment	Lime Dosing Pump Fail	0		RDI 10
OFF	Treatment	Lime Dosing Pump Run	0		RDI 18
NML	Treatment	Lime Hopper Low Level Alarm	0		RDI 15
NML	Treatment	Lime Hopper Pit Flood	0		RDI 11
NML	Treatment	Lime Hopper Pit Sub Pump Run	0		RDI 19
NML	Treatment	Lime Solution Tank High or Low Level Alarm	0		RDI 12
NML	Treatment	Lime Solution Tank Low Low Level Alarm	0		RDI 13

Bridge Street Bore 2					
State	Equipment Name	Point Name	Value	Units	I/O Point Reference
	Site	Comms Usage Today (%)	4.24	%	
NML	Site	Battery Low	0		
NML	Site	Comms Fail	0		
	Site	Comms Usage Yesterday (%)	4.65	%	
	Site	Time in Comms Fail Last 24 Hours	0.4	Hr	
	Bore 2	Bore Level	0	M	RAI 3
NML	Bore 2	Low Water	0		RDI 3
	Bore 2	Pressure	446.5	kPa	RAI 2
NML	Bore 2	Pump Fault	0		RDI 2
ON	Bore 2	Pump Run	1		RDI 1
	Bore 2	Pump Speed	40.1	Hz	RAI 1
	Bore 2	Pump Temperature	19	deg C	RAI 4
OFF	Bore 2	Remote Shutdown	0		RDO 1

Domain					
State	Equipment Name	Point Name	Value	Units	I/O Point Reference
	Site	Comms Usage Today (%)	2.52	%	
	Site	System Flow	30.36	l/s	RAI 21

	Site	Turbidity	0	NTU	RAI 4
NML	Site	Bore 5 Comms Fail	0		NDI 1
NML	Site	Comms Fail	0		
	Site	Comms Usage Yesterday (%)	2.32	%	
NML	Site	Generator Fault	0		RDI 5
OFF	Site	Generator in Auto	0		RDI 3
NML	Site	Generator on Load	0		RDI 2
NML	Site	Generator Run	0		RDI 4
	Site	Time in Comms Fail Last 24 Hours	0	Hr	
NML	Site	Turbidity High	0		NDI 7
	Site	Turbidity High Setpoint	2.5	NTU	NAO 6
	Chlorine	Residual	0.463	mg/l	RAI 2
NML	Chlorine	Residual High Alarm	0		NDI 3
	Chlorine	Residual High Setpoint	1.5	mg/l	NAO 2
NML	Chlorine	Residual Low Alarm	0		NDI 4
	Chlorine	Residual Low Setpoint	0.25	mg/l	NAO 3
	pH Analyser	pH	7.94	pH	RAI 3
NML	pH Analyser	pH High Alarm	0		NDI 5
	pH Analyser	pH High Setpoint	8	pH	NAO 4
NML	pH Analyser	pH Low Alarm	0		NDI 6
	pH Analyser	pH Low Setpoint	7	pH	NAO 5
	Treatment	Chlorine Tank Level (%)	93.5	%	RAI 5
ON	Treatment	Lime Auger Run	1		RDI 23
NML	Treatment	Chlorine Dosing Pump Fail	0		RDI 6
ON	Treatment	Chlorine Dosing Pump Run	1		RDI 22
NML	Treatment	Chlorine Tank Low Level Alarm	0		NDI 2
	Treatment	Chlorine Tank Reorder Chlorine Level	20	%	NAO 1
NML	Treatment	Lime Auger Fail	0		RDI 20
ON	Treatment	Lime Dosing Pump Run	1		RDI 24
NML	Treatment	Lime Hopper Low Level Alarm	0		RDI 21
NML	Treatment	Lime Hopper Pit Flood	0		RDI 17
OFF	Treatment	Lime Hopper Pit Sub Pump Run	0		RDI 25
NML	Treatment	Lime Solution Tank High or Low Level Alarm	0		RDI 18
NML	Treatment	Lime Solution Tank Low Low Level Alarm	0		RDI 19
	Pump No 5	Pressure	397.6	kPa	
	Pump No 5	Bore Level	39	m BGL	RAI 9
NML	Pump No 5	Fault	0		RDI 10
	Pump No 5	HoursLast2	0		
	Pump No 5	HoursLast24	21.3	Hours	

NML	Pump No 5	Low Water	0		RDI 11
	Pump No 5	Motor Temperature	13.6	°C	RAI 10
	Pump No 5	Pump Speed	0	Hz	RAI 7
OFF	Pump No 5	Run	0		RDI 9
OFF	Pump No 5	Shutdown Active	0		RDI 12
	Pump No 5	StartsLast2	0		
	Pump No 5	StartsLast24	0	Starts	
	Pump No 6	Pressure	382.9	kPa	
	Pump No 6	Pump Speed	0	Hz	RAI 13
	Pump No 6	Bore Level	8.2	m BGL	RAI 15
	Pump No 6	Motor Temperature	11.9	°C	RAI 16
NML	Pump No 6	Fault	0		RDI 27
	Pump No 6	HoursLast2	0		
	Pump No 6	HoursLast24	0	Hours	
NML	Pump No 6	Low Water	0		RDI 28
OFF	Pump No 6	Run	0		RDI 26
	Pump No 6	StartsLast2	0		
	Pump No 6	StartsLast24	0	Starts	
	Pump No 7	Pump Speed	34.7	Hz	RAI 17
	Pump No 7	Pressure	370.7	kPa	
	Pump No 7	Motor Temperature	14.8	°C	RAI 20
	Pump No 7	HoursLast24	7.3	Hours	
	Pump No 7	Bore Level	39	m BGL	RAI 19
NML	Pump No 7	Fault	0		RDI 30
	Pump No 7	HoursLast2	2		
NML	Pump No 7	Low Water	0		RDI 31
ON	Pump No 7	Run	1		RDI 29
	Pump No 7	StartsLast2	0		
	Pump No 7	StartsLast24	1	Starts	
	Totalised Flow	Daily Quantity	1917	m³	NAI 1
	Totalised Flow	Weekly Quantity	3655	m3	NAI 3
	Totalised Flow	Yesterday Quantity	1738	m³	NAI 2

Tinwald					
State	Equipment Name	Point Name	Value	Units	I/O Point Reference
	Bore	Pump Run Hours	20469	Hours	RAI 16
	Bore	Pump Starts	17541	Starts	RAI 17
	Bore	Pump Speed	38.7	Hz	RAI 2
	Bore	Bore Level	16.1	m	RAI 4
	Bore	Pump Temperature	16.3	°C	RAI 5
ON	Bore	Pump Available	1		RDI 11
NML	Bore	Pump Over Temperature	0		RDI 13
ON	Bore	Pump Run	1		RDI 2

NML	Bore	Low Flow Fault	0		RDI 29
NML	Bore	Pump Fault	0		RDI 3
NML	Bore	Low Water	0		RDI 4
	Chlorine	Residual	0.34	mg/L	RAI 11
	Chlorine	Dose Reference	28	????	RAI 14
	Chlorine	Used Yesterday	0	L	RAI 19
	Chlorine	Added Yesterday	0	L	RAI 20
	pH Analyser	pH	7.52		RAI 12
NML	pH Analyser	pH High Alarm	0		RDI 23
	Plant	Instantaneous Flow (RTU)	42.08	l/s	RAI 1
	Plant	Instantaneous Flow (PLC)	42.47	l/s	RAI 10
	Plant	System Pressure	470	kPa	RAI 3
NML	PLC	Comms Link Fail	0		NDI 1
	Site	Comms Usage Today (%)	2.86	%	
	Site	Last Comms	14/03/2018 14:37		
NML	Site	Battery Low	0		
NML	Site	Comms Fail	0		
	Site	Comms Usage Yesterday (%)	2.72	%	
	Site	Time in Comms Fail Last 24 Hours	0	Hr	
NML	Site	Mains Fail	0		RDI 1
	Soda Ash	Soda Dose Reference	481	????	RAI 13
	Soda Ash	Used Yesterday	2	????	RAI 21
	Soda Ash	Added Yesterday	252	????	RAI 22
	Totalised Flow	7-Day Moving Total	10671	m^3	RAI 18
	Totalised Flow	Daily Total	0	m^3	RAI 23
NML	Treatment	Chlorine Residual High or Low	0		NDI 2
	Treatment	Setpoint Trim	0	????	RAI 15
	Treatment	Chlorine Tank Level	2448	L	RAI 7
	Treatment	Soda Dosing Tank Level	980	L	RAI 8
	Treatment	Soda Makeup Tank Level	1300	L	RAI 9
NML	Treatment	Mixer Fault	0		RDI 14
NML	Treatment	Transfer Pump Fault	0		RDI 15
NML	Treatment	Chlorine Dosing Pump Fault	0		RDI 16
NML	Treatment	Soda Dosing Pump Fault	0		RDI 17
OFF	Treatment	Mixer Emergency Stop	0		RDI 18
NML	Treatment	Chlorine Tank Low Level	0		RDI 19
NML	Treatment	Chlorine Dose High	0		RDI 20
NML	Treatment	Chlorine Dose Low	0		RDI 21
NML	Treatment	Soda Tank Low Level	0		RDI 22
OFF	Treatment	Transfer Pump Run	0		RDI 24
	Treatment	Fill Soda Tank	0		RDI 25

OFF	Treatment	Mixer Run	0		RDI 26
ON	Treatment	Soda Dosing Pump Run	1		RDI 27
ON	Treatment	Chlorine Dosing Pump Run	1		RDI 28
NML	Pump No 6	Fault	0		RDI 27
	Pump No 6	HoursLast2	0		
	Pump No 6	HoursLast24	0	Hours	
NML	Pump No 6	Low Water	0		RDI 28
OFF	Pump No 6	Run	0		RDI 26
	Pump No 6	StartsLast2	0		
	Pump No 6	StartsLast24	0	Starts	
	Pump No 7	Pump Speed	34.7	Hz	RAI 17
	Pump No 7	Pressure	370.7	kPa	
	Pump No 7	Motor Temperature	14.8	°C	RAI 20
	Pump No 7	HoursLast24	7.3	Hours	
	Pump No 7	Bore Level	39	m BGL	RAI 19
NML	Pump No 7	Fault	0		RDI 30
	Pump No 7	HoursLast2	2		
NML	Pump No 7	Low Water	0		RDI 31
ON	Pump No 7	Run	1		RDI 29
	Pump No 7	StartsLast2	0		
	Pump No 7	StartsLast24	1	Starts	
	Totalised Flow	Daily Quantity	1917	m³	NAI 1
	Totalised Flow	Weekly Quantity	3655	m3	NAI 3
	Totalised Flow	Yesterday Quantity	1738	m³	NAI 2

Table 6: SCADA Signal List

5.8 Maintenance and Administration

Ashburton 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 management and operation of the plant undertake on-going training.

6 Critical Points for Hazard Management

Figure 27 (over the page) presents a schematic of the water supply from source to consumer. Critical points, where hazards can be eliminated, minimised or isolated are indicated in blue. Barriers to contamination are indicated in red.

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

Critical Point	Description
Wellhead	*Possible point for microbiological and protozoal contamination* *Possible point for loss of supply*
Chlorine dosing	*Possible failure of chlorine dosing would result in loss of the systemic protection provided by the chlorine residual* *Overdosing may exceed chemical MAV*
pH correction	*Overdosing may raise pH above 8 and thus lower the effectiveness of the chlorine residual (FAC equivalent)*
Reticulation	*Possible point for microbiological contamination* *Possible point for loss of supply*

Table 7: Ashburton Water Supply Critical Points

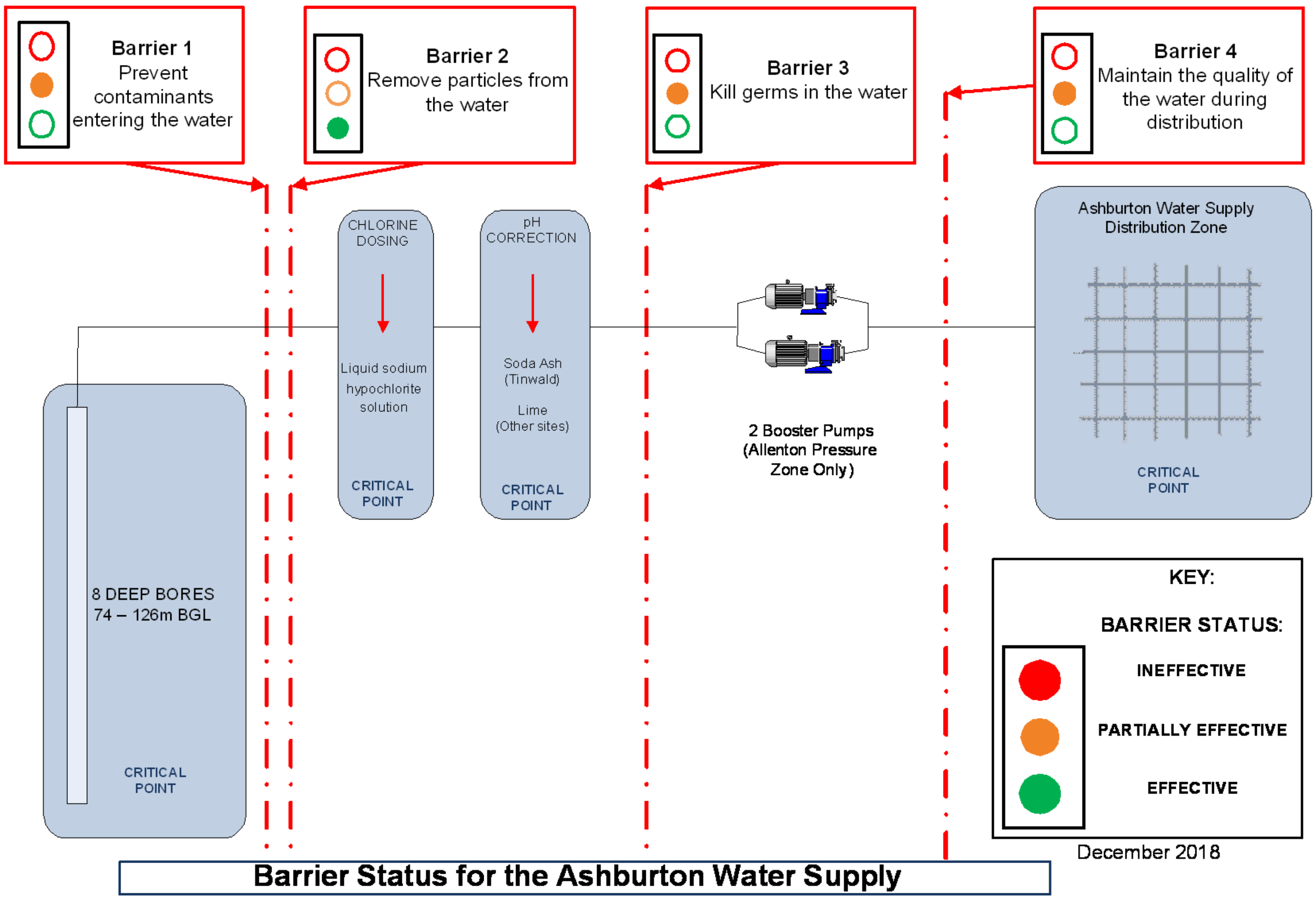

Figure 33: Ashburton Water Supply Schematic

7 Barriers to Contamination

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

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

7.1 Prevent contaminants from entering the raw water

The water for all eight bores is sourced from deep groundwater and all eight bores have been age dated and found to be appropriately old and thus at a low risk of microbiological contamination.

Up until February 2018, all of the bores were deemed “Secure” under Section 4.5 of the Drinking-water Standards for New Zealand 2005 (2008). They were compliant under Criterion 1, 2 and 3.

Argyle Park 1 and 2, Bridge St 1 & 2 and Domain 5 bores were recently assessed (Nov 2017) to ascertain whether **bore water security criterion 2 (bore head must provide satisfactory protection)** was still valid. The report detailed that this was not the case and the “Secure” status of these particular bores was revoked by the Drinking Water Assessor in February 2018.

Tinwald bore was reassessed in May 2018 and was found to still meet bore water security criterion 2 and Domain bores 6 & 7 are not due for re-assessment until 2020. As all eight bore contribute to the whole water supply, ADC are taking the approach that the whole water supply is now not “Secure” and there is now a risk that contaminants can enter the raw water until “Secure” status is re-established (see improvement section).

Whilst **bore water security criterion 1 (bore water must not be directly affected by surface or climatic influences)** and **bore water security criterion 3 (*Escherichia coli* must be absent from bore water)** are still being demonstrated, **bore water security criterion 2 (bore head must provide satisfactory protection)** is not.

7.1.1 Summary

The following measures contribute to provision of a **partially effective barrier against contaminants entering the raw water**:

- Bore water security criterion 1: bore water must not be directly affected by surface or climatic influences is being demonstrated on all bores
- Bore water security criterion 2: bore head must provide satisfactory protection is being demonstrated at three of the boreheads
- Bore water security criterion 3: *Escherichia coli* must be absent from bore water is being demonstrated on all bores
- The bores are 74 to 126m deep

This barrier could be enhanced by:

- Regaining "Secure" bore status
- Further identification, understanding and monitoring of the source protection zones

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

7.2 Remove particles from the water

Until February 2018, when the "Secure" security status for the bores was revoked, this barrier would not have been applicable. Until the "Secure" status is re-established there is now some uncertainty over whether this barrier is applicable or not. ADC are of the opinion that because the bores are all between 74 and 126m deep, with turbidity values below 0.19 NTU and total suspended solids below detection levels (<3mg / L), that there is still no requirement for any form of filtration.

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

7.3 Kill germs in the water

Prior to the "Secure" water status being revoked, there was not a requirement for any disinfection process and the risk of germs being present was negligible. Despite the "Secure" status, there is a chlorination system at all four of the treatment plants, however, this is used to provide a disinfection residual in the distribution zone

Since the "Secure" water status has been revoked, daily sampling to detect E.coli presence / absence is being carried out. Although chlorination is used, there is no above ground storage so an adequate contact time cannot be demonstrated. To demonstrate bacterial compliance for water leaving the treatment plant, Compliance Criterion 1 is used, which is daily sampling.

Argyle Park 1 and 2, Bridge St 1 & 2 and Domain 5 bores are also technically non-compliant for Protozoa from 14th February 2018 when the "Secure" status was revoked, and will remain so until the water security criterion 2 requirements are considered met again by the DWA. ADC have highlighted re-instating “Secure” bore status as a priority and once this is successfully achieved, the bores will become protozoal compliant again. That being said, ADC have provisioned for the installation of UV disinfection at all of the Ashburton treatment plants should a) regaining “Secure” status not be practicable for whatever reason or b) Government makes changes following the Havelock North Inquiry recommendations and “Secure” status is no longer an option and additional treatment is required. These are both identified as risks.

While re-instatement of “Secure” status is the main route to protozoal compliance, with ADC wishing to both meet and exceed any requirements we will be installing UV disinfection at the Ashburton treatment plants ASAP.

7.3.1 Summary

The following measures contribute to provision of a **partially effective barrier against killing germs in the water**:

- Disinfection by chlorination of the water supply

This barrier could be enhanced by:

- Regaining “Secure” bore status
- Confirming the position of the DWA regarding protozoal treatment requirements

7.4 Maintain the quality of the water during distribution

7.4.1 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 chlorination system is controlled by a PLC, with the dose rate being proportional to the flow rate passing through the main water meter. Chlorine analysers only provide a residual reading and are not incorporated into the dosing control.

A chlorine residual is maintained in the reticulation to provide protection in the case of bacterial contamination. The FAC and pH levels in the post-treatment water are monitored via SCADA. ACL Operators also undertake weekly sampling at site with calibrated hand-held chlorine analysers. These hand-held chlorine analysers were upgraded in February 2018 to newer models which can be routinely calibrated. ADC's Environmental Monitoring Officer utilises the same model, for accuracy and also consistency of readings.

ADC's Environmental Monitoring Officer undertakes the *E.coli* monitoring program in the reticulation. Twenty two *E. coli* samples per quarter are taken on a rotating basis from five sampling points in the distribution zone. The samples must be taken on all days of the week each quarter, with a maximum of 6 days between samples and cover at least 7 days of the week.

Immediate action is required if a positive *E. coli* test result occurs, see Contingency Plan 10.4.

7.4.2 Pumpstations

Not only do the eight bore pumps draw water from underground, they also maintain pressure in the reticulation, thus reducing the risk of backflow contaminating the distribution. The Allenton Pressure Zone has additional booster pumps installed at the Argyle Park treatment Plant to provide the same function.

7.4.3 Backflow prevention

Any properties that require back flow prevention require annual checking under the Building Act. Council's Building Services Department ensures that these tests are up to date.

All new service connections are fitted with dual check backflow preventer manifolds as standard. If maintenance is required, all existing manifolds are replaced with dual check backflow preventer manifolds as standard.

7.4.4 General

Maintenance procedures and hygiene practices, alongside trained and experienced operators, reduce the contamination risks associated with working on the water mains.

Under the Code of Practice for Utility Operators Access to Road Corridors (NZUAG) contractors working in roads are required to inform ADC, as a utility operator, and to ascertain the whereabouts of utilities before digging in the road or footpath. As part of this process, ADC uses the commercial beforeUdig service that automatically provides asset location information from the GIS on demand, and identifies clearly critical assets on the supplied maps.
This helps to prevent any accidental pipe breakages.

7.4.5 Summary

The following measures contribute to the provision of a **partially effective barrier against recontamination** of water following treatment:

- Hygiene procedures are documented and followed for all distribution system maintenance.
- A disinfection residual is maintained within the distribution zone.
- The plant is on mains electricity supply with a backup generator that is regularly tested and the results are recorded. The generator is locked. (all except Tinwald).
- New domestic connections are assessed against the backflow prevention policy and as a minimum are installed with a dual check valve in the manifold.

This barrier could be enhanced by:

- Adding an additional sample bollard into the North East area of Ashburton that services a new sub-division and a business park.
- Regular training refreshers.
- Installation of a backup generator at Tinwald.

8 Risk Tables

8.1 Risk Assessment Worksheet – Groundwater Source

The events associated with raw water on the Ashburton 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; and
- knowing where the recharge zone of the source is and the nature of the land in this area.

Table 8.1 Risk Assessment Worksheet – Bore and Source 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**
B1	Microbiological contamination in catchment	Contaminated source water – humans, livestock, septic tanks, agricultural activities, surface runoff, etc	No	Raw water E.coli	All bores are deep and satisfy Criterion 1 (4.5.2.1) & 3 (4.5.2.3) of DWSNZ 2005 (2008) 3 of the 8 bores satisfy Criterion 2 (4.5.2.2) of DWSNZ 2005 (2008) Chlorine disinfection for residual protection in network Community drinking water supply protection zone around the bore under Land & Water Regional Plan Resource consent applications managed by Regional Council for possible impacts on bore Daily monitoring for absence / presence of *E.coli* Protection zone has been surveyed for septic tanks, bores and other risk items.	Partial	Unusual	Substantial	V High	Required improvements to bore heads to regain “Secure” status (bore head must provide sanitary protection, plus testable backflow prevention device, plus bores raised above ground) Review protection zone survey information and develop an action plan.
B2	Chemical contamination of source water – general	Contaminated source water – agrichemicals, surface runoff,	No		Wellheads are secured from casual access Annual basic water chemistry	Partial	Unusual	Substantial	V High	Required improvements to bore heads to regain ”Secure” status (bore head must provide sanitary protection, plus testable backflow

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**
		chemical spills			testing undertaken All bores are deep and satisfy Criterion 1 (4.5.2.1) & 3 (4.5.2.3) of DWSNZ 2005 (2008) 3 of the 8 bores satisfy Criterion 2 (4.5.2.2) of DWSNZ 2005 (2008) Community drinking water supply protection zone around the bore under Land & Water Regional Plan Resource consent applications managed by Regional Council for possible impacts on bore					prevention device, plus bores raised above ground) Review protection zone survey information and develop an action plan.
B3	Contamination of source water	Contaminant entry via well head e.g. vandalism, flooding	No		The boreheads are sealed at the surface, although not all of them to DWSNZ standards The above ground components of the bores (sampling bollards etc) are visually for signs of damage and disrepair on a monthly basis, when ADC Water Sampling staff take bore raw water samples. Any defects are reported by exception The boreheads are assessed against DWSNZ 2005 (2008) with Bore Water Security Criterion 2	Partial	Unusual	Substantial	V High	Required improvements to bore heads to regain ”Secure” status (bore head must provide sanitary protection, plus testable backflow prevention device, plus bores raised above ground) Formalise documented findings of the 3-monthly bore headworks and underground chamber installation inspections: creation of a detailed inspection card

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**
					(wellhead sanitary security) by approved MoH engineers every 5 years The bore headworks and underground chamber installations are inspected 3-monthly and noted in the plant record book Treatment plants are locked Tinwald treatment plant is fenced and locked					
B4	Chemical contamination of source water – nitrates	Changing nitrate levels in the groundwater	No		Monthly monitoring of nitrate-nitrogen at the plants (Tinwald is above 50% of the MAV but the rest of the plants are not) Depth of groundwater means that changes are slow and can be planned for	Yes				
B5	Contamination of source water	Catastrophic failure, e.g. seismic activity disrupting the aquifer confinement or wellhead	No		Inspection of facilities following a significant earthquake Annual water chemistry profiles to determine that the water quality is relatively unchanged over time	Partial	Rare	Substantial	High	Investigate resilience of plant to natural hazards Develop site-specific Emergency Response Plan

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**
		protection			Monthly monitoring of nitrate-nitrogen in abstracted water					
B6	Insufficient water available	Drought conditions will lead to lower groundwater levels Power supply interruption Bore pump(s) failure(s)	No		Regional Council responsible for allocation of water abstraction consents and any new bores must be assessed before approved Bore water levels are monitored through SCADA and alarmed On-site generator provides a source of backup power should power failure occur Redundancy through having 8 bores supply the water reticulation Bore pump failure alarms are on SCADA so any failure will be immediately investigated Bore levels trends emailed to operational staff weekly Water restriction practices are well established Weekly plant reports – that include pump details – emailed and reviewed by staff and ACL Actions and initiatives for demand management are	Partial	Rare (to affect all 8 bores)	Medium (to affect all 8 bores)	Medium	Closer adherence to the ADC water supply bylaw Develop a schedule and carry out end to end testing of SCADA critical alarms and signals Install backup generator at Tinwald

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**
					established Yearly, ongoing leak detection programme is established					

8.2 Risk Assessment Worksheet – Treatment

The treatment at the plants consists of disinfection via liquid chlorination, and the addition of soda ash (Tinwald) or lime (other plants). The event creating the greatest risk to the drinking water-for the Ashburton 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; and
- put an alarm on the chlorine supply to let you know when the supply is running low. Maintain records so you are aware of when this might happen; always have a spare supply on hand or readily available.

Table 8.3 Risk Assessment Worksheet – Treatment

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	Online chlorine analyser – connected to SCADA with alarms for low residual chlorine Automatic standby power generation Power failure SCADA alarm Routine checks and inspections Daily *E. coli* monitoring	Partial	Unusual (all 4 treatment plants affected)	Major (all 4 treatment plants affected)	High	Install an automatically controlled chlorine dosing system – analyser, dosing pumps and associated SCADA signals Develop a schedule and carry out end to end testing of SCADA critical alarms and signals
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	Online chlorine analyser – connected to SCADA with alarms for low residual chlorine and low chlorine storage level Routine checks and inspections Sodium hypochlorite solution delivered by reputable supplier Chlorine solution is diluted to reduce rate of decay while in storage Clear instructions for refilling and diluting the chlorine solution are on site	Partial	Unusual (all 4 treatment plants affected)	Major (all 4 treatment plants affected)	High	Install an automatically controlled chlorine dosing system – analyser, dosing pumps and associated SCADA signals Develop a schedule and carry out end to end testing of critical SCADA 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**
T4	Over-chlorination (too much free available chlorine)	Dosing pump or control system malfunction.	Yes	Free chlorine	Online chlorine analyser – connected to SCADA with alarms for high residual chlorine Routine checks and inspections Dosing pump only turns on when the bore pumps are running	Partially	Unusual (all 4 treatment plants affected)	Major (all 4 treatment plants affected)	High	Install an automatically controlled chlorine dosing system – analyser, dosing pumps and associated SCADA signals Develop a schedule and carry out end to end testing of critical SCADA alarms and signals
T5	Over-chlorination (too much free available chlorine)	Incorrect dose rate or solution strength too high.	Yes	Free chlorine	Sodium hypochlorite solution delivered by reputable supplier. Experienced and trained operators Clear instructions for refilling and diluting the chlorine system are on site Calibration device for the dosing pumps installed	Partially	Unusual (all 4 treatment plants affected)	Major (all 4 treatment plants affected)	High	Install an automatically controlled chlorine dosing system – analyser, dosing pumps and associated SCADA signals Develop a schedule and carry out end to end testing of critical SCADA alarms and signals
T6	Failure to remove chemical contaminants from raw water	Treatment system inadequate.	No		Monthly monitoring of nitrate-nitrogen at the plants (Tinwald is above 50% of the MAV but the rest of the plants are not) Depth of groundwater means that changes are slow and can be planned for	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**
T7	Insufficient water available	Inadequate treatment plant capacity	No		The Ashburton Water Supply benefits from 8 separate bores supplying the scheme. The capacity of these bores is more than adequate to meet instantaneous flow rate.	Yes				
T8	Insufficient water available	Damage to plant by natural hazard	No		Redundancy available through 8 separate bores and 4 separate treatment plants Contingency plans in place for alternative supply (e.g. tankers) if necessary	Partial	Unusual (all 4 treatment plants affected)	Medium (all 4 treatment plants affected)	Medium	Investigate resilience of plant to natural hazards Develop site-specific Emergency Response Plan
T9	Inadequate protozoa inactivation	Protozoa risk not formally assigned Treatment system inadequate	It would be a yes	If treatment is required, a CCP will be developed and implemented	Not yet required	N/A				ADC is currently in a transition area with regard to protozoa. As "Secure" bore status has been lost then the supply is technically non-compliant with regards to protozoa treatment. If "Secure" status cannot be regained then protozoa treatment will be required. Also, Governmental changes may mean that "Secure" status no longer exists and protozoa treatment is required regardless. These issues are identified as risks and ADC have budgeted in the Long Term Plan accordingly for UV treatment and this will be installed ASAP

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**
T10	Chemical contamination after chemical dosing	Use of contaminated or poor-quality chemicals (chlorine, lime, soda ash)	No		Chemicals supplied by reputable supplier(s) meeting appropriate standards and certified by manufacturer. Basic water chemistry test would identify long-term contamination.	Yes	Rare	Substantial	Medium	
T11	Inadequate residual disinfection (not enough free available chlorine-equivalent due to high pH above 8)	Dosing pump or control system malfunction Incorrect dose rate or chemical strength	Yes	pH	pH continuously monitored at the treatment plant and alarms set at 8 (high) and 7 (low) FACE calculated for manual reticulation samples and low results reported to operators and council for action	Partially	Unlikely	Substantial	V High	FACE calculated and displayed via SCADA to ensure that even at values above pH 8 the FACE residual is maintained.

8.3 Risk Assessment Worksheet –Distribution

The event creating the greatest risks involved in the operation of the distribution network for Ashburton Water Supply is **contamination getting into the system**.

The most important preventive measures are:

- controlling backflow from customer connections
- making sure maintenance crews follow good hygiene and disinfection practices
- maintaining a disinfectant residual in the distribution network
- 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 8.4 Risk Assessment Worksheet – Treatment

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	Introduction of contaminants into the distribution system	Backflow from customer connections	No		Chlorine residual maintained in the distribution zone 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 Bore and booster pumps controlled by pressure set point on the network Filling stations are fitted with backflow preventers and are tested annually with records kept Ongoing and established leak detection programme	Partial	Unusual	Medium	Medium	
S2	Introduction of contaminants into the distribution system	Operation and maintenance activities	No		Contractor has documented practices and procedures for working on water supplies Contractor is experienced in working with water supplies and	Partial	Unusual	Medium	Medium	Re-audit current water hygiene practices and procedures

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**
					appropriate training is provided Chlorine residual maintained in system					
S3	Introduction of contaminants into the distribution system	Pipe materials, age and condition, plumbo-solvency	No		Customers are notified of plumbosolvency twice per year as required by DWSNZ Activity management plans and associated renewals programmes are regularly reviewed and maintained	Partial	Unusual	Medium	Medium	
S4	Introduction of contaminants into the distribution system	Damage to distribution system by natural hazards	No		Pressure maintained will help prevent ingress of foreign material Damaged sections of reticulation can be isolated	Partial	Rare	Medium	Medium	Develop site-specific Emergency Response Plan

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			*Is this a Critical Control Point (CCP)? What are the CCP Parameters?*		*Is this under control?*		*If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.*			*What could be done to improve?*
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
S5	Insufficient water available	Pump or power failure	No		Automatic standby generator onsite to maintain power supply Redundancy in the fact that 8 bores supply the water distribution Failure of Allenton Pressure Pumps only results in reduced pressure (Level of Service) and not loss of supply SCADA alarms for pump and / or power failure Weekly plant reports – that include pump details – emailed and reviewed by staff and ACL	Partial	Rare (all 8 bores affected)	Medium (all 8 bores affected)	Medium	Install backup generator at Tinwald Develop a schedule and carry out end to end testing of critical SCADA 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**
S6	Insufficient water available	Damage to distribution system e.g. water main failure, earthquake damage	No		Lifecycle management plans for pipe maintenance and renewals Damaged sections of the reticulation can be isolated Ability to tanker water in to meet demand ADC approval is required for third parties to work in the road corridor Staff trained and skilled to repair water mains as required Shutdowns are managed to avoid water pressure surges e.g. water hammer and undue damage to the existing mains Criticality analysis of the network undertaken to assist renewals planning	Partial	Rare (all 4 treatment plants affected)	Medium (all areas of the distribution affected)	Medium	Investigate resilience of plant to natural hazards Develop site-specific Emergency Response Plan

8.4 Risk Assessment Worksheet – Other

The events 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; and
- 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;
- carry out a training needs analysis – “skill gap analysis”;
- develop a training program;
- develop and budget for a training program for water supply staff; and
- link these with other components of the water supply system.

Table 8.6 Risk Assessment Worksheet – Other

List what could happen that may cause drinking-water to become unsafe (deterioration in water quality)			***Is this a Critical Control Point (CCP)? What are the CCP Parameters?***		***Is this under control?***		***If not, judge whether this needs urgent attention. Urgent attention is needed for something that happens a lot and/or could cause significant illness.***			***What could be done to improve?***
Ref	**Risk Event**	**Potential Cause of Risk Event**	**CCP?**	**CCP Parameters**	**Measures in Place to Control and/or Identify Risk Event**	**Controlled? Yes / No / Partial**	**Likelihood of Risk Event**	**Consequences of Risk Event**	**Risk Level, Urgent Attention Required?**	**Additional Measures to Control Risk Event**
O1	Incorrect water quality data used for supply management (failure to identify inadequate water quality)	Inappropriate / inadequate / incorrect sampling and reporting	No		Council have a sampling calendar for sampling compliance Staff are trained to take samples and alternate personnel are available to cover for absences Results are reported through DWO system to the Drinking Water Assessor Sampling locations are clearly labelled ADC lab is a Ministry of Health recognised laboratory	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**
O2	System does not perform as intended	Incorrect operation, inadequate maintenance	No		Operators have sound knowledge of systems Key operation instructions are displayed permanently on site Plant manuals, drawings, procedure instructions are up to date and available at the plant An operations log is kept on site Plant records are copied and filed Activity management plans and associated asset renewal programmes are regularly reviewed and maintained	Partial	Unusual (all 4 treatment plants affected)	Medium (all 4 treatment plants affected)	Medium	
O3	System does not perform as intended	Inadequate skills or training	No		Staff are qualified and experienced, and supported by an ongoing training programme Plant manuals, drawings, procedure instructions are up to date and available at the plant	Partial	Unusual (all 4 treatment plants affected)	Medium (all 4 treatment plants affected)	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**
O4	System damaged or contaminated by construction/ maintenance work	Inadequate controls on construction and maintenance work	No		All maintenance is undertaken by contractor's trained/authorised staff Construction work is appropriately supervised Carriageway Access Request (CAR) and BeforeUDig used to permit maintenance and construction works	Yes				
O5	Inability to access site(s) for operation/ maintenance/ emergency works	Flood, slip, bridge washout, snow fall or other hazard preventing vehicular access	No		Operations staff are equipped with suitable 4WD vehicles and given training in these use of these	Yes				

9 Improvements

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

The proposed improvements will provide public health benefits by reducing the risk of adverse health outcomes associated with poor drinking water quality.

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

9.1 Improvements Schedule

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

ACL = Ashburton Contracting Limited (Water Supply Operator)

Ashburton 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**
1	V HIGH	Bore & Source Abstraction	B1,B2,B3	Required improvements to bore heads to regain "Secure" status (bore head must provide sanitary protection, plus testable backflow prevention device, plus bores raised above ground)	AM	$192,500 + staff time	31/06/2020
2	V HIGH	Bore & Source Abstraction	B1,B2	Develop further understanding of the recharge zone	AM	$2,000 + staff time	Completed
3	V HIGH	Bore & Source Abstraction	B1	Survey properties within the community drinking water protection zones for any septic tanks	AM	Staff time	Completed
4	V HIGH	Bore & Source Abstraction	B1,B2,B3	Survey properties within the community drinking water protection zones for any holes or bores or any abandoned or improperly decommissioned wells	AM	Staff time	Completed
2	V HIGH	Bore & Source Abstraction	B1, B2, B3	Review results of catchment surveys and develop risk assessment and action plan	AM	Staff time	30/6/2019
5	V HIGH	Bore & Source Abstraction	B3	Formalise documented findings of the 3-monthly bore headworks and underground chamber installation inspections: creation of a detailed inspection card	AM / ACL	Staff time	30/6/2019
6	V HIGH	Treatment	T11	FACE calculated and displayed via SCADA to ensure that even at values above pH 8 the FACE residual is maintained.	AM	Staff time	31/1/2019
8	HIGH	Treatment	T9	Install UV treatment for protozoa	AM	$292,600 + staff time	30/6/2020

Ashburton 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**
9	HIGH	Bore & Source Abstraction / Treatment / Distribution	B6,T1,T2,T4,T5,S5	Develop a schedule and carry out end to end testing of SCADA critical alarms and signals	AM	$2,000 + staff time	31/12/2019
10	HIGH / MEDIUM	Bore & Source Abstraction / Treatment / Distribution	B5,T8,S6	Investigate resilience of plant to natural hazards	AM	$3,000 + staff time	30/06/2021
11	HIGH / MEDIUM	Bore & Source Abstraction / Treatment / Distribution	B5,T8,S4,S6	Develop a site-specific Emergency Response Plan	AM	$2,000 + Staff time	30/06/2021
12	MEDIUM	Bore & Source Abstraction / Distribution	B6,S5	Install backup generator at Tinwald WTP	AM	$110,000 + staff time	31/12/2019
13	MEDIUM	Distribution / Other	S2,O3	Identify and record and staff training needs	AM / ACL	Staff time	30/06/2020
14	MEDIUM	Distribution	S2	Re-audit current water hygiene practices and procedures	AM / ACL	Staff time	30/06/2021
15	MEDIUM	Distribution / Other	S2,O3	Produce an updated training record, policy and procedure	AM / ACL	Staff time	30/06/2020
	MEDIUM	Treatment	T1,T2,T4,T5	Install an automatically controlled dosing system – analyser, dosing pumps and associated SCADA signals	AM	$52,800 + staff time	30/6/2021

10 Contingency Plans

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

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

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

10.1 Insufficient Source Water Available

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

10.2 Microbiological Contamination of Source Water

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

10.3 Chemical Contamination of Source Water

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

10.4 E. coli Transgression in Water leaving the Treatment Plant

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

10.5 Over Disinfection

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

10.6 Inadequate Disinfection

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

10.7 E. coli Transgression in Water in the Distribution Zone

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

10.8 Chemical Contamination of Water in Distribution Zone

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

10.9 Insufficient Water Available in the Distribution Zone

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

10.10 Insufficient Water Available due to Unplanned Shutdown

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

11 Critical Control Points

11.1 pH Correction – Plant

Process objectives:

- Provide a **pH correction Quality Control Point** to help ensure lime or soda ash are not being overdosed, and that pH is not raised to the point where chlorine disinfection loses effectiveness

Operational monitoring of control process:	
What	pH in pH units; free available chlorine equivalent (FACe) in mg/L
When	Continuous
Where	Chlorine and pH analysers are installed at Argyle Park, Bridge Street, Domain and Tinwald treatment plants
How	Online chlorine and pH analysers
Who	ACL Operator
Records	SCADA historian

Process performance criteria at the operational monitoring point:		**Correction if operating criteria are not met:**
Target Range:	pH between 7 and 8	Operator to adjust dosing system to achieve target range if noticed to be outside of target range during routine checking procedures
Action Limits:	pH >8 or pH < 7 pH >8	Duty Operator to respond by adjusting dosing to within target limits. Duty Operator to notify Duty Supervisor Duty Operator to check FACe (available through DATRAN or manually calculated) and adjust chlorine dosing if required to maintain FACe above 0.2mg/L
Critical Limits:	FACe: < 0.25 mg/L (upon inspection or SCADA)	Duty Operator to respond by adjusting dosing to within target limits. Duty Operator to notify Duty Supervisor. Duty Supervisor to contact ADC Compliance Officer. Contingency plan 10.6 (inadequate disinfection) is to be followed.

Supporting programs:

- Monthly monitoring (or manufacturer timescales) 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 pH correction of drinking water.
- Only utilise potable water grade chemicals from approved supplier.

11.2 Chlorine Disinfection – Plant

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 equivalent (FACe) concentration in mg/L
When	Continuous
Where	Analysers are installed at Argyle Park, Bridge Street, Domain and Tinwald treatment plants
How	Online chlorine analyser
Who	ACL Operator
Records	SCADA historian

Process performance criteria at the operational monitoring point:		**Correction if operating criteria are not met:**
Target Range:	FACe: 0.4-0.6 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:	FACe: < 0.3 mg/L (upon inspection or SCADA) > 0.8 mg/L (upon inspection or SCADA)	Duty Operator to respond by adjusting dosing to within target limits[1]. Duty Operator to notify Duty Supervisor
Critical Limits:	FACe: < 0.25 mg/L (upon inspection or SCADA) > 1.0 mg/L (upon inspection)	Duty Operator to respond by adjusting dosing to within target limits[1]. Duty Operator to notify Duty Supervisor. Duty Supervisor to contact ADC Compliance Officer. Contingency plan 10.5 (over disinfection) or contingency plan 10.6 (inadequate disinfection) is to be followed.

Supporting programs:

- Monthly monitoring (or manufacturer timescales) 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 chlorination of drinking water.
- Only utilise potable water grade chlorine stock solution from approved supplier.

11.3 Chlorine Disinfection – Reticulation

Process objectives:

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

Operational monitoring of control process:	
What	Free available chlorine equivalent (FACe) concentration in mg/L
When	ADC: 22 samples/quarter ACL: weekly
Where	ADC staff: Ashburton has five reticulation sample taps, located on: Maronan Road, Tinwald; Suffolk Street, Farm Road and McNally Street, Ashburton; Huntingdon Avenue, Lake Hood. ACL operators: Sampling bollards as above
How	Hand-held pocket colorimeter with vendor-supplied reagents
Who	ADC Environmental Monitoring Officer and ACL Operator
Records	ACL: Plant log-book ADC: Water Outlook

Process performance criteria at the operational monitoring point:		**Correction if operating criteria are not met:**
Target Range:	FACe: 0.4-0.6 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:	FACe: < 0.3 mg/L (upon inspection or SCADA) > 0.8 mg/L (upon inspection or SCADA)	Duty Operator to respond by adjusting dosing to within target limits[1]. Duty Operator to notify Duty Supervisor
Critical Limits:	FACe: < 0.25 mg/L (upon inspection or SCADA) > 1.0 mg/L (upon inspection)	Duty Operator to respond by adjusting dosing to within target limits[1]. Duty Operator to notify Duty Supervisor. Duty Supervisor to contact ADC Compliance Officer. Contingency plan 10.5 (over disinfection) or contingency plan 10.6 (inadequate disinfection) is to be followed.

Supporting programs:

- Monthly monitoring (or manufacturer timescales) 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 chlorination of drinking water.
- Only utilise potable water grade chlorine stock solution from approved supplier.