GWMWater

2016/17 Water Quality Annual Report

2016/17 Annual Report for Water Quality

After an extended four year period of dry conditions, 2016/2017 has been a wetter season with above average rainfall. The above average rainfall caused minor flooding in the Region, but also provided inflows that significantly raised the reservoir and major storage levels.

Maintaining water quality in towns supplied from the Grampians catchment have been assisted by the Wimmera Mallee Pipeline that has preserved very good source water quality in Lake Bellfield, Lake Wartook and Lake Fyans. Our water treatment plants in the Northern Mallee Pipeline towns were challenged by variations in raw water especially during a Black Water event in the Murray River.

GWMWater is committed to improving water quality whether it be in meeting the regulations of the Safe Drinking Water Act 2003 in drinking water towns or maintaining the aesthetics in regulated water towns. The improvements in water quality are evidenced by the decrease in the number of customer complaints relating to water quality.

The challenges of GWMWater and the work done by GWMWater to address these challenges has been recognised by the water industry. Four technical papers focused on improving and managing water quality were presented at the Australian Water Association's International Water Conference, OzWater in May 2017. GWMWater also received an invitation and presented at an international conference, the Pacific Water and Wastewater Conference in Samoa, on an innovative treatment process for managing and improving water quality for regulated supplies.

During the year GWMWater completed the installation of PAC dosing at the Mt Zero Water Treatment Plant. In recent times Horsham and Natimuk have had incidences in mid-summer through to early autumn of musty, earthy taste and odour due to the presence of 2-methylisoborneol (MIB). MIB in drinking water supplies does not pose adverse health effect but does make the water less palatable.

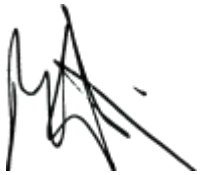
Challenges exist with another taste and odour compound, geosmin in the St. Arnaud water supply which GWMWater is monitoring to assess the extent of the issue and potential future solutions.

Nitrification has been occurring seasonally in the Willaura - Lake Bolac reticulation system which leads to a deterioration in water quality over time. A chlorine clean was conducted in the reticulation system in response to this nitrification. The chlorine clean assisted in improving the water quality and improving the disinfectant residual in the water supplied, and removed microbiology in the reticulation system.

Of GWMWater's 32,700 urban customers, 91% are now in receipt of a drinking water supply from drinking water treatment facilities that are consistent with the Safe Drinking Water Regulations 2015 of the Safe Drinking Water Act 2003.

During the year, GWMWater commenced fluoridation of the Ararat water supply as part of the broader oral hygiene public health program run by the Department of Health and Human Services. The Department of Health and Human Services approved the commissioning of the Ararat Fluoride Dosing Plant under Section 6(2) of the Health (Fluoridation) Act 1973 and fluoridation commenced in August 2016.

GWMWater continues to provide sustainable water for regional growth, a healthy environment and vibrant communities through understanding our customer needs and strong partnerships with stakeholders and suppliers. We will be proactive and adaptive to meet the challenges and mitigate the impact of climate change through innovative and affordable solutions to provide safe drinking water. These initiatives ultimately support regional growth and promote the liveability of our communities.



Mark Williams
Managing Director

Section 23 of the Safe Drinking Water Act 2003 requires Grampians Wimmera Mallee Water Corporation (GWMWater) to make available for inspection by the public the results of any water quality monitoring program conducted on any drinking water supplied by GWMWater. Customers and members of the public may access drinking water quality data by contacting GWMWater either by telephone on 1300 659 961 or by the internet at www.gwmwater.org.au.

Revision	Revision Date	Details	Authorised
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2	16 August 2017	Water Regulation review	Mark Ferguson
3	22 August 2017	Department of Health and Human Services review	Cameron Laidlaw
4	7 September 2017	Executive Manager Infrastructure review	Robert Atkin
5	9 October 2017	Review by Senior Leadership Team	Senior Leadership Team
6	24 October 2017	Managing Director review and sign off	Mark Williams
7	26 October 2017	Final copy to Department of Health and Human Services	

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1 Introduction

Grampians Wimmera Mallee Water Corporation (trading as GWMWater) is a government-owned corporation, created by an order of the Victorian Government under the *Water Act* 1989. On 1 July 2004, GWMWater assumed the responsibilities of the predecessor organisations Grampians Water and Wimmera Mallee Water. The vision and mission of GWMWater are:

Vision
'Sustainable water for regional growth, a healthy environment and vibrant communities.'

Mission
'Providing innovative and affordable services through partnerships with stakeholders, customers and the community.'

GWMWater provides water supplies to a population of around 58,000 urban customers living in 71 urban areas throughout the region. Domestic and stock water supplies are provided to 11,000 rural customers living throughout the region. The region covers an area of 62,000 km^2, with a population density of less than one person/km^2.

GWMWater employs approximately 178 people throughout its operational region, with the corporate office being located in Horsham, Victoria.

1.1 *Safe Drinking Water Act* 2003

1.1.1 Background

The *Safe Drinking Water Act* 2003 (the Act) and the Safe Drinking Water Regulations 2015 (the Regulations) is the legislative framework for assuring drinking water quality in Victoria.

The Act is based on:
a) Adoption of 'catchment-to-tap' risk management obligations.
b) Standards are applicable to all drinking water samples for key water quality criteria.
c) Information disclosure obligations for water suppliers.
d) Adoption of systemic community consultation processes.

This approach is consistent with regulatory best practice for the management of complex and inter-dependent risks.

1.1.2 Purpose and Outline

The Act:

a) Requires water suppliers and water storage managers to prepare and implement Risk Management Plans (RMP) to manage risk in relation to drinking water and some types of non-potable water.
b) Provides for the auditing of those plans by approved auditors.
c) Requires water suppliers to ensure that the drinking water they supply meets quality standards specified by the regulations.
d) Requires water suppliers to disclose to the public information concerning the quality of drinking water.
e) Provides for the variation, after community consultation, of water quality standards that relate only to aesthetic factors.
f) Requires the reporting of known or suspected contamination of drinking water to the Department of Health and Human Services (DHHS).

1.1.3 Definitions

The Act provides the following definitions for water quality classification:

Drinking Water
Water that is intended for human consumption or for purposes connected with human consumption, such as the preparation of food or the making of ice for consumption or for the preservation of unpackaged food, whether or not the water is used for other purposes.

Regulated Water
Regulated water is defined as water that is not drinking water but may in circumstances be mistaken as being drinking water according to Section 6 (2) in the Act.

1.1.4 Safe Drinking Water Regulations 2015

This annual report includes the specific requirements from the Regulations.

The objective of the Regulations is to give effect to key aspects of the Act. In particular, the Regulations:

a) Specifies the major elements to be incorporated in risk management plans.
b) Specifies the standards relating to the quality of drinking water supplied to customers by water suppliers.
c) Specifies criteria for approval of auditors.
d) Specifies details to be included in annual reports.

1.2 Australian Drinking Water Guidelines 2011

The Australian Drinking Water Guidelines 2011 (ADWG) (updated November 2016) provide a framework for the management of drinking water supplies and is designed to assure safety at point of use. The ADWG has been developed after consideration of the best available scientific evidence.

The ADWG provides an authoritative reference of what comprises safe, good quality water, how it can be achieved and how it can be assured. The ADWG is concerned with both health and aesthetic quality.

The ADWG is the authoritative reference of what constitutes safe, good quality water, and aligns with the Victorian's Safe Drinking Water Regulatory Framework. They are consistent with the Act, and provide a basis for determining the quality of water to be supplied to consumers in all parts of Australia. These determinations need to consider the diverse array of regional or local factors, and take into account economic, political and cultural issues, including customer expectations and willingness and the ability to pay.

The ADWG are intended for use by the Australian community and all agencies with responsibilities associated with the supply of drinking water, including catchment and water resource managers, drinking water suppliers, water regulators and health authorities.

1.3 Characterisation of the System

GWMWater's operational area is shown in Figure 1. Key components of the water supply system include:

1.3.1 Headworks system, comprising the area in and around the Grampians Ranges and the Wimmera River. The main storages are Lake Bellfield, Taylors Lake, Lake Wartook and Rocklands Reservoir. Total catchment area is 400,000 hectares with a maximum reservoir operating capacity of 522,000 megalitres.

1.3.2 GWMWater provides water to the majority of towns through two extensive pipeline systems.

a) The Wimmera Mallee Pipeline (WMP) system, as follows:

- Supply Systems 1,2,3 4 and 6, which originate from the Grampians headworks and consists of approximately 7,300 kilometres of pipeline; and

- Supply System 5, which draws water from the Murray River and consists of approximately 1,800 kilometres of pipeline.

b) The Northern Mallee Pipeline (NMP) system consisting of 3,200 kilometres of pipeline which also draws water from the Murray River.

1.3.3 A total of 1,221 kilometres of reticulation pipeline servicing the 71 urban water supplies.

1.3.4 Twenty-nine towns receive water that is classified as drinking water (Table 1-1). Of these 29 towns, 28 receive fully treated water, and one receives disinfection only.

The fully treated water is supplied by 15 water treatment plants owned and operated by GWMWater, and a further four water treatment plants operated under a Build, Own, Operate and Transfer (BOOT) agreement. These BOOT plants are located at Halls Gap, Ararat, Great Western and Stawell, and are operated by Trility as of 23 June 2014, an independent private sector owner and operator.

The one disinfection only urban water supply that is classified as drinking water is Sea Lake.

1.3.6 GWMWater also supplies regulated water to 42 towns (Table 1-2). These supplies are harvested from a range of sources, including surface water and groundwater. The water is not put through any form of treatment and consequently is not intended for human consumption and is not fit for drinking or food preparation.

1.4 Source of Water

GWMWater sources water from a range of surface water catchments, rivers and groundwater aquifers across the region. Table 1-1 and Table 1-2 provide a summary of the source waters by water supply for both drinking water and regulated water.

Figure 1 - GWMWater's Operational Area.

Table 1-1 - Water Source for Drinking Water Supplies.

Water Supply	Source Water	Raw Storage	Treatment Plant	Population
Ararat	Surface water (Lake Fyans, Mt Cole Reservoir, Langi Ghiran Reservoir)	Copes Hill and Olivers Gully earthen storages	Ararat WTP	8,297
Birchip	Grampians Headworks (WMP)	1 x lined earthen storages	Birchip WTP	702
Charlton	Grampians Headworks (WMP)	1 x lined earthen storages	Charlton WTP	1,050
Dimboola	Grampians Headworks (WMP)	2 x lined earthen storages	Dimboola WTP	1,730
Donald	Grampians Headworks (WMP)	2 x lined steel tanks	St Arnaud WTP	1,498
Edenhope	Groundwater (bores)	N/A – Feed directly fed from bores	Edenhope WTP	946
Great Western	Surface water (Lake Fyans)	Verrings Basin earthen storage	Great Western WTP	400
Halls Gap	Surface water (Lake Bellfield, Dairy Creek)	Lake Bellfield and Dairy Creek earthen storages	Halls Gap WTP	430
Hopetoun	Grampians Headworks (WMP)	1 x lined earthen storages	Hopetoun WTP	739
Horsham	Surface and bore water (Lake Wartook and Laharum Bores)	1 x lined earthen storages	Mt Zero WTP	14,543
Jeparit	Grampians Headworks (WMP)	2 x lined steel tanks	Rainbow WTP	477
Lake Bolac	Surface water (Mt William Creek, Stony Creek, Masons Creek) & Groundwater (bores)	2 x lined earthen storages at Willaura and Mt Pleasant	Willaura WTP	330
Manangatang	Surface water (Murray River via NMP)	N/A – Feed directly via Piangil Pipeline from Murray River	Manangatang WTP	309
Minyip	Grampians Headworks (WMP)	2 x poly lined steel tanks	Murtoa WTP	524
Murtoa	Grampians Headworks (WMP)	1 x lined earthen storages	Murtoa WTP	865
Natimuk	Surface and bore water (Lake Wartook and Laharum bores)	1 x lined steel tank	Mt Zero WTP	514
Nhill	Surface water Grampians Headworks (WMP)	2 x lined steel storages elevated tank	Dimboola WTP	2,184
Ouyen	Surface water (Murray River via NMP)	2 x earthen storages	Ouyen WTP	1,191
Pomonal	Surface water (Lake Bellfield, Dairy Creek)	1 x concrete tank	Halls Gap WTP	322

Water Supply	Source Water	Raw Storage	Treatment Plant	Population
Quambatook	Surface water (Goulburn & Loddon Rivers) via Normanville Pipeline	1 x earthen storage	Quambatook WTP	249
Rainbow	Grampians Headworks (WMP)	2 x lined earthen storages	Rainbow WTP	683
Rupanyup	Grampians Headworks (WMP)	2 x poly lined steel tanks	Murtoa WTP	536
Sea Lake	Surface water (Murray River via NMP)	2 x earthen storages	Sea Lake chlorinator	640
St Arnaud	Grampians Headworks (WMP)	Volcano storage, lined 720 ML capacity St Arnaud, earthen storage of 1,000 ML capacity	St. Arnaud WTP	2,193
Stawell	Surface water (Lake Fyans, Lake Bellfield, Fyans Creek)	3 x earthen storages totalling 505.4 ML capacity	Stawell WTP	6,032
Underbool	Surface water (Murray River via NMP)	2 x earthen storages	Underbool WTP	215
Warracknabeal	Grampians Headworks (WMP)	2 x lined earthen storages	Warracknabeal WTP	2,438
Willaura	Surface water (Mt William Creek, Stony Creek, Masons Creek) and Groundwater (bores)	2 x earthen storages at Willaura and Mt Pleasant	Willaura WTP	530
Wycheproof	Grampians Headworks (WMP)	2 x poly lined steel tanks	Charlton WTP	635

N/A Not Available
Water Treatment Plant (WTP)
WMP – Wimmera Mallee Pipeline
NMP – Northern Mallee Pipeline

Table 1-2 - Water Source for Regulated Water Supplies.

Water Supply	Source Water	Raw Water Storage	Population
Antwerp	Grampians Headworks (WMP)	2 x poly lined steel tanks	23
Apsley	Groundwater (bores)	elevated steel tank	277
Berriwillock	Surface water (Murray River via NMP)	2 x earthen storages	184
Beulah	Grampians Headworks (WMP)	2 x poly lined steel tanks	329
Brim	Grampians Headworks (WMP)	2 x poly lined steel tanks	171
Buangor	Surface water (McLeods Creek)	1 x earthen storage	103
Chillingollah	Surface water (Murray River via NMP)	1 x earthen storage	5
Chinkapook	Surface water (Murray River via NMP)	concrete tank	32
Cowangie	Groundwater (bores)	elevated tank	36
Culgoa	Surface water (Murray River via NMP)	1 x earthen storage	101
Dooen	Grampians Headworks (WMP)	2 x poly tanks	240
Elmhurst	Surface water (Hickmans Creek)	1 x earthen storage	183
Glenorchy	Grampians Headworks (WMP)	2 x elevated steel tanks	125
Goroke	Groundwater (bores)	2 x elevated steel tanks	299
Harrow	Groundwater (bores) & surface water (Glenelg River)	1 x earthen storage, elevated steel tank	200
Jung	Grampians Headworks (WMP)	2 x poly lined steel tanks	241
Kaniva	Groundwater (bores)	Elevated concrete tank	803
Kiata	Groundwater (bores)	2 x concrete tanks	62
Lalbert	Surface water (Murray River via NMP)	2 x poly lined steel tanks	151
Lascelles	Grampians Headworks (WMP)	2 x lined steel tanks	93
Lillimur	Groundwater (bores)	elevated steel tank	110

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Water Supply	Source Water	Raw Water Storage	Population
Marnoo	Grampians (bores)	1 x earthen storage	122
Miram	Groundwater (bores)	elevated steel tank	40
Moyston	Surface water (Mt William, Stony and Masons Creeks) and Groundwater (bores)	1 x earthen storage	348
Murrayville	Groundwater (bores)	elevated tank	280
Nandaly	Surface water (Murray River via NMP)	concrete tank	39
Nullawil	Surface water (Murray River via NMP)	2 x lined steel tanks	93
Patchewollock	Surface water (Murray River via NMP)	2 x earthen storages	133
Pimpinio	Grampians Headworks (WMP)	2 x lined earthen storages elevated tank storage	184
Serviceton	Groundwater (bores)	elevated steel tank	120
Speed	Surface water (Murray River via NMP)	concrete tank	78
Streatham	Groundwater (bores)	1 x earthen storage	156
Tarranyurk	Grampians Headworks (WMP)	2 x lined steel tanks	30
Tempy	Surface water (Murray River via NMP)	1 x steel and 1 x concrete tanks	57
Ultima	Surface water (Murray River via NMP)	2 x poly lined steel tanks	174
Waitchie	Surface water (Murray River via NMP)	concrete tank	48
Walpeup	Surface water (Murray River via NMP)	2 x earthen storages	158
Watchem	Grampians Headworks (WMP)	2 x poly lined steel tanks	114
Westmere	Groundwater (bores)	1 x earthen storage	40
Wickliffe	Surface water (Mt William, Stony and Masons Creeks) and Groundwater (bores)	1 x earthen storage	113
Woomelang	Grampians Headworks (WMP)	2 x poly lined steel tanks	201
Yaapeet	Grampians Headworks (WMP)	2 x poly lined steel tanks	84

WMP – Wimmera Mallee Pipeline
NMP – Northern Mallee Pipeline

2 Quality Management System

2.1 Water Treatment

The water treatment processes utilised at the drinking water treatment plants are shown in Table 2-1.

2.2 Water Treatment Changes

In this reporting period, fluoride has been added as part of the water treatment process at the Ararat Water Treatment Plant (WTP). The DHHS approved the Ararat Fluoride Dosing Plant under Section 6(2) of the *Health (Fluoridation) Act* 1973 and fluoridation commenced in August 2016. Refer to Section 3.4.10 for further information.

As part of GWMWater's water treatment improvements, the coagulant was changed from aluminium sulphate (Alum) to aluminium chlorohydrate (Megapac 23) in August 2016 at the Horsham WTP. Since the change, the need for raw water pH adjustment has been eliminated and decrease the usage of coagulant.

Horsham and Natimuk receives water from Mt Zero WTP. The raw water storages at Mt Zero WTP experience seasonal elevated levels of the taste and odour compound 2-methylisorborneol (MIB), usually between spring and summer. As a result, the drinking water has a musty odour and earthy taste. MIB does not pose as an adverse health effects but leads to customer complaints and dissatisfaction with the aesthetic quality of drinking water. After detailed studies and consideration by GWMWater, powdered activated carbon (PAC) dosing was introduced to the WTP as an additional treatment step in January 2017. PAC is aimed to remove MIB and improve the drinking water quality. The addition of PAC will be seasonal or as required. Customers were informed of the additional water treatment process.

A chlorine clean was conducted in Willaura and Lake Bolac to combat nitrification in the system, and as such the system was changed from a chloraminated to chlorinated system temporarily from September to November 2016. The chlorine clean of the reticulation system assisted in improving the disinfectant residual in the drinking water supply, and removed microbiology in the reticulation system. Drinking water trailers were placed at Willaura and Lake Bolac during this time. Customers were informed prior to the chlorine clean and were updated until the system was reverted to back to chloramination.

Table 2-1 - Water Treatment Processes and Chemicals in Drinking Water Towns.

Water Sampling Localities	Treatment Processes	Chemicals used in Treatment	Comments
Ararat*^	Coagulation, flocculation, dissolved air flotation, filtration, disinfection, pH correction, fluoridation	Lime, potassium permanganate, powder activated carbon, aluminium sulphate, polymer, chlorine, fluorosilicic acid	Fluoridation commenced (August 2016)
Birchip*	Coagulation, flocculation, dissolved air flotation, filtration, disinfection, pH correction	Sulphuric acid, aluminium chlorohydrate, polymer, chlorine	
Charlton*	Coagulation, flocculation, dissolved air flotation, filtration, disinfection, pH correction	Sulphuric acid, aluminium chlorohydrate, polymer, chlorine	
Dimboola*	Coagulation, flocculation, dissolved air flotation, filtration disinfection, pH correction	Sodium hydroxide, aluminium chlorohydrate, polymer, chlorine	
Donald	Receives water from St Arnaud WTP, booster disinfection	Chlorine	
Edenhope*	Coagulation, flocculation, dissolved air flotation, filtration, desalination, disinfection	Aluminium chlorohydrate, polymer, antiscalant, chlorine	
Great Western*^	Microfiltration, disinfection, pH correction	Sulphuric acid, polyaluminium chloride, polymer, sodium hydroxide, chlorine	
Halls Gap*^	Coagulation, flocculation, dissolved air flotation, filtration, disinfection, pH correction	Lime, aluminium sulphate, polymer, chlorine	
Hopetoun*	Coagulation, flocculation, dissolved air flotation, filtration, disinfection, pH correction	Soda ash, aluminium chlorohydrate, polymer, chlorine	
Horsham*	Powdered activated carbon dosing, coagulation, flocculation, dissolved air flotation, filtration, disinfection, pH correction, fluoridation	Lime, aluminium chlorohydrate, polymer, chlorine, carbon dioxide, fluorosilicic acid	Powdered activated carbon dosing unit installed (January 2017) Changed coagulant (August 2016)
Jeparit	Receives water from Rainbow WTP, booster disinfection	Chlorine	

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Water Sampling Localities	Treatment Processes	Chemicals used in Treatment	Comments
Lake Bolac	Receives water from Willaura	-	Changed chlorine disinfection method from chloramination to chlorination at Willaura WTP to reduce nitrification (September to November 2016).
Manangatang*	Coagulation, flocculation, multimedia filtration, microfiber filtration (2 µm), disinfection	Ultrion 44560 coagulant, chlorine	
Minyip	Receives water from Murtoa WTP, booster disinfection	Chlorine	
Murtoa*	Coagulation, flocculation, dissolved air flotation, filtration, pH correction, disinfection	Sodium hydroxide, Aluminium chlorohydrate, polymer, chlorine	
Natimuk	Receives water from Horsham, booster disinfection	Chlorine	
Nhill	Receives water from Dimboola, booster disinfection	Chlorine	
Ouyen*	Microfiltration, disinfection	Aluminium chlorohydrate, chlorine	
Pomonal	Receives water from Halls Gap, booster disinfection	Chlorine	
Quambatook*	Coagulation, flocculation, dissolved air flotation, filtration, granular activated carbon filtration, pH correction, disinfection	Aluminium chlorohydrate, hydrochloric acid, chlorine	
Rainbow*	Coagulation, flocculation, dissolved air flotation, filtration, disinfection	Aluminium chlorohydrate, chlorine	
Rupanyup	Receives water from Murtoa WTP, booster disinfection	Chlorine	
Sea Lake*	Disinfection Only	Chlorine	

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Water Sampling Localities	Treatment Processes	Chemicals used in Treatment	Comments
St Arnaud*	Coagulation, flocculation, dissolved air flotation, filtration, pH correction, disinfection	Aluminium chlorohydrate, polymer, sodium hydroxide, chlorine	
Stawell*^	Coagulation, flocculation, dissolved air flotation, filtration, disinfection, pH correction	Lime, aluminium sulphate, polymer, chlorine	
Underbool*	Coagulation, flocculation, sand filters, pH correction	Hydrochloric acid, Ultrion 44560 coagulant, chlorine	
Warracknabeal*	Coagulation, flocculation, dissolved air flotation, filtration, pH correction, disinfection	Lime, aluminium chlorohydrate, chlorine	
Willaura*	Coagulation, flocculation, microfiltration, pH correction, disinfection	Soda ash, calcite, aluminium chlorohydrate, sodium hypochlorite, carbon dioxide, ammonia	Changed chlorine disinfection method from chloramination to chlorination to reduce nitrification (September to November 2016).
Wycheproof	Receives water from Charlton WTP, booster disinfection	Chlorine	

^ *Operated by Trility under a BOOT Contract*
* *Localities with Water Treatment Plant*

Table 2-2 - Water Treatment Processes and Chemicals in Regulated Towns.

Water Supply	Treatment Processes	Chemicals used in Treatment
Berriwillock	Coagulation	Polydadmac
Beulah	Coagulation, disinfection	Polydadmac, chlorine
Brim	Coagulation, disinfection	Polydadmac, chlorine, ammonia
Culgoa	Coagulation	Polydadmac
Glenorchy	Coagulation	Polydadmac
Jung	Coagulation, disinfection	Polydadmac, chlorine
Lalbert	Coagulation, disinfection	Polydadmac, chlorine
Lascelles	Coagulation	Polydadmac
Marnoo	Coagulation	Polydadmac
Nullawil	Coagulation, disinfection	Polydadmac, chlorine
Ultima	Coagulation, disinfection	Polydadmac, chlorine
Walpeup	Disinfection	Chlorine
Watchem	Coagulation, disinfection	Polydadmac, chlorine
Woomelang	Coagulation, disinfection	Polydadmac, chlorine
Yaapeet	Coagulation	Polydadmac

3 Drinking Water Quality Results

For the period 1 July 2016 to 30 June 2017, the sampling frequency of the drinking water quality standards, *Escherichia coli*¸ Trihalomethanes and turbidity is specified in Schedule 2 under the Regulations applied (Table 3-1). The water quality standards are discussed further below.

The Water Sampling Program for the entire region is risk based and is determined by specific risks in those water distribution systems, from catchment to tap. The water sampling points are located within a water sampling locality and are designed to ensure that the samples collected are representative of the supply system. The sampling program is reviewed on a regular basis to align with changes in the risk profile of each locality. Samples are sent to NATA accredited laboratory for analysis.

Regulation 6 of the Regulations states that a water sampling locality is:

- An area supplied with drinking water.
- A discrete area of similar water quality – generally water entering the area is supplied form a common source.
- Inclusive of all consumers supplied with drinking water of similar water quality.
- Able to be described by its boundaries.

In February 2017, the Nhill water sampling locality was extended to include a sampling point where a food processer was receiving drinking water from the Nhill reticulation system. Nhill customers receive drinking water from Dimboola WTP.

Table 3-1 – Summary of Water Quality data for 1 July 2016 to 30 June 2017.

Parameter	Sampling frequency	Benchmark compliance standard	All Standard met	Comments
Escherichia coli (*E.coli*)	Weekly	No *Escherichia coli* per 100 mL of drinking water, with the exception of any false positive samples.	Yes	All localities were compliant for the period. Refer to Section 3.1 for details.
Trihalomethanes (THM)	Monthly	Must not exceed 0.25 mg/L.	No	Four localities were not compliant for the period. Refer to Section 3.2 for details.
Turbidity	Weekly	95th percentile of results for samples in any 12 months must be ≤ 5.0 NTU.	Yes	All localities were compliant for the period. Refer to Section 3.3 for details.

3.1 *Escherichia coli* (*E. coli*)

The health impacts and epidemiology of thermotolerant coliforms, and specifically *E. coli,* are described in detail in the ADWG fact sheet.

E. coli is used as a specific indicator of faecal contamination and hence is a measure used to determine the safety of water for drinking. *E. coli* should not be detected in a sample of drinking water. If detected, immediate action is taken.

As required by the Regulations, one sample of drinking water collected each week per water sampling locality is required. All samples of drinking water collected in any 12 months period must contain no *E. coli* per 100 mL, with the exception of any false positive sample.

3.1.1 Results

All sites met the standard for the reporting period of 2016/2017 (Table 3-2).

There were no missed samples for *E. coli* during the reporting period.

Table 3-2 – Results for Escherichia coli in Drinking Water: 1 July 2016 – 30 June 2017. All samples of drinking water collected in any 12 months period must contain no E.coli/100 mL, with the exception of any false positive sample.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		No. of samples where standard was not met (S18)
			Max	Average	
Ararat*	Twice-weekly	104	0	0	0
Birchip	Weekly	52	0	0	0
Charlton	Weekly	52	0	0	0
Dimboola	Weekly	52	0	0	0
Donald	Weekly	52	0	0	0
Edenhope	Weekly	52	0	0	0
Great Western	Weekly	52	0	0	0
Halls Gap	Weekly	52	0	0	0
Haven[Δ]	Weekly	52	0	0	0
Hopetoun	Weekly	52	0	0	0
Horsham*	Twice-weekly	104	0	0	0
Jeparit	Weekly	52	0	0	0
Lake Bolac	Weekly	52	0	0	0
Manangatang	Weekly	52	0	0	0
Minyip	Weekly	52	0	0	0
Murtoa	Weekly	52	0	0	0
Natimuk	Weekly	52	0	0	0
Nhill	Weekly	63	0	0	0
Ouyen	Weekly	52	0	0	0
Pomonal	Weekly	52	0	0	0
Quambatook	Weekly	52	0	0	0
Rainbow	Weekly	52	0	0	0
Rupanyup	Weekly	52	0	0	0
Sea Lake	Weekly	52	0	0	0
St. Arnaud	Weekly	52	0	0	0
Stawell*	Twice-weekly	104	0	0	0
Underbool	Weekly	52	0	0	0
Warracknabeal	Weekly	52	0	0	0
Willaura	Weekly	52	0	0	0
Wycheproof	Weekly	52	0	0	0

* *Due to the population size of these towns two samples are taken every month.*

Δ *Included as part of the Horsham locality.*

3.2 Trihalomethanes (THMs)

Trihalomethanes (THMs) are present in drinking water, principally as the result of a reaction between organic and inorganic material in the water with chlorine, and to a lesser extent chloramines.

Based on health considerations, the concentration of THMs, either individually or in total, in drinking water should not exceed 0.25 mg/L. The ADWG stated that THM concentrations fluctuating occasionally up to 1.0 mg/L are unlikely to pose a significant health risk.

3.2.1 Results

THM sampling and analysis was undertaken on a minimum monthly basis for all drinking water supplies (Table 3-3).

There were seven exceedances in this reporting period, one in Willaura and Sea Lake, two in Lake Bolac and three in Great Western.

There were no missed samples for THM during the reporting period.

3.2.2 Actions Undertaken in relation to values outside the guidelines.

Willaura and Lake Bolac experience seasonal nitrification, resulting in a loss of disinfectant residual, increase in plate counts indicating microbial growth in the reticulation, lowering of the pH and alkalinity of the drinking water, and formation of nitrite and nitrate. The 2015/2016 summer had one of the highest average summer temperatures for the region. A combination of high temperatures and free ammonia in the network, enabled nitrification to take hold in the drinking water reticulation system.

Control measures such as minimising residence time in tanks, increasing the disinfectant dose at the WTP, and flushing were conducted prior to chlorine clean, but with little effect. Hence, a chlorine clean was conducted by GWMWater between September to November 2016 to remediate the water quality in Willaura and Lake Bolac.

Disinfection method was changed from chloramination to chlorination from 9 September to 15 November 2016. During the period, rainfall was above average causing an increase of organic matter and colour in the raw water. Willaura WTP is a membrane plant with low organic and colour removal capacity, and the addition of chlorine led to formation of THM. The concentration of THM for both the towns decreased to normal levels (< 0.25 mg/L), after the chlorine clean was completed, and the system was reverted back to chloramination.

One THM exceedance occurred in Sea Lake in December 2016. The colour in the source water was increasing due to the above average rainfall in 2016. The Sea Lake WTP is a disinfection only plant and was therefore unable to remove organic carbon from the raw water. Upgrades to the Sea Lake treatment process are currently in the planning stage.

Three THM exceedances in Great Western in December 2016, February and March 2017. Great Western WTP is a membrane plant and has limited capacity for removal of colour. The above average rainfall in 2016 resulted in higher colour and flow in of organic matter in the raw water and chlorine was reacting with the organic material and produce THM. Water treatment was optimised and coagulant dosing was adjusted appropriately to minimise THM formation. Flushing and resampling in multiple locations was conducted.

Table 3-3 – Results for Trihalomethanes in Drinking Water: 1 July 2016 – 30 June 2017. The concentration of THM should not exceed 0.25 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		No. of samples where standard was not met	Comments
			Max	Average		
Ararat*	Twice-monthly	24	0.14	0.08	0	
Birchip	Monthly	12	0.06	0.05	0	
Charlton	Monthly	12	0.10	0.07	0	
Dimboola	Monthly	12	0.10	0.07	0	
Donald	Monthly	12	0.12	0.10	0	
Edenhope	Monthly	12	0.13	0.08	0	
Great Western	Monthly	12	0.45	0.21	3	Higher colour and flow in of organic matter in the raw water and chlorine was reacting with the organic material and produce THM.
Halls Gap	Monthly	12	0.09	0.07	0	
Haven$^{\Delta}$	Monthly	12	0.18	0.12	0	
Hopetoun	Monthly	12	0.08	0.06	0	
Horsham*	Twice-monthly	24	0.18	0.13	0	
Jeparit	Monthly	12	0.10	0.07	0	

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Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		No. of samples where standard was not met	Comments
			Max	Average		
Lake Bolac	Monthly	12	0.41	0.07	2	THM exceedances in Lake Bolac and Willaura occurred during the chlorine clean when the disinfection method changed from chloramination to chlorination to reduce nitrification.
Manangatang	Monthly	12	0.24	0.09	0	
Minyip	Monthly	12	0.11	0.09	0	
Murtoa	Monthly	12	0.12	0.08	0	
Natimuk	Monthly	12	0.21	0.16	0	
Nhill	Monthly	12	0.08	0.07	0	
Ouyen	Monthly	12	0.24	0.14	0	
Pomonal	Monthly	13	0.09	0.07	0	
Quambatook	Monthly	12	0.13	0.11	0	
Rainbow	Monthly	12	0.07	0.05	0	
Rupanyup	Monthly	12	0.14	0.08	0	
Sea Lake	Monthly	12	0.26	0.14	1	Disinfection only plant and was therefore unable to remove organic carbon from the raw water.
St Arnaud	Monthly	12	0.08	0.06	0	
Stawell*	Twice-monthly	24	0.09	0.07	0	
Underbool	Monthly	12	0.09	0.06	0	
Warracknabeal	Monthly	12	0.11	0.08	0	
Willaura	Monthly	12	0.29	0.05	1	THM exceedances in Lake Bolac and Willaura occurred during the chlorine clean when the disinfection method changed from chloramination to chlorination to reduce nitrification.
Wycheproof	Monthly	12	0.08	0.08	0	

* *Due to the population size of these towns two samples are taken every month.*

Δ *Included as part of the Horsham locality.*

3.3 Turbidity

Turbidity is caused by the presence of very fine suspended matter, such as clay, silt, colloidal particles, plankton and other microscopic organisms in water. High turbidity can result in a water sample having a 'muddy' or 'milky' appearance.

Turbidity is a measurement of the light scattering property of water, and the degree of scattering is dependent on the amount, size and composition of the suspended matter.

The ADWG fact sheet contains a detailed account of turbidity and its implications for water supply. The Regulations require that the 95th percentile of results for samples in any 12-month period must not exceed five Nephelometric Turbidity Units (NTU).

3.3.1 Results

Turbidity sampling and analysis undertaken on a minimum weekly basis for all drinking water supplies (Table 3-4).

There were no missed samples for turbidity during the reporting period.

Table 3-4 – Results for turbidity in Drinking Water: 1 July 2016 – 30 June 2017.

Sampling Locality	Sampling Frequency	No. of Samples	Results (NTU)		
			Max	Max 95th percentile in any 12 months	No. of 95th percentile of results in any 12 months above standard (S18)
Ararat*	Twice-weekly	104	1.20	0.20	0
Birchip	Weekly	52	0.40	0.20	0
Charlton	Weekly	52	0.60	0.30	0
Dimboola	Weekly	52	0.20	0.20	0
Donald	Weekly	52	0.50	0.30	0
Edenhope	Weekly	52	0.70	0.30	0
Great Western	Weekly	52	0.40	0.10	0
Halls Gap	Weekly	52	0.30	0.25	0
Haven^Δ	Weekly	52	0.80	0.30	0
Hopetoun	Weekly	52	0.60	0.30	0
Horsham*	Twice-weekly	104	1.90	0.30	0
Jeparit	Weekly	52	0.50	0.20	0
Lake Bolac	Weekly	52	0.80	0.45	0
Manangatang	Weekly	52	2.20	1.19	0
Minyip	Weekly	52	0.60	0.20	0

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Sampling Locality	Sampling Frequency	No. of Samples	Results (NTU)		
			Max	Max 95th percentile in any 12 months	No. of 95th percentile of results in any 12 months above standard (S18)
Murtoa	Weekly	52	0.50	0.30	0
Natimuk	Weekly	52	0.50	0.25	0
Nhill	Weekly	52	0.30	0.20	0
Ouyen	Weekly	52	0.30	0.15	0
Pomonal	Weekly	52	0.60	0.30	0
Quambatook	Weekly	52	0.50	0.35	0
Rainbow	Weekly	52	2.90	0.30	0
Rupanyup	Weekly	52	1.10	0.50	0
Sea Lake	Weekly	52	5.50	4.51	0
St Arnaud	Weekly	52	0.70	0.40	0
Stawell*	Twice-weekly	104	0.60	0.20	0
Underbool	Weekly	52	0.30	0.20	0
Warracknabeal	Weekly	52	1.90	0.20	0
Willaura	Weekly	52	0.60	0.25	0
Wycheproof	Weekly	52	0.50	0.25	0

* *Due to the population size of these towns two samples are taken every week.*

Δ *Included as part of the Horsham locality.*

3.4 Other Algae, Pathogen, Chemical or Substances

Regulation 12(b) requires the water supplier to ensure that the drinking water supplied to customers does not contain any chemical, toxin, pathogen or other substance at the levels that may pose a risk to human health. The ADWG fact sheet contains a detailed account of other water quality standard and its implications for water supply.

3.4.1 Algae, pesticides and radiological parameters

Pesticides, algae or radiological parameters were tested in raw water storage and reservoir. All the test results obtained were below the limit of detection. The sampling of these parameters is risk-based. No algae, pesticides and radiological samplings was conducted in drinking water supplied in 2016/2017.

3.4.2 Chlorine

Chlorine is used extensively as a disinfectant for drinking water supplies. Based on health considerations, the guideline value for total chlorine in drinking water is 5 mg/L. The fact sheets in ADWG provide a detailed account of the health impacts and other considerations relating to chlorine.

3.4.2.1 Results

All samples for chlorine met the standard for the reporting period (Table 3-5). Free chlorine was measured in localities with chlorination system and total chlorine was measured in chloramination systems.

There were no missing samples for chlorine during the reporting period.

Table 3-5 - Concentrations of chlorine in Drinking Water for 1 July 2016 – 30 June 2017. The concentrations of chlorine should not exceed 5.0 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		Comments
			Max	Average	
Ararat*	Twice-weekly	104	2.20	0.53	
Birchip	Weekly	52	1.09	0.62	
Charlton	Weekly	52	1.20	0.31	
Dimboola	Weekly	52	1.00	0.83	
Donald	Weekly	52	2.00	0.71	
Edenhope	Weekly	52	0.85	0.50	
Great Western	Weekly	52	1.80	0.47	
Halls Gap	Weekly	52	2.20	0.94	
Haven^Δ	Weekly	52	1.20	0.82	
Hopetoun	Weekly	52	1.35	0.76	
Horsham*	Twice-weekly	104	0.95	0.69	
Jeparit	Weekly	52	1.75	0.61	
Lake Bolac	Weekly	52	2.10	0.30	Chloramination system. Total chlorine was measured. Changed chlorine disinfection method from chloramination to chlorination at Willaura WTP. Free chlorine was measured during chlorine clean.
Manangatang	Weekly	52	1.48	0.85	
Minyip	Weekly	52	1.80	0.71	
Murtoa	Weekly	52	1.10	0.66	
Natimuk	Weekly	53	1.63	0.59	

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Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		Comments
			Max	Average	
Nhill	Weekly	52	0.95	0.71	
Ouyen	Weekly	52	1.68	0.82	
Pomonal	Weekly	52	2.20	0.58	
Quambatook	Weekly	52	1.27	0.64	
Rainbow	Weekly	52	1.19	0.83	
Rupanyup	Weekly	52	0.97	0.70	
Sea Lake	Weekly	52	1.98	0.98	
St Arnaud	Weekly	52	2.00	0.91	
Stawell*	Twice-weekly	104	1.00	0.48	
Underbool	Weekly	52	1.22	0.70	
Warracknabeal	Weekly	52	1.00	0.72	
Willaura	Weekly	52	2.13	0.80	Chloramination system. Total chlorine was measured. Changed chlorine disinfection method from chloramination to chlorination at Willaura WTP. Free chlorine was measured during chlorine clean.
Wycheproof	Weekly	52	1.08	0.65	

* *Due to the population size of these towns two samples are taken every week.*

Δ *Included as part of the Horsham locality.*

3.4.3 Boron

Boron can be present in drinking water through the natural leaching of boron-containing mineral, or by contamination of water sources. Based on health considerations, the guideline value of boron in drinking water should not exceed 4 mg/L. The fact sheets in ADWG provide a detailed account of the health impacts and other considerations relating to boron.

3.4.3.1 Results

All samples for boron met the standard for the reporting period (Table 3-6).

There were no missing samples for boron during the reporting period.

Table 3-6 - Concentrations of Boron in Drinking Water for 1 July 2016 – 30 June 2017. The concentrations of boron should not exceed 4 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)	No of samples where standard was not met (S18)
Ararat*	Yearly	2	0.020	0
Birchip	Yearly	1	0.020	0
Charlton	Yearly	1	0.020	0
Dimboola	Yearly	1	0.020	0
Donald	Yearly	1	0.020	0
Edenhope	Monthly	12	0.080	0
Great Western	Yearly	1	0.030	0
Halls Gap	Yearly	1	0.020	0
Haven[Δ]	Yearly	1	0.020	0
Hopetoun	Yearly	1	0.020	0
Horsham*	Yearly	2	0.020	0
Jeparit	Yearly	1	0.020	0
Lake Bolac	Yearly	1	0.020	0
Manangatang	Yearly	1	0.020	0
Minyip	Yearly	1	0.020	0
Murtoa	Yearly	1	0.020	0
Natimuk	Yearly	1	0.020	0
Nhill	Yearly	1	0.020	0
Ouyen	Yearly	1	0.020	0
Pomonal	Yearly	1	0.020	0
Quambatook	Yearly	1	0.060	0
Rainbow	Yearly	1	0.020	0
Rupanyup	Yearly	1	0.020	0
Sea Lake	Yearly	1	0.030	0
St Arnaud	Yearly	1	0.020	0
Stawell*	Yearly	1	0.020	0
Underbool	Yearly	1	0.030	0
Warracknabeal	Yearly	1	0.020	0
Willaura	Yearly	1	0.020	0
Wycheproof	Yearly	1	0.020	0

* *Due to the population size of these towns two samples are taken every week.*

[Δ] *Included as part of the Horsham locality.*

3.4.4 Chromium

Chromium is present in the environment in the trivalent and hexavalent states. Chromium can be removed from drinking water sources by coagulation/filtration, ion exchange, reverse osmosis and lime softening. Trivalent chromium can be oxidised to hexavalent chromium with disinfectants, particularly chlorine, chlorine dioxide and ozone. Hexavalent chromium presence in water is generally the result of industrial and domestic chromium was discharge.

Based on health considerations, the guideline value of hexavalent chromium in drinking water should not exceed 0.05 mg/L. The fact sheets in ADWG provide a detailed account of the health impacts and other considerations relating to chromium.

3.4.4.1 Results

All samples for chromium met the standard for the reporting period (Table 3-7).

There were no missing samples for chromium during the reporting period.

Table 3-7 - Concentrations of Chromium in Drinking Water for 1 July 2016 – 30 June 2017. The concentrations of chromium should not exceed 0.05 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)	No of samples where standard was not met (S18)
Ararat*	Yearly	2	0.001	0
Birchip	Yearly	1	0.001	0
Charlton	Yearly	1	0.001	0
Dimboola	Yearly	1	0.001	0
Donald	Yearly	1	0.001	0
Edenhope	Monthly	12	0.001	0
Great Western	Yearly	1	0.001	0
Halls Gap	Yearly	1	0.001	0
Haven^	Yearly	1	0.001	0
Hopetoun	Yearly	1	0.001	0
Horsham*	Yearly	2	0.001	0
Jeparit	Yearly	1	0.001	0
Lake Bolac	Yearly	1	0.001	0
Manangatang	Yearly	1	0.001	0
Minyip	Yearly	1	0.001	0
Murtoa	Yearly	1	0.001	0
Natimuk	Yearly	1	0.001	0
Nhill	Yearly	1	0.001	0

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Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)	No of samples where standard was not met (S 18)
Ouyen	Yearly	1	0.001	0
Pomonal	Yearly	1	0.001	0
Quambatook	Yearly	1	0.001	0
Rainbow	Yearly	1	0.001	0
Rupanyup	Yearly	1	0.001	0
Sea Lake	Yearly	1	0.001	0
St Arnaud	Yearly	1	0.001	0
Stawell*	Yearly	1	0.001	0
Underbool	Yearly	1	0.001	0
Warracknabeal	Yearly	1	0.001	0
Willaura	Yearly	1	0.001	0
Wycheproof	Yearly	1	0.001	0

* *Due to the population size of these towns two samples are taken every week.*

Δ *Included as part of the Horsham locality.*

3.4.5 Chloroacetic acids

Chloroacetic acids (monochloroacetic acid, dichloroacetic acid and trichloroacetic acid) produced in drinking water as disinfection by-products (DBPs) of the reaction between chlorine and naturally occurring humic and fulvic acids. The fact sheets in ADWG provide a detailed account of the health impacts and other considerations relating to chloroacetic acids.

3.4.5.1 Results

All samples for monochloroacetic acid met the standard for the reporting period (Table 3-8).

There were exceedances of dichloroacetic acid (Table 3-9) and trichloroacetic acid (Table 3-10) at Lake Bolac and Willaura during the chlorine clean. Willaura and Lake Bolac experience seasonal nitrification, resulting in a loss of disinfectant residual, increase in plate counts indicating microbial growth in the reticulation, lowering of the pH and alkalinity of the drinking water, and formation of nitrite and nitrate.

Disinfection method was changed from chloramination to chlorination from 9 September to 15 November 2016 to remediate the water quality in Willaura and Lake Bolac. Willaura WTP is a membrane plant with low organic and colour removal capacity, and the addition of chlorine led to formation of DBPs. The concentration of dichloroacetic acid and trichloroacetic acid for both the towns decreased to normal levels (< 0.1 mg/L and < 0.1

mg/L respectively), after the chlorine clean was completed, and the system was reverted back to chloramination.

There were trichloroacetic acid exceedances at Great Western and Ouyen (Table 3-10) that resulted from high colour in the raw water during floodwater events.

Ouyen WTP is a membrane plant that has limited capacity for removal of colour. The above average rainfall in 2016 and black water event in the Murray River resulted in higher colour and organic matter in the raw water that reacted with the disinfectant to produce these DBPs. The raw water storage was treated with a coagulant to aid in the removal of colour, and the water treatment process coagulant dose rate was optimised to minimise DBP formation. Flushing was also conducted in the reticulation.

Likewise, the Great Western WTP is a membrane plant with limited capacity for removal of colour. Due to the above average rainfall in 2016, the raw water experienced elevated colour that reacted with chlorine to produce these DBPs. The coagulant dose used at the water treatment plant was optimised, and flushing was conducted in the reticulation system to try to minimise DBP formation.

There were no missing samples for chloroacetic acids during the reporting period.

Table 3-8 - Concentrations of monochloroacetic acid in Drinking Water for 1 July 2016 – 30 June 2017. The concentrations of monochloroacetic acid should not exceed 0.15 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		No. of samples where standard was not met (S18)
			Max	Average	
Ararat*	Twice-monthly	24	0.003	0.002	0
Birchip	Monthly	12	0.003	0.002	0
Charlton	Monthly	12	< 0.002	0.002	0
Dimboola	Monthly	12	0.003	0.002	0
Donald	Monthly	12	< 0.002	0.002	0
Edenhope	Monthly	12	< 0.002	0.002	0
Great Western	Monthly	12	0.020	0.006	0
Halls Gap	Monthly	12	< 0.002	0.002	0
Haven^Δ	Monthly	12	0.003	0.002	0
Hopetoun	Monthly	12	0.004	0.003	0
Horsham*	Twice-monthly	24	< 0.002	0.002	0
Jeparit	Monthly	12	0.004	0.003	0
Lake Bolac	Monthly	12	0.010	0.004	0
Manangatang	Monthly	12	0.009	0.003	0

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Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		No. of samples where standard was not met (S18)
			Max	Average	
Minyip	Monthly	12	< 0.002	0.002	0
Murtoa	Monthly	12	0.003	0.002	0
Natimuk	Monthly	12	0.004	0.003	0
Nhill	Monthly	24	0.003	0.002	0
Ouyen	Monthly	12	0.006	0.004	0
Pomonal	Monthly	12	0.014	0.003	0
Quambatook	Monthly	12	0.006	0.003	0
Rainbow	Monthly	12	< 0.002	0.002	0
Rupanyup	Monthly	12	0.002	0.002	0
Sea Lake	Monthly	12	0.007	0.005	0
St Arnaud	Monthly	12	< 0.002	0.002	0
Stawell*	Twice-monthly	24	0.003	0.002	0
Underbool	Monthly	24	0.003	0.002	0
Warracknabeal	Monthly	12	0.004	0.002	0
Willaura	Monthly	12	0.010	0.005	0
Wycheproof	Monthly	12	< 0.002	0.002	0

* *Due to the population size of these towns two samples are taken every week.*
Δ *Included as part of the Horsham locality.*
< *Less than limit of detection.*

Table 3-9 - Concentrations of dichloroacetic Acids in Drinking Water of 1 July 2016 – 30 June 2017. The dichloroacetic acid should not exceed 0.1 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		No. of samples where standard was not met (S18)	Comments
			Max	Average		
Ararat*	Twice-monthly	24	0.027	0.014	0	
Birchip	Monthly	12	0.022	0.012	0	
Charlton	Monthly	12	0.015	0.009	0	
Dimboola	Monthly	12	0.027	0.018	0	
Donald	Monthly	12	0.022	0.015	0	
Edenhope	Monthly	12	0.002	0.002	0	
Great Western	Monthly	12	0.087	0.049	0	
Halls Gap	Monthly	12	0.024	0.016	0	
HavenΔ	Monthly	12	0.031	0.019	0	

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Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		No. of samples where standard was not met (S18)	Comments
			Max	Average		
Hopetoun	Monthly	12	0.040	0.021	0	
Horsham*	Twice-monthly	24	0.019	0.013	0	
Jeparit	Monthly	12	0.042	0.023	0	
Lake Bolac	Monthly	12	0.170	0.029	2	S18 submitted. Disinfection method temporarily changed from chloramination to chlorination to reduce nitrification.
Manangatang	Monthly	12	0.100	0.032	0	
Minyip	Monthly	12	0.018	0.011	0	
Murtoa	Monthly	12	0.029	0.019	0	
Natimuk	Monthly	12	0.034	0.024	0	
Nhill	Monthly	24	0.028	0.022	0	
Ouyen	Monthly	12	0.079	0.044	0	
Pomonal	Monthly	12	0.057	0.024	0	
Quambatook	Monthly	12	0.020	0.015	0	
Rainbow	Monthly	12	0.018	0.012	0	
Rupanyup	Monthly	12	0.016	0.008	0	
Sea Lake	Monthly	12	0.072	0.045	0	
St Arnaud	Monthly	12	0.015	0.012	0	
Stawell*	Twice-monthly	24	0.017	0.013	0	
Underbool	Monthly	12	0.025	0.015	0	
Warracknabeal	Monthly	12	0.034	0.022	0	
Willaura	Monthly	12	0.150	0.039	2	S18 submitted. Disinfection method temporarily changed from chloramination to chlorination to reduce nitrification.
Wycheproof	Monthly	12	0.012	0.009	0	

* *Due to the population size of these towns two samples are taken every week.*

$^{\Delta}$ *Included as part of the Horsham locality.*

Table 3-10 - Concentrations of trichloroacetic acids in Drinking Water for 1 July 2016 – 30 June 2017. The trichloroacetic acid should not exceed 0.1 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		No. of samples where standard was not met (S18)	Comments
			Max	Average		
Ararat*	Twice-monthly	24	0.036	0.021	0	
Birchip	Monthly	12	0.016	0.012	0	
Charlton	Monthly	12	0.022	0.012	0	
Dimboola	Monthly	12	0.021	0.016	0	
Donald	Monthly	12	0.018	0.013	0	
Edenhope	Monthly	12	0.002	0.002	0	
Great Western	Monthly	12	0.160	0.097	4	S18 submitted. WTP unable to remove high colour in raw water affected by high rainfall.
Halls Gap	Monthly	12	0.027	0.018	0	
Haven$^{\Delta}$	Monthly	12	0.032	0.020	0	
Hopetoun	Monthly	12	0.051	0.024	0	
Horsham*	Twice-monthly	24	0.014	0.010	0	
Jeparit	Monthly	12	0.052	0.026	0	
Lake Bolac	Monthly	12	0.270	0.046	2	S18 submitted. Disinfection method temporarily changed from chloramination to chlorination to reduce nitrification. .
Manangatang	Monthly	12	0.140	0.046	0	
Minyip	Monthly	12	0.025	0.014	0	
Murtoa	Monthly	12	0.030	0.018	0	
Natimuk	Monthly	12	0.072	0.042	0	
Nhill	Monthly	24	0.028	0.023	0	
Ouyen	Monthly	12	0.110	0.074	4	S18 submitted. High colour and organic matter present during the flood and blackwater event. WTP unable to remove high organic material in raw water.
Pomonal	Monthly	12	0.042	0.026	0	
Quambatook	Monthly	12	0.009	0.007	0	

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Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		No. of samples where standard was not met (S18)	Comments
			Max	Average		
Rainbow	Monthly	12	0.018	0.011	0	
Rupanyup	Monthly	12	0.027	0.015	0	
Sea Lake	Monthly	12	0.100	0.063	0	
St Arnaud	Monthly	12	0.011	0.008	0	
Stawell*	Twice-monthly	24	0.016	0.013	0	
Underbool	Monthly	24	0.029	0.019	0	
Warracknabeal	Monthly	12	0.042	0.027	0	
Willaura	Monthly	12	0.250	0.042	2	S18 submitted. Disinfection method temporarily changed from chloramination to chlorination to reduce nitrification.
Wycheproof	Monthly	12	0.020	0.013	0	

* *Due to the population size of these towns two samples are taken every week.*
Δ *Included as part of the Horsham locality.*

3.4.6 Lead

Lead can be present in drinking water as a result of dissolution from natural sources, or from household plumbing systems containing lead. Lead concentrations in drinking water can be reduced by conventional methods of water treatment using coagulants or lime softening.

Based on health considerations, the guideline value of lead in drinking water should not exceed 0.01 mg/L. The fact sheets in ADWG provide a detailed account of the health impacts and other considerations relating to lead.

3.4.6.1 Results

All samples for lead met the standard for the reporting period (Table 3-11).
One compliance sample result was received from the laboratory with a lead concentration of 0.11 mg/L in Pomonal. Investigation identified that the sample was obtained from a private tank water supply, not drinking water supply. Refer to Section 10 for further information.

There were no missing samples for lead during the reporting period.

Table 3-11 - Concentrations of lead in Drinking Water for 1 July 2016 – 30 June 2017. The lead should not exceed 0.01 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)	No of samples where standard was not met (S18)	Comments
Ararat*	Yearly	2	0.001	0	
Birchip	Yearly	1	0.002	0	
Charlton	Yearly	1	0.001	0	
Dimboola	Yearly	1	0.001	0	
Donald	Yearly	1	0.001	0	
Edenhope	Monthly	12	0.001	0	
Great Western	Yearly	1	0.001	0	
Halls Gap	Yearly	1	0.001	0	
Haven[Δ]	Yearly	1	0.001	0	
Hopetoun	Yearly	1	0.001	0	
Horsham	Yearly	2	0.001	0	
Jeparit	Yearly	1	0.001	0	
Lake Bolac	Yearly	1	0.001	0	
Manangatang	Yearly	1	0.001	0	
Minyip	Yearly	1	0.001	0	
Murtoa	Yearly	1	0.006	0	
Natimuk	Yearly	1	0.001	0	
Nhill	Yearly	1	0.001	0	
Ouyen	Yearly	1	0.001	0	
Pomonal	Yearly	1	0.013	0	Result was not obtained from drinking water supplied. Refer to Section 10 for details.
Quambatook	Yearly	1	0.001	0	
Rainbow	Yearly	1	0.005	0	
Rupanyup	Yearly	1	0.001	0	
Sea Lake	Yearly	1	0.001	0	
St Arnaud	Yearly	1	0.001	0	
Stawell*	Yearly	1	0.001	0	
Underbool	Yearly	1	0.001	0	
Warracknabeal	Yearly	1	0.001	0	
Willaura	Yearly	1	0.001	0	
Wycheproof	Yearly	1	0.001	0	

* *Due to the population size of these towns two samples are taken every week.*

[Δ] *Included as part of the Horsham locality.*

3.4.7 Nitrite and Nitrate

Nitrite: Based on health considerations, the concentration of nitrite in drinking water should not exceed 3 mg-NO_2/L (as nitrite).

Nitrate: Based on health considerations, the guideline value of 50 mg-NO_3/L (as nitrate) has been set to protect bottle-fed infants under three months of age and up to 100 mg-NO_3/L can be safely consumed by adults.

A detailed description of nitrite and nitrate and its implications in a water supply can be found by reference to the ADWG.

3.4.7.1 Results

Nitrite and Nitrate were only measured in chloramination systems, Willaura and Lake Bolac.

All the results for nitrate (Table 3-12) and nitrite (Table 3-13) met the standard for this reporting period.

There were no missing samples during the reporting period.

Table 3-12 - Concentrations of nitrite in Drinking Water for 1 July 2016 – 30 June 2017. Nitrite should not exceed 3 mg-NO_2/L (as nitrite).

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)	No of samples where standard was not met (S18)
Lake Bolac	Monthly	12	0.160	0
Willaura	Monthly	12	0.360	0

Table 3-13 - Concentrations of Nitrate in Drinking Water for 1 July 2016 – 30 June 2017. Nitrate should not exceed 50 mg-NO_3/L (as nitrate).

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)	No of samples where standard was not met (S18)
Lake Bolac	Monthly	12	0.110	0
Willaura	Monthly	12	0.340	0

3.4.8 Copper

The concentration of copper should not exceed 1 mg/L based on aesthetic considerations but would not be a health consideration unless the concentration exceeds 2 mg/L. Copper can occur naturally in catchments as it is widely distributed in rocks and soils as carbonate and sulphide minerals. A detailed description of copper and its implications in a water supply can be found by reference to the ADWG.

3.4.8.1 Results

All samples for copper met the standard for the reporting period (Table 3-14). There were no missing samples during the reporting period.

Table 3-14 - Concentrations of copper in Drinking Water for 1 July 2016 – 30 June 2017. Copper should not exceed 1 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)	No of samples where standard was not met (S18)
Ararat	Yearly	2	0.016	0
Birchip	Yearly	1	0.180	0
Charlton	Yearly	1	0.005	0
Dimboola	Yearly	1	0.006	0
Donald	Yearly	1	0.001	0
Edenhope	Monthly	12	0.015	0
Great Western	Yearly	1	0.120	0
Halls Gap	Yearly	1	0.051	0
Haven^	Yearly	1	0.002	0
Hopetoun	Yearly	1	0.008	0
Horsham*	Yearly	2	0.017	0
Jeparit	Yearly	1	0.100	0
Lake Bolac	Yearly	1	0.015	0
Manangatang	Yearly	1	0.130	0
Minyip	Yearly	1	0.007	0
Murtoa	Yearly	1	0.059	0
Natimuk	Yearly	1	0.002	0
Nhill	Yearly	1	0.007	0
Ouyen	Yearly	1	0.043	0
Pomonal	Yearly	1	0.097	0
Quambatook	Yearly	1	0.036	0

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Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)	No of samples where standard was not met (S18)
Rainbow	Yearly	1	0.025	0
Rupanyup	Yearly	1	0.017	0
Sea Lake	Yearly	1	0.130	0
St Arnaud	Yearly	1	0.004	0
Stawell*	Yearly	2	0.007	0
Underbool	Yearly	1	0.150	0
Warracknabeal	Yearly	1	0.004	0
Willaura	Yearly	1	0.077	0
Wycheproof	Yearly	1	0.041	0

* *Due to the population size of these towns two samples are taken every week.*

Δ *Included as part of the Horsham locality.*

3.4.9 Arsenic

The concentration of arsenic should not exceed 0.01 mg/L in drinking water based on health consideration. Arsenic is naturally occurring element, which can be introduced into water through dissolution of minerals and ore from industrial effluent and atmospheric deposition.

A detailed description of arsenic and its implications in a water supply can be found by reference to the ADWG.

3.4.9.1 Results

All samples for arsenic met the standard for the reporting period (Table 3-15). There were no missing samples during the reporting period.

Table 3-15 - Concentrations of arsenic in Drinking Water for 1 July 2016 – 30 June 2017. Arsenic should not exceed 0.1 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)	No of samples where standard was not met (S18)
Ararat*^	Yearly	2	< 0.001	0
Birchip	Yearly	1	< 0.001	0
Charlton	Yearly	1	< 0.001	0
Dimboola	Yearly	1	< 0.001	0
Donald	Yearly	1	< 0.001	0
Edenhope	Monthly	12	0.006	0
Great Western	Yearly	1	< 0.001	0
Halls Gap	Yearly	1	< 0.001	0
Haven^Δ	Yearly	1	< 0.001	0
Hopetoun	Yearly	1	< 0.001	0
Horsham*	Yearly	2	< 0.001	0
Jeparit	Yearly	1	< 0.001	0
Lake Bolac	Yearly	1	< 0.001	0
Manangatang	Yearly	1	< 0.001	0
Minyip	Yearly	1	< 0.001	0
Murtoa	Yearly	1	< 0.001	0
Natimuk	Yearly	1	< 0.001	0
Nhill	Yearly	1	< 0.001	0
Ouyen	Yearly	1	< 0.001	0
Pomonal	Yearly	1	< 0.001	0
Quambatook	Yearly	1	< 0.001	0
Rainbow	Yearly	1	< 0.001	0
Rupanyup	Yearly	1	< 0.001	0
Sea Lake	Yearly	1	< 0.001	0
St Arnaud	Yearly	1	< 0.001	0
Stawell*	Yearly	1	< 0.001	0
Underbool	Yearly	1	< 0.001	0
Warracknabeal	Yearly	1	< 0.001	0
Willaura	Yearly	1	< 0.001	0
Wycheproof	Yearly	1	< 0.001	0

* *Due to the population size of these towns two samples are taken every week.*

Δ *Included as part of the Horsham locality.*

< *Less than limit of detection*

3.4.10 Fluoride

Fluoride is added to some water supplies to help protect teeth against dental decay. Based on health considerations, the concentration of fluoride in fluoridated drinking water supplies should not exceed 1.5 mg/L and must not result in an average optimum concentration in excess of 1.0 mg/L of water. A detailed description of fluoride and its implications in a water supply can be found by reference to the ADWG.

GWMWater has three fluoridated water supplies, including Ararat, Horsham and Natimuk. In November 2006, the Horsham water supply became fluoridated. The Natimuk water supply is sourced from Horsham's WTP, and is also therefore a fluoridated supply. In August 2016, Ararat's water supply became fluoridated.

3.4.10.1 Results

All water supplies complied with the ADWG health-based guideline value for fluoride and the requirements of the *Health (Fluoridation) Act* 1973 (Table 3-16).

There were no missing samples for turbidity during the reporting period.

Table 3-16 - Fluoride results in Drinking Water for 1 July 2016 – 30 June 2017. Fluoride should not exceed 1.5 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		Target Optimum operating concentration (mg/L)	No. of samples where standard was not met (S18)
			Max	Average		
Ararat*^	Twice-weekly	104	0.97	0.77	0.9	0
Birchip	Yearly	1	0.05	0.05	-	0
Charlton	Yearly	1	0.05	0.05	-	0
Dimboola	Yearly	1	0.07	0.07	-	0
Donald	Yearly	1	0.05	0.05	-	0
Edenhope	Yearly	1	0.28	0.28	-	0
Great Western	Yearly	1	0.06	0.06	-	0
Halls Gap	Yearly	1	0.05	0.05	-	0
Haven^^	Monthly	52	0.80	0.67	-	0
Hopetoun	Yearly	1	0.05	0.05	-	0
Horsham*^	Twice-weekly	104	0.82	0.67	0.9	0
Jeparit	Yearly	1	0.05	0.05	-	0
Lake Bolac	Yearly	1	0.05	0.05	-	0

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Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		Target Optimum operating concentration (mg/L)	No. of samples where standard was not met (S18)
			Max	Average		
Manangatang	Yearly	1	0.07	0.07	-	0
Minyip	Yearly	1	0.05	0.05	-	0
Murtoa	Yearly	1	0.05	0.05	-	0
Natimuk^	Weekly	52	0.77	0.67	-	0
Nhill	Yearly	1	0.05	0.05	-	0
Ouyen	Yearly	1	0.10	0.10	-	0
Pomonal	Yearly	1	0.05	0.05	-	0
Quambatook	Yearly	1	0.20	0.20	-	0
Rainbow	Yearly	1	0.05	0.05	-	0
Rupanyup	Yearly	1	0.05	0.05	-	0
Sea Lake	Yearly	1	0.14	0.14	-	0
St Arnaud	Yearly	1	0.05	0.05	-	0
Stawell*	Bi-Annually	1	0.05	0.05	-	0
Underbool	Yearly	1	0.18	0.18	-	0
Warracknabeal	Yearly	1	0.05	0.05	-	0
Willaura	Yearly	1	0.05	0.05	-	0
Wycheproof	Yearly	1	0.05	0.05	-	0

^ *Fluoridated water supplies.*
* *Due to the population size of these towns two samples are taken.*
Δ *Included as part of the Horsham locality.*

3.4.11 Aluminium

Aluminium sulphate (ALUM) and aluminium chlorohydrate (Megapac 23) are general-purpose coagulants that are used in water treatment to remove turbidity, natural organic matter (including colour), microorganisms and many inorganic chemicals. As stated in the ADWG, based on aesthetic problems caused by post-flocculation, the concentration of acid-soluble aluminium in drinking water should not exceed 0.2 mg/L.

3.4.12 Results

Aluminium acid-soluble sampling and analysis was undertaken on a minimum monthly basis (Table 3-17).

There were no missed samples for aluminium acid-soluble during the reporting period.

Throughout this reporting period, there was one aluminium acid-soluble exceedance in Birchip (February 2017). A Birchip laboratory sample showed an aluminium acid-soluble exceedance of 0.21 mg/L on the 7 February 2017. The Birchip WTP was operating

adequately during the incident and did not produce any non-compliant water. Regular jar testing and aluminium testing work orders are in place, which showed no elevated aluminium results. The elevated aluminium acid-soluble was thought to be due to sediment accumulating in the reticulation, and as such, a flushing was conducted. The resampled result was 0.03 mg/L.

Table 3-17 – Aluminium acid-soluble in Drinking Water for 1 July 2016 – 30 June 2017. Aluminium acid-soluble should not exceed 0.2 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		No. of samples where standard was not met (S18)	Comments
			Max	Average		
Ararat*	Twice-monthly	24	0.07	0.05	0	
Birchip	Monthly	12	0.21	0.03	1	S18 submitted. The exceedance was due to sediment accumulating in the reticulation system.
Charlton	Monthly	12	0.04	0.02	0	
Dimboola	Monthly	12	0.06	0.03	0	
Donald	Monthly	12	0.06	0.04	0	
Edenhope	Monthly	12	0.01	0.01	0	
Great Western	Monthly	12	0.05	0.03	0	
Halls Gap	Monthly	12	0.05	0.03	0	
Haven$^{\Delta}$	Monthly	12	0.08	0.04	0	
Hopetoun	Monthly	12	0.04	0.02	0	
Horsham*	Twice-monthly	24	0.04	0.03	0	
Jeparit	Monthly	12	0.03	0.01	0	
Lake Bolac	Weekly	12	0.09	0.03	0	
Manangatang	Monthly	12	0.10	0.02	0	
Minyip	Monthly	12	0.03	0.02	0	
Murtoa	Monthly	12	0.04	0.02	0	
Natimuk	Monthly	12	0.06	0.04	0	
Nhill	Monthly	12	0.09	0.03	0	
Ouyen	Monthly	12	0.02	0.01	0	
Pomonal	Monthly	12	0.11	0.04	0	
Quambatook	Monthly	12	0.04	0.02	0	
Rainbow	Monthly	12	0.02	0.01	0	

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Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		No. of samples where standard was not met (S18)	Comments
			Max	Average		
Rupanyup	Monthly	12	0.05	0.02	0	
Sea Lake	-	0	-	-	-	No analysis conducted as coagulation is not part of a treatment at Sea Lake WTP.
St Arnaud	Monthly	12	0.12	0.05	0	
Stawell*	Twice-monthly	24	0.06	0.04	0	
Underbool	Monthly	12	0.03	0.01	0	
Warracknabeal	Monthly	12	0.05	0.03	0	
Willaura	Monthly	12	0.09	0.03	0	
Wycheproof	Monthly	12	0.05	0.02	0	

* *Due to the population size of these towns two samples are taken every week.*

Δ *Included as part of the Horsham locality.*

4 Analysis of Results

Regulation 16(h) requires a reporting of analysis of all water quality sample information, data and results of drinking water supplied for this reporting period, 2016/2017 with the last two reporting periods, 2014/2015 and 2015/2016 (Table 4-1).

The water quality performance for *Escherichia coli*, turbidity, monochloroacetic acid, chlorine, boron, chromium, lead, nitrite, nitrate, copper, arsenic and fluoride has remained consistent over the reporting periods with no exceedances.

The water quality incidents for disinfectant by-products, THM, dichloroacetic acid and trichloroacetic acid has increased in this reporting period compared to the last reporting period. This is due to:

- Lake Bolac and Willaura during chlorine clean where disinfection method changed from chloramination to chlorination to reduce nitrification (Refer to Section 3.2 and 3.4.5 for details).

- DBP exceedances at Great Western, Sea Lake and Ouyen was due to above average rainfall in 2016, black water event in the Murray River and organic matter washed into the raw water storage (Refer to Section 3.2 and 3.4.5 for details).

There was one aluminium exceedance in Birchip. Occasionally, there are high aluminium due to old sediment build-up in the reticulation. Although the cause of the elevated aluminium was not known, it was thought that this could be the most likely cause. As a result from this incident, air scouring was organised for the town. A flushing program has been developed and is planned to be implemented in coming budgets to ensure reticulation water quality.

Table 4-1 - Comparison of analysis of water quality results of drinking water supplied from 2014/2015 to 2016/2017.

Parameters	2014/2015		2015/2016		2016/2017	
	% of water sampling localities met standards	% of customers supplied with drinking water that met standard	% of water sampling localities met standards	% of customers supplied with drinking water that met standard	% of water sampling localities met standards	% of customers supplied with drinking water that met standard
Escherichia coli	89.66	97.37	100	100	100	100
Trihalomethanes	96.55	99.58	100	100	86.21	96.29
Turbidity	96.55	99.58	100	100	100	100
Aluminium acid-soluble	93.10	98.55	93.10	61.85	96.55	98.63
Monochloroacetic acid	100	100	100	100	100.00	100.00
Dichloroacetic acid	100	100	100	100	93.10	98.32
Trichloroacetic acid	100	100	100	100	82.76	94.61
Chlorine	100	100	100	100	100	100
Boron	100	100	100	100	100	100
Chromium	100	100	100	100	100	100
Lead	100	100	100	100	100	100
Nitrite	100	100	100	100	100	100
Nitrate	100	100	100	100	100	100
Copper	100	100	100	100	100	100
Arsenic	100	100	100	100	100	100
Fluoride	100	100	100	100	100	100
pH	89.66	98.37	89.66	96.73	51.72	68.00
Colour	100	100	93.10	99.15	93.10	100
Hardness	100	100	96.55	99.59	100	100
Electrical conductivity	100	100	100	100	100	100
Iron	93.10	97.93	100	100	100	100
Manganese	100	100	100	100	100	100

5 Aesthetic Parameters

Individual monitoring results for 1 July 2016 to 30 June 2017 that exceed the aesthetic guideline value set out in ADWG are highlighted in the tables in this section.

5.1 Hydrogen Ion Concentration, pH

The aesthetic parameter, pH is a measure of the hydrogen ion concentration of water. It is measured on a logarithmic scale from 0 to 14. A pH of seven is neutral, while a pH greater than seven is alkaline, and a pH less than seven is acidic.

The ADWG suggests that, based on the need to reduce corrosion and encrustation in pipework, drinking water should have a pH value between pH 6.5 and pH 8.5.

5.1.1 Results

Sampling and laboratory analysis for pH during the reporting period was undertaken on a weekly basis for all drinking water towns (Table 5-1).

There were a number of individual results, which did not satisfy the aesthetic guideline values set out in the ADWG 2011. Birchip, Charlton, Dimboola, Donald, Hopetoun, Manangatang, Minyip, Natimuk, Ouyen, Quambatook, Rainbow, Stawell, Willaura and Wycheproof experienced some values outside the pH guideline values.

There were no missing results.

5.1.2 Actions Undertaken in relation to values outside the guidelines.

The pH exceedances at Birchip, Dimboola, Donald, Hopetoun, Natimuk, Stawell and Wycheproof were minimal (≤ 3 exceedances at each site in the last 12 months). Trends showed that pH is not an on-going issue at the above-mentioned localities and pH of treated water produce from the WTPs is not an issue, hence no immediate corrective actions were taken. Continuous monitoring of pH will occur in GWMWater compliance sampling routine.

The blackwater event in the Murray River resulted in low pH water, and as a result, Manangatang and Ouyen WTPs had pH exceedances August to October 2016.

Minyip experiences seasonal high pH due to the reaction of water with reticulation pipes. It is expected that over time, the pH variations will reduce. In the interim, flushing was carried out in the reticulation to remove the high pH water. If the issue persists, investigations are currently underway to identify other options to help remediate the seasonal pH fluctuations.

The average pH of drinking water supplied from Charlton WTP was 7.7, however occasionally; there were a few locations with pH issues. Ad-hoc flushing was carried out in the end mains to maintain drinking water quality. No obvious cause for the high pH was found, however continuous monitoring will occur.

The pH water in Rainbow is slightly acidic due the pH of the raw water. There is no pH correction at Rainbow WTP. GWMWater recognise that pH of the raw water is an issue and a strategy to upgrade the pH correction facility at Taylor's Lake and Longerenong is in the planning stages.

Table 5-1 - pH results for Drinking Water for 1 July 2016 – 30 June 2017.

Sampling Locality	Sampling Frequency	No. of Samples	Results (pH)		
			Max	Min	Average
Ararat*	Twice-weekly	104	7.6	6.6	7.1
Birchip	Weekly	52	8.4	6.2	7.0
Charlton	Weekly	52	9.1	6.5	7.7
Dimboola	Weekly	52	9.0	6.5	7.2
Donald	Weekly	52	8.9	6.7	7.4
Edenhope	Weekly	52	8.0	6.8	7.3
Great Western	Weekly	52	7.8	6.7	7.2
Halls Gap	Weekly	52	7.6	6.6	7.1
Haven[Δ]	Weekly	52	7.6	6.6	7.0
Hopetoun	Weekly	52	8.3	6.4	7.2
Horsham*	Twice-weekly	104	8.1	6.6	7.0
Jeparit	Weekly	52	7.7	6.5	7.0
Lake Bolac	Weekly	52	8.2	6.9	7.5
Manangatang	Weekly	52	8.1	6.0	6.9
Minyip	Weekly	52	9.7	6.8	8.2
Murtoa	Weekly	52	7.7	6.5	7.1
Natimuk	Weekly	52	7.9	6.4	7.1
Nhill	Weekly	52	7.7	6.6	7.2
Ouyen	Weekly	52	8.6	6.6	7.4
Pomonal	Weekly	52	7.7	6.6	7.0
Quambatook	Weekly	52	9.0	6.5	7.2

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Sampling Locality	Sampling Frequency	No. of Samples	Results (pH)		
			Max	Min	Average
Rainbow	Weekly	52	8.3	6.3	6.9
Rupanyup	Weekly	52	8.4	6.6	7.1
Sea Lake	Weekly	52	8.1	6.7	7.5
St Arnaud	Weekly	52	8.3	6.7	7.3
Stawell*	Twice-weekly	104	8.3	6.4	7.0
Underbool	Weekly	52	8.4	6.7	7.5
Warracknabeal	Weekly	52	8.0	6.6	7.2
Willaura	Weekly	52	7.6	6.4	7.1
Wycheproof	Weekly	52	9.1	6.5	7.2

* *Due to the population size of these towns two samples are taken every week.*

Δ *Included as part of the Horsham locality.*

5.2 Colour

In natural waters, colour is due mainly to the presence of Dissolved Organic Matter (DOM), which originates from soil and decaying vegetation.

The dissolution of metals in pipes and fittings can also discolour drinking water. In bore water, 'red water' is a frequent problem, caused by the oxidation of iron. In addition, a black discolouration in reservoirs and distribution systems can result from the action of bacteria on dissolved manganese to produce insoluble oxides. Some of these compounds form colloidal suspensions, or are only partially dissolved, and so contribute to apparent rather than true colour.

The fact sheet in the ADWG for colour states that, based on aesthetic considerations, true colour in drinking water should not exceed 15 Hazen Units (HU). GWMWater has an internal performance benchmark that the mean true colour will be less than 15 Hazen Units.

5.2.1 Results

True colour sampling and analysis was undertaken on a minimum monthly basis for all drinking water supplies (Table 5-2). There were two results, one in Lake Bolac and one in Willaura, which did not satisfy the aesthetic guideline values set out in the ADWG 2011.

There were no missing samples for the reporting period.

5.2.2 Actions Undertaken in relation to values outside the guidelines.

Lake Bolac and Willaura had two occurrences of colour exceeding the ADWG aesthetic guideline value in September and December 2016. In September 2016, the region had above average rainfall and the surface water creeks started to flow, causing high dissolved organic carbon and high true colour flowing into the storages. In December 2016, Mt Pleasant and Bald Hill storages that supplies Willaura WTP experience algal bloom causing high true colour. The membrane filtration at Willaura WTP is not capable of removing colour from raw water.

The need to upgrade the existing membrane filtration system at Willaura WTP been recognised by GWMWater and the options to upgrade the WTP is currently under review.

Table 5-2 - True colour results for Drinking Water Supplied of 1 July 2016 – 30 June 2017.

Sampling Locality	Sampling Frequency	No. of Samples	Results (HU)
			Max
Ararat*	Twice-monthly	24	4.0
Birchip	Monthly	12	2.0
Charlton	Monthly	12	4.0
Dimboola	Monthly	12	2.0
Donald	Monthly	12	2.0
Edenhope	Monthly	12	4.0
Great Western	Monthly	12	6.0
Halls Gap	Monthly	12	4.0
Haven^Δ	Monthly	12	2.0
Hopetoun	Monthly	12	2.0
Horsham*	Twice-monthly	24	4.0
Jeparit	Monthly	12	2.0
Lake Bolac	Monthly	12	16.0
Manangatang	Monthly	12	12.0
Minyip	Monthly	12	2.0
Murtoa	Monthly	12	4.0
Natimuk	Monthly	12	2.0
Nhill	Monthly	12	2.0
Ouyen	Monthly	12	10.0
Pomonal	Monthly	12	2.0
Quambatook	Monthly	12	2.0
Rainbow	Monthly	12	2.0
Rupanyup	Monthly	12	2.0
Sea Lake	Monthly	12	10.0
St Arnaud	Monthly	12	2.0

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Sampling Locality	Sampling Frequency	No. of Samples	Results (HU)
			Max
Stawell*	Twice-monthly	24	2.0
Underbool	Monthly	12	2.0
Warracknabeal	Monthly	12	2.0
Willaura	Monthly	12	18.0
Wycheproof	Monthly	12	2.0

* *Due to the population size of these towns two samples are taken every month.*

Δ *Included as part of the Horsham locality.*

5.3 Hardness

Hardness is caused primarily by the presence of calcium and magnesium ions.

The ADWG has a full discussion on the ramifications of hardness and what constitutes hard and soft water. ADWG suggest that, to minimise build-up of scale in hot water systems, total hardness (as calcium carbonate) in drinking water should not exceed 200 mg/L. GWMWater has an internal performance benchmark that the mean hardness should be less than 200 mg/L.

High total hardness may be a problem for supplies reliant on groundwater. Surface waters can generally be expected to have acceptable values.

5.3.1 Results

Hardness sampling and analysis was undertaken on a quarterly basis for drinking water supplies, and twice quarterly for the larger sized localities including Ararat, Horsham and Stawell (Table 5-3).

There were no exceedance of hardness and no missing samples for the reporting period.

Table 5-3 - Hardness results for Drinking Water Supplied of 1 July 2016 – 30 June 2017.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)
			Max
Ararat*	Twice-quarterly	8	58
Birchip	Quarterly	4	22
Charlton	Quarterly	4	31
Dimboola	Quarterly	4	24
Donald	Quarterly	4	29
Edenhope	Quarterly	4	170
Great Western	Quarterly	4	46
Halls Gap	Quarterly	4	46
Haven[Δ]	Quarterly	4	56
Hopetoun	Quarterly	4	23
Horsham*	Twice-quarterly	8	56
Jeparit	Quarterly	4	27
Lake Bolac	Quarterly	4	40
Manangatang	Quarterly	4	27
Minyip	Quarterly	4	30
Murtoa	Quarterly	4	23
Natimuk	Quarterly	4	53
Nhill	Monthly	12	26
Ouyen	Quarterly	4	58
Pomonal	Quarterly	4	46
Quambatook	Quarterly	4	140
Rainbow	Quarterly	4	25
Rupanyup	Quarterly	4	28
Sea Lake	Quarterly	4	84
St Arnaud	Quarterly	4	25
Stawell*	Twice-quarterly	8	44
Underbool	Quarterly	4	83
Warracknabeal	Quarterly	4	27
Willaura	Quarterly	4	27
Wycheproof	Quarterly	4	24

* *Due to the population size of these towns two samples are taken every quarter.*

[Δ] *Included as part of the Horsham locality.*

5.4 Electrical Conductivity

Electrical Conductivity (EC) is caused by inorganic salts and small amounts of organic matter that are dissolved in water. Electrical conductivity comprises sodium, potassium, calcium, magnesium, chloride, sulphate, bicarbonate, carbonate, silica, organic matter, fluoride, iron, manganese, nitrate (and nitrite) and phosphate.

High EC values may be associated with excessive scaling in pipes, fittings and household appliances.

The ADWG provides that, based on taste, electrical conductivity in drinking water should not exceed 1000 µS/cm. GWMWater has an internal performance benchmark that the mean electrical conductivity should be less than 1000 µS/cm.

The ADWG also describe the guideline values for Total Dissolved Solids (TDS) and approximates that the electrical conductivity standard is approximately twice that of the total dissolved solids. As it is easier and more cost effective to monitor electrical conductivity than total dissolved solids, the analysis for compliance is based on electrical conductivity.

5.4.1 Results

Sampling and field analysis for electrical conductivity was undertaken on a weekly basis for all drinking water supplies other than Ararat, Stawell and Horsham where twice weekly samples were taken (Table 5-4). All analysis was undertaken using a TPS hand-held meter.

During the reporting period, EC values in water supplied to customers were stable.

There were no missing samples for the reporting period.

Table 5-4 - Electrical Conductivity (EC) results for Drinking Water Supplied of 1 July 20165 – 30 June 2017.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)
			Max
Ararat*	Twice-weekly	104	304
Birchip	Weekly	52	129
Charlton	Weekly	52	140
Dimboola	Weekly	52	135
Donald	Weekly	52	166

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Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)
			Max
Edenhope	Weekly	52	932
Great Western	Weekly	52	273
Halls Gap	Weekly	52	163
Haven[Δ]	Weekly	52	385
Hopetoun	Weekly	52	158
Horsham*	Twice-weekly	104	376
Jeparit	Weekly	52	125
Lake Bolac	Weekly	52	260
Manangatang	Weekly	52	205
Minyip	Weekly	52	194
Murtoa	Weekly	52	145
Natimuk	Weekly	52	501
Nhill	Weekly	52	125
Ouyen	Weekly	52	224
Pomonal	Weekly	52	173
Quambatook	Weekly	52	628
Rainbow	Weekly	52	124
Rupanyup	Weekly	52	147
Sea Lake	Weekly	52	246
St Arnaud	Weekly	52	160
Stawell*	Twice-weekly	104	240
Underbool	Weekly	52	273
Warracknabeal	Weekly	52	125
Willaura	Weekly	52	220
Wycheproof	Weekly	52	136

Δ *Included as part of the Horsham locality.*
* *Due to the population size of these towns two samples are taken every month.*

5.5 Iron

At concentrations exceeding 0.3 mg/L, iron imparts an undesirable taste to water and stains plumbing fixtures and laundry. Some nuisance micro-organisms can concentrate iron and give rise to taste, odour and turbidity problems in distribution systems.

The ADWG suggest that, based on aesthetic considerations, the concentration of iron in drinking water should not exceed 0.3 mg/L. A detailed description of iron and its implications in a water supply can be found by reference to the ADWG.

5.5.1 Results

Iron sampling and analysis was undertaken on a quarterly basis for drinking water supplies, and twice quarterly for the larger sized localities including Ararat, Horsham and Stawell (Table 5-5).

During the reporting period iron values in water supplied to customers were stable.

There were no missing samples for the reporting period.

Table 5-5- Iron results for Drinking Water Supplied of 1 July 2016 – 30 June 2017.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)
			Max
Ararat*	Twice-quarterly	8	0.080
Birchip	Quarterly	4	0.050
Charlton	Quarterly	4	0.090
Dimboola	Quarterly	4	0.060
Donald	Quarterly	4	0.060
Edenhope	Quarterly	4	0.030
Great Western	Quarterly	4	0.040
Halls Gap	Quarterly	4	0.020
Haven[Δ]	Quarterly	4	0.050
Hopetoun	Quarterly	4	0.020
Horsham*	Twice-quarterly	8	0.040
Jeparit	Quarterly	4	0.070
Lake Bolac	Quarterly	4	0.050
Manangatang	Quarterly	4	0.040
Minyip	Quarterly	4	0.050
Murtoa	Quarterly	4	0.080
Natimuk	Quarterly	4	0.030
Nhill	Quarterly	16	0.020
Ouyen	Quarterly	4	0.010
Pomonal	Quarterly	4	0.070
Quambatook	Quarterly	4	0.060
Rainbow	Quarterly	4	0.060
Rupanyup	Quarterly	4	0.060
Sea Lake	Quarterly	4	0.250
St Arnaud	Quarterly	4	0.010
Stawell*	Twice-quarterly	8	0.060
Underbool	Quarterly	4	0.010

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Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)
			Max
Warracknabeal	Quarterly	4	0.020
Willaura	Quarterly	4	0.020
Wycheproof	Quarterly	4	0.070

* *Due to the population size of these towns two samples are taken every quarter.*

Δ *Included as part of the Horsham locality.*

5.5 Manganese

The concentration of manganese should not exceed 0.1 mg/L based on aesthetic considerations but would not be a health consideration unless the concentration exceeds 0.5 mg/L. At concentrations exceeding 0.1 mg/L, manganese imparts an undesirable taste to water and stains plumbing fixtures and laundry. Even at concentrations of 0.02 mg/L, manganese will form a coating on pipes, which can slough off as black ooze. Some nuisance micro-organisms can concentrate manganese and give rise to taste, odour and turbidity problems in distribution systems. A detailed description of manganese and its implications in a water supply can be found by reference to the ADWG 2011.

5.5.1 Results

All samples for manganese met the standard for the reporting period (Table 5-6).

There were no missing samples during the reporting period.

Table 5-6 - Concentrations of manganese in Drinking Water for 1 July 2016 – 30 June 2017. Manganese should not exceed 0.5 mg/L.

Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		No. of samples where standard was not met (S18)
			Max	Average	
Ararat*	Quarterly	8	0.010	0.002	0
Birchip	Quarterly	4	0.012	0.008	0
Charlton	Quarterly	4	0.001	0.001	0
Dimboola	Quarterly	4	0.001	0.001	0
Donald	Quarterly	4	0.002	0.001	0
Edenhope	Quarterly	4	0.004	0.003	0
Great Western	Quarterly	4	0.001	0.001	0
Halls Gap	Quarterly	4	0.012	0.004	0
HavenΔ	Quarterly	4	0.004	0.002	0

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Sampling Locality	Sampling Frequency	No. of Samples	Results (mg/L)		No. of samples where standard was not met (S18)
			Max	Average	
Hopetoun	Quarterly	4	0.001	0.001	0
Horsham*	Quarterly	8	0.008	0.003	0
Jeparit	Quarterly	4	0.001	0.001	0
Lake Bolac	Quarterly	4	0.001	0.001	0
Manangatang	Quarterly	4	0.002	0.001	0
Minyip	Quarterly	4	0.001	0.001	0
Murtoa	Quarterly	4	0.002	0.002	0
Natimuk	Quarterly	4	0.007	0.005	0
Nhill	Monthly	12	0.001	0.001	0
Ouyen	Quarterly	4	0.003	0.002	0
Pomonal	Quarterly	4	0.002	0.001	0
Quambatook	Quarterly	4	0.005	0.003	0
Rainbow	Quarterly	4	0.003	0.002	0
Rupanyup	Quarterly	4	0.001	0.001	0
Sea Lake	Quarterly	4	0.016	0.010	0
St Arnaud	Quarterly	4	0.001	0.001	0
Stawell*	Quarterly	8	0.001	0.001	0
Underbool	Quarterly	4	0.001	0.001	0
Warracknabeal	Quarterly	4	0.001	0.001	0
Willaura	Quarterly	4	0.011	0.007	0
Wycheproof	Quarterly	4	0.001	0.001	0

* *Due to the population size of these towns two samples are taken every week.*

Δ *Included as part of the Horsham locality.*

6 Complaints

6.1 Complaints and Responses

GWMWater's Customer Complaints and Disputes Policy recognise customers' rights, including the right to complain.

GWMWater systematically records all complaints in a complaint register. Trends in water quality complaints are able to be tracked and monitored and appropriate action taken.

All customer complaints are investigated to determine the cause and significance of the complaint. Operational changes or capital improvements which optimise treated water quality, may be implemented in response to significant customer complaints. In response to a complaint, customers are contacted directly followed by appropriate action, which will be vary depending on the nature of the complaint.

Table 6-1 and Table 6-2 below summarises the complaints received during the reporting period for both drinking water and regulated water supplies.

Table 6-3 and Table 6-4 provide a detailed breakdown of the total number of complaints received from customers supplied with drinking and regulated water respectively.

Table 6-1 – Drinking water quality complaints comparison between 2014/2015 2016/2017.

Type of Complaint	Number of complaints			Comparison with previous reporting periods
	2014/2015	2015/2016	2016/2017	
Discoloured	102	63	67	No significant change
Taste/Odour	39	20	4	Significant decline
Air in water	1	1	2	No significant change
Other	8	5	0	Significant decline
Total	150	89	73	Gradually trending down

Table 6-2 – Regulated water quality complaints comparison between 2014/2015 and 2016/2017.

Type of Complaint	Number of complaints			Comparison with previous reporting periods
	2014/2015	2015/2016	2016/2017	
Discoloured	56	58	48	No significant change
Taste/Odour	46	36	8	Significant decline
Air in water	0	0	0	No significant change
Other	4	8	0	Significant decline
Total	150	102	56	Gradually trending down

6.2 Analysis of Issues

Over this reporting period, GWMWater experienced a decrease of 16 percent complaints for drinking water and 46 percent for regulated supplies compared to the last two reporting period. Discoloured water complaints were the highest number of complaints across the categories for both drinking and regulated water supplies.

No significant change of number of complaints due to discoloured water from this reporting period to the last reporting period in drinking water towns. Discoloured water complaints at Nhill was the highest colour complaints. Before Nhill was upgraded to drinking water, it was provided with non-treated groundwater as a regulated supply and naturally occurring minerals in the groundwater (particularly iron) built up in the reticulation. As Nhill was converted to a drinking water supply in October 2013, reticulation pipeworks were thoroughly cleaned by air-scouring to remove soft iron deposits. Over time, the reticulation supply has continued to self-clean as potable water redissolves remaining iron in the pipeworks, and washes it through to customers tap. This results in the increasing customer complaints with the main response being rusty and orange water. Some customers may have had to flush internal pipework to clear water discolouration and GWMWater applied a lower water rate to those customers. GWMWater has been addressing the issue with a flushing and air-scouring program, and are looking to implement additional water quality improvements with a series of ice pigging works due to commence in the next reporting period. Customers in Nhill have been informed of the issue and any maintenance works undertaken on the water main.

Discoloured water and air in water complaints at Ararat were mainly due to a high number of mains repairs and mains replacement in the town. Taste and odour complaints in Willaura and Lake Bolac were related to the chlorine clean.

There was a significant decreased of taste and odour complaints, by 80 percent in this reporting period in drinking water supplies. In the last reporting period, most of the taste and odour complaints were received from Horsham. Previously, Horsham seasonally experienced elevated levels of 2-methylisorborneol (MIB) which causes the drinking water to have a musty odour and earthy taste. GWMWater implement a treatment upgrade at Horsham WTP to improve the drinking water quality.

Due to the high number of water quality complaints in regulated towns in the last two reporting periods, GWMWater has undertaken flushing and implemented raw water storage cleaning program and mains swabbing program. These actions are effective as compared to the last reporting period, where there was a 17.2 percent decrease for discolouration and 77.8 percent decreased for taste and odour complaints. To help with reticulation maintenance, regulated towns have been included in a draft mains-flushing program.

Table 6-3 - Water quality complaints for Drinking Water towns of 1 July 2016 – 30 June 2017.

Water Supply	Pop'n served	ESC Customers†	Number of Complaints				
			Colour	T&O^	Air	Other	Total
Ararat	8297	4036	17				17
Birchip	702	457	1				1
Charlton	1050	698			1		1
Dimboola	1730	882	2				2
Donald	1498	886					0
Edenhope	946	547	1				1
Great Western	400	133					0
Halls Gap	430	514	4				4
Hopetoun	739	380					0
Horsham*	14543	8419	9		1		10
Jeparit	477	303	1				1
Lake Bolac	330	171		2			2
Manangatang	309	165	1				1
Minyip	524	276					0
Murtoa	865	484	1				1
Natimuk	514	269	1				1
Nhill	2184	1151	28				28
Ouyen	1191	688					0
Pomonal	322	127					0
Quambatook	249	168					0
Rainbow	683	368					0
Rupanyup	536	249					0
Sea Lake	640	422					0
St Arnaud	2193	1428		1			1
Stawell	6032	3286	1				1
Underbool	215	133					0
Warracknabeal	2438	1440					0
Willaura	530	264		1			1
Wycheproof	635	429					0
Total	**51202**	**28773**	**67**	**4**	**2**	**0**	**76**

† *ESC defines a customer as a property which, is connected to the water business' water system; and receives a fixed and/or usage account.*
^ *Taste and Odour (T & O).*
* *Haven results included as part of Horsham.*

Table 6-4 - Water quality complaints for Regulated Supplies of 1 July 2015 – 30 June 2016.

Water Supply	Pop'n served	ESC Customers†	Number of Complaints				
			Colour	T&O^	Air	Other	Total
Antwerp	63	12					0
Apsley	277	122					0
Berriwillock	184	89	1				1
Beulah	329	174	1				1
Brim	171	56	1				1
Buangor	103	39	2				2
Chillingollah	5	6					0
Chinkapook	32	15					0
Cowangie	36	12					0
Culgoa	101	77	3	2			5
Dooen	240	18					0
Elmhurst	183	119	3				3
Glenorchy	125	61	2				2
Goroke	299	176					0
Harrow	200	93	1				1
Jung	241	40	2				2
Kaniva	803	524	7				7
Kiata	62	20					0
Lalbert	151	58					0
Lascelles	93	30					0
Lillimur	110	19					0
Marnoo	122	69	1				1
Miram	40	10	1				1
Moyston	348	92	1				1
Murrayville	280	196	1	1			2
Nandaly	39	33	2				2
Nullawil	93	47	2				2
Patchewollock	133	53	1	1			2
Pimpinio	184	38		1			1
Serviceton	120	31	1				1
Speed	78	38	2	2			4
Streatham	156	48					0
Tarranyurk	30	7	1				1
Tempy	174	30					0
Ultima	174	99	6				6
Waitchie	48	6					0
Walpeup	158	75		1			1

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Water Supply	Pop'n served	ESC Customers†	Number of Complaints				
			Colour	T&O^	Air	Other	Total
Watchem	114	84					0
Westmere	40	16					0
Wickliffe	113	45	4				4
Woomelang	201	145	1				1
Yaapeet	84	33	1				1
Total	**6537**	**2955**	**48**	**8**	**0**	**0**	**56**

† *ESC defines a customer as a property which, is connected to the water business' water system; and receives a fixed and/or usage account.*

^ *Taste and Odour (T & O).*

7 Risk Management Plan Audit

7.1 Summary of Risk Management Plan Audit

No regulatory audits were required during 2016/2017.

GWMWater underwent a drinking water risk management plan audit in the last reporting period 2015/2016. GWMWater achieved compliance on the audit and demonstrated the integration of the Drinking Water System into the whole organisation risk and asset management. The areas assessed included risk management plan, development and implementation of preventative strategies (including appropriate control and monitoring measures), detailed description of supply, details of emergency management arrangements and procedures for dealing with an incident and event or emergency that may adversely affect the quality or safety of drinking water.

8 Undertakings under Section 30 of the Act

There were no undertakings during the reporting period.

9 Regulated Water

Regulated water is water that is not intended for drinking, but which could reasonably be mistaken as drinking water. This could be the case when such water is, for example, delivered to households through a piped reticulation system.

Section 6 of the *Safe Drinking Water Act* 2003 allows the Minister for Health to declare certain water as regulated.

GWMWater must manage risks in relation to water that is not intended for drinking, as part of its normal business practices. GWMWater is required to:

a) prepare a Risk Management Plan for the regulated water,
b) ensure the Risk Management Plan contains the matters specified in Regulation 8 of the Safe Drinking Water Regulations,
c) have the Plan audited by an approved auditor,
d) take all reasonable steps to minimise the likelihood of the water being mistaken as drinking water, and
e) include a summary of the management activities for regulated water supply in the Annual Report.

GWMWater had a total of 42 towns supplied with water classified as 'regulated water' under Section 6 of the Act during the reporting period. The regulated water supplies are listed in Table 1-2 and Table 2-2 and were audited for the period with feedback to elevate the highest risks into the corporate framework, which has been complete. The Minister for Health also declared all rural water pipelines, other than the WMP, as regulated supplies in the Victorian Government Gazette No. S 36 on Monday 23 February 2009.

Under section 25 of the *Safe Drinking Water Act* 2003, water suppliers are required to report on the steps taken to make the public aware of regulated water. GWMWater informs their customers in towns with a regulated water supply are advised of the water quality through:

a) notices on their water bills,
b) regular newsletters,
c) signage on publicly accessible taps in cooperation with Local Government,
d) letters to new tenants (when this advice is received by GWMWater form real estate agents or property owners), and
e) delivery of a 'Living with an Untreated Water Supply' pamphlet to new customers.

10 Emergency / Incident Management

10.1 Emergencies

GWMWater reviewed its Emergency Management Plan during 2009/2010. The Emergency Management Plan includes specific procedures for the management of water quality incidents.

Water quality incidents are notifiable to DHHS under Section 22 of the Act. The Emergency Management Plan reflects this requirement.

10.2 Chlorine incident – Pomonal (Section 22 notification)

The Pomonal water pump station (WPS) with chlorine booster was operating at high chlorine residual between the 8 to 9 May 2017, and filling the clearwater storage (CWS). The high chlorine water reached the Southern end of town at approximately 8 mg/L at 10 am on the 9 May. The CWS was isolated and the town flushed between 10 am and 12:30 pm until the residuals were returned to 0.8 mg/L. GWMWater report the incident DHHS immediately followed by a Section 22 submission. DHHS was updated throughout the incident and all affected customer were notified via phone calls, SMS, door knock and letter drop regarding the situation.

Multiple issues caused the chlorine incident in Pomonal WPS:

- Incorrect programmable logic controller (PLC) coding, with a missed control message to close the chlorine dosing valve.
- On-call Operator was not familiar with the system.
- Insufficient investigation done when the Critical Control Point (CCP) alarm was triggered.
- The schematic of the Pomonal CWS site on SCADA did not accurately reflect the correct flow of water.

Following the event, a debrief was undertaken and recommendations were implemented to prevent a re-occurrence:

- The PLC coding at the Pomonal WPS chlorinator has since been rectified.
- All pumps/inhibitor were checked to ensure that the communication between the PLC and pumps are aligned.
- Ensure on call Operators are familiar with other sites.
- Schematics were reviewed to ensure that they accurately reflected the flow of water.

10.3 Lead incident – Pomonal (Mis-sample)

A compliance sample came back from the laboratory, with a lead exceedance at Pomonal, having a concentration of 0.011 mg/L as sampled on the 20 February 2017. In response, an investigation was conducted, the location was flushed, and sampling was conducted in multiple locations in the reticulation. During the incident, DHHS was notified. The investigation identified the root cause of the non-compliance was a 'mis-sample' due to having a new sampler who was unfamiliar with the sampling site, and taking water from a tap that led to a rainwater tank that fed water to the garden.

Following the event:

- A review of all drinking water sampling locations was conducted.
- Ensure all new samplers received sufficient training to perform task.

11 Water Storage Manager

In addition to being a water supplier for the purposes of the Act, GWMWater is also a water Storage Manager. This situation arises when water corporations supply water to other water corporations, which in turn uses the supplied water for the supply of drinking water to a water sampling locality. GWMWater assumes this role for the two water corporations described below. Being both a water supplier and a water storage manager places some additional legislative responsibilities onto GWMWater. To address this, GWMWater has executed a Memorandum of Understanding (MoU) with Wannon Water and Coliban Water, stating how its obligations as a water storage manager will be met.

Monthly monitoring is undertaken for a suite of predetermined parameters, with all analysis being conducted by a NATA accredited laboratory. These results are made available to the other water corporations as needed, as is access to all monitoring data conducted by GWMWater in its role of Water Supply Manager.

GWMWater has developed a risk management framework for the headworks storages under its control. GWMWater's operational staff meet with personnel from Coliban Water and Wannon Water on an annual basis to discuss the agreement.

Table 11-1 – Summary of water supply systems.

Catchments	Source Water	Raw water storage	Treatment	Treatment Plant	Water Suppliers
Lake Bellfield	Supply System 4 of Wimmera Mallee Pipeline	N/A	N/A	N/A	Coliban Water
Willaura Headwork – Mt William and Stoney Creek	Glenthompson Pipeline	N/A	N/A	N/A	Wannon Water
Rocklands Reservoir	Pipeline	N/A	N/A	N/A	Wannon Water

11.1 Coliban Water

GWMWater provides raw water to Coliban Water, which subsequently treats the water and supplies it to the localities of Wedderburn, Borung, Korong Vale and Wychitella (Figure 2). This water is sourced from Supply System 4 of WMP, which is fed from the Grampians Headworks, primarily Lake Bellfield. Taylors Lake provides a back-up source of supply to the WMP, should Lake Bellfield become unsuitable for any reason. The catchment of Lake Bellfield is National Park. The catchment of Taylors Lake includes both streams originating in the National Park, and land utilised for farming. Taylors Lake can also receive water transfers from other reservoirs within the Grampians Headworks.

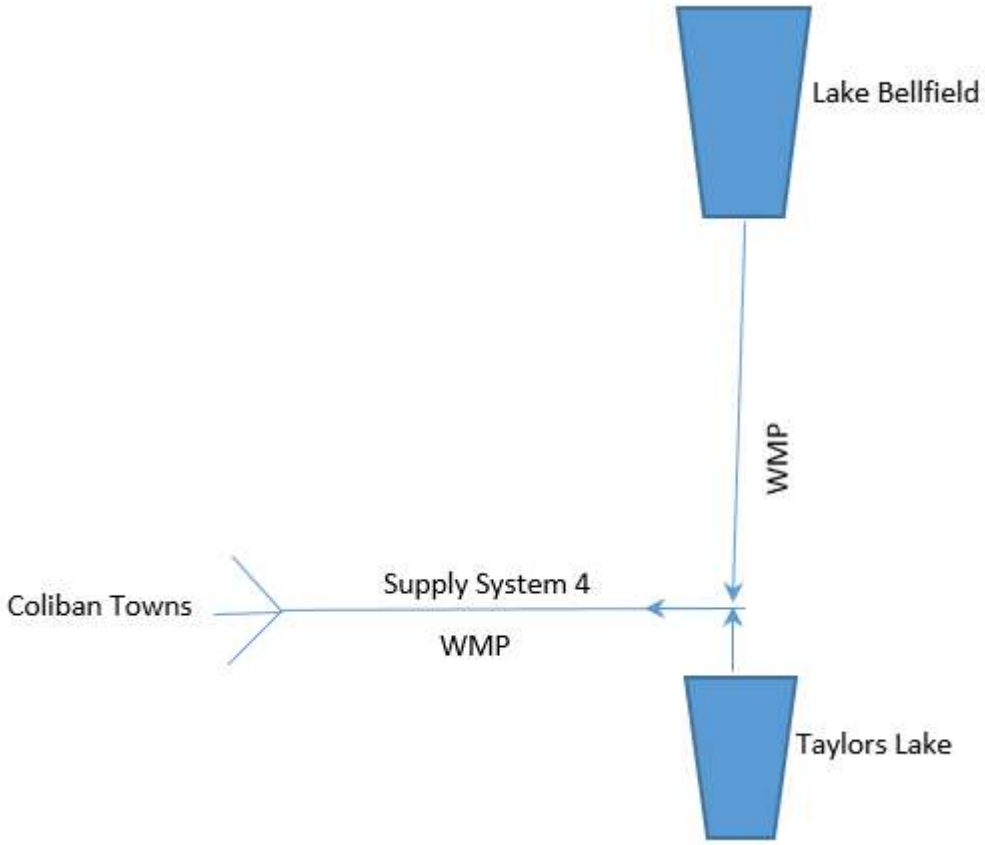

Figure 2: Simplified schematic diagram showing supplies to Coliban Water.

11.2 Wannon Water

GWMWater provides raw water to Wannon Water (Figure 3), which subsequently treats the water and supplies it to the localities of Balmoral and Glenthompson. The water for the latter is sourced from the Willaura Headwork (Mt William and Stoney Creek) and is delivered to Wannon Water through the Glenthompson Pipeline. Between the months of June and December, water supplied to Glenthompson is primarily from surface water diversion from unregulated waterways in the Grampians National Park. Groundwater bores supplies between January and May.

The water for Hamilton and Balmoral is taken directly from Rocklands Reservoir.

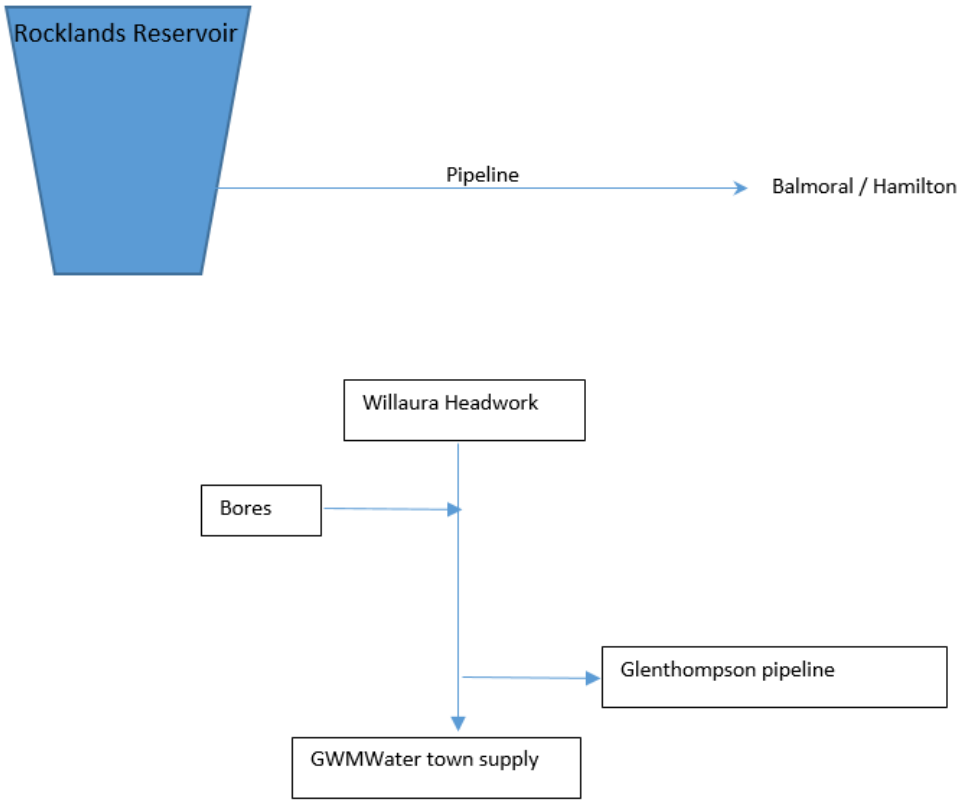

Figure 3: Simplified schematic diagram showing supplies to Wannon Water.

12 Glossary of Terms

Terms and abbreviations used in this report have been collated into a Glossary to provide clarity.

Term/Abbreviation	Description
ADWG, 2011:	The Australian Drinking Water Guidelines provide a framework for the management of drinking water supplies designed to ensure safety at the point of use.
Alum:	Aluminium sulphate as used as a coagulant in the water treatment process.
BGA:	Blue Green Algae.
BOOT:	Build Own Operate and Transfer. A form of commercial contract associated with the provision of treated water at privately-owned water treatment plants.
Bore:	Conduit for extracting groundwater from an aquifer to the surface for use in a town water supply.
CCP:	Critical Control Point in the Risk Management Plan.
Chlorination:	Process of adding chlorine gas to water as a disinfectant.
Coagulation:	The clumping together of solids so they can more easily be settled out or filtered out of water. A chemical called aluminium sulphate (alum) or aluminium chlorohydrate (Megapac 23) is generally used to aid coagulation in water treatment.
Concentration:	A measure of how much of a given substance there is mixed with another substance (in this case water), usually expressed as a weight to volume, e.g. milligrams per litre (mg/L).
CWS:	Clear Water Storage.
DHHS:	Department of Health and Human Services.
DBP:	Disinfection by-product – a reaction of natural organic material with the disinfectant medium producing by-products via reaction.
Disinfection-only Water supplies:	Water supplies that have disinfection as their only form of treatment.
Dissolution:	A form of chemical weathering in which water molecules, sometimes in combination with acid or another compound in the environment, attract and remove oppositely charged ions or ion groups from a mineral or rock.
Distribution system:	The system of pipes delivering water from the water treatment plant to the reticulation system.
DOC:	Dissolved organic carbon – a measure of the concentration of humic and fulvic acids in the water.
DOM:	Dissolved organic matter – this term can be interrelated with the amount of 'colour' in the water (is similar to DOC).
Drinking water:	Legislatively defined as water intended for human consumption or associated with purposes for human consumption. Also known as a potable supply.
EC:	Electrical conductivity as measured in micro Siemens per centimetre (µS/cm).

Entry point:	The point at which the water supply enters the reticulation system.
ESC:	Essential Services Commission.
Flocculation:	The water treatment process after coagulation that uses gentle stirring to cause suspended particles to form larger, aggregated masses (floc). The aggregates are removed from the water by a separation process (e.g. sedimentation, flotation, or filtration).
Fluoridation:	The act of adding fluoride to a water supply in accordance with the *Health (Fluoridation) Act*,1973.
Fully-treated water Supplies:	Water supplies that have coagulation and filtration processes in addition to disinfection.
GWMWater:	Grampians Wimmera Mallee Water Corporation (trading as GWMWater).
Hardness:	Caused by the presence of calcium and magnesium ions in water and can contribute to scale build up in pipes and appliances.
HU:	Scientific units for true colour measurements – Hazen Units.
Jar Testing:	A bench top test designed to optimise chemical dose rates based on known quality of raw water.
kL:	Kilolitre (1,000L).
L:	Litre
Megapac 23:	Aluminium chlorohydrate as used as a coagulant in the water treatment process.
mg/L:	Scientific units for the concentration of a parameter given as milligrams per litre. Also known as parts per million (ppm).
ML:	Megalitre (1,000,000 L).
NATA:	National Association of Testing Authorities, Australia. National Accredited Testing Authority.
NMP:	Northern Mallee Pipeline drawing its water from the Murray River.
Notifications:	Pursuant to Sections 18 and 22 of the *Safe Drinking Water Act,* 2003.
NTU:	Scientific units for turbidity measurements – Nephelometric Turbidity Units.
Orgs/100mL:	Organisms per 100 mL. A measure of the number of *E.coli*.
pH:	The measure of the concentration of hydrogen ions in a sample related to a logarithmic scale between 1 (acidic) and 14 (basic).
Regulated water:	Water not intended for human consumption, but that could easily be mistaken as such. Also known as non-potable supply. This term is defined in the *Safe Drinking Water Act,* 2003.
Reticulation system:	The system of pipes delivering water to the customers tap from the entry point of the system.
RMP:	Risk Management Plan pursuant to the *Safe Drinking Water Act*, 2003.
Safe Drinking Water Act, 2003:	Legislative framework for assuring drinking water quality in Victoria.

Safe Drinking Water Regulations, 2015:	Regulations made subsequent to the *Safe Drinking Water Act* that give effect to key aspects of the Act.
Sampling:	The process of collecting a representative amount of water from a reticulation system to analyse and compare against the ADWG Standards and subsequently report to DHHS.
SCADA:	Supervisory Control and Data Acquisition. A computer interface to acquire data remotely through a telemetered communications exchange network.
T&O:	Taste and odour.
THMs:	Trihalomethanes – disinfection by-products formed when using chlorine as a disinfectant. Take the form of trichloromethane, bromodichloromethane, dibromochloromethane and tribromomethane.
TWS:	Treated Water Storage (applicable to disinfection only supplies).
UCL:	Upper Confidence Limit: A statistical method of evaluating a sample set.
Undertakings:	Legally binding commitment made pursuant to Section 30 of the *Safe Drinking Water Act,* 2003.
WMP:	Wimmera Mallee Pipeline.
WPS:	Water pump station.
WTP:	Water treatment plant.

13 References

a) **Australian Drinking Water Guidelines 2011**, National Health and Medical Research Council, Canberra, 2011
b) ***Safe Drinking Water Act* 2003** (Act No. 46/2003), 11 June 2003, Parliament of Victoria.
c) **Safe Drinking Water Regulations 2015** (S/R No. 88/2015), 18 July 2015, Parliament of Victoria.