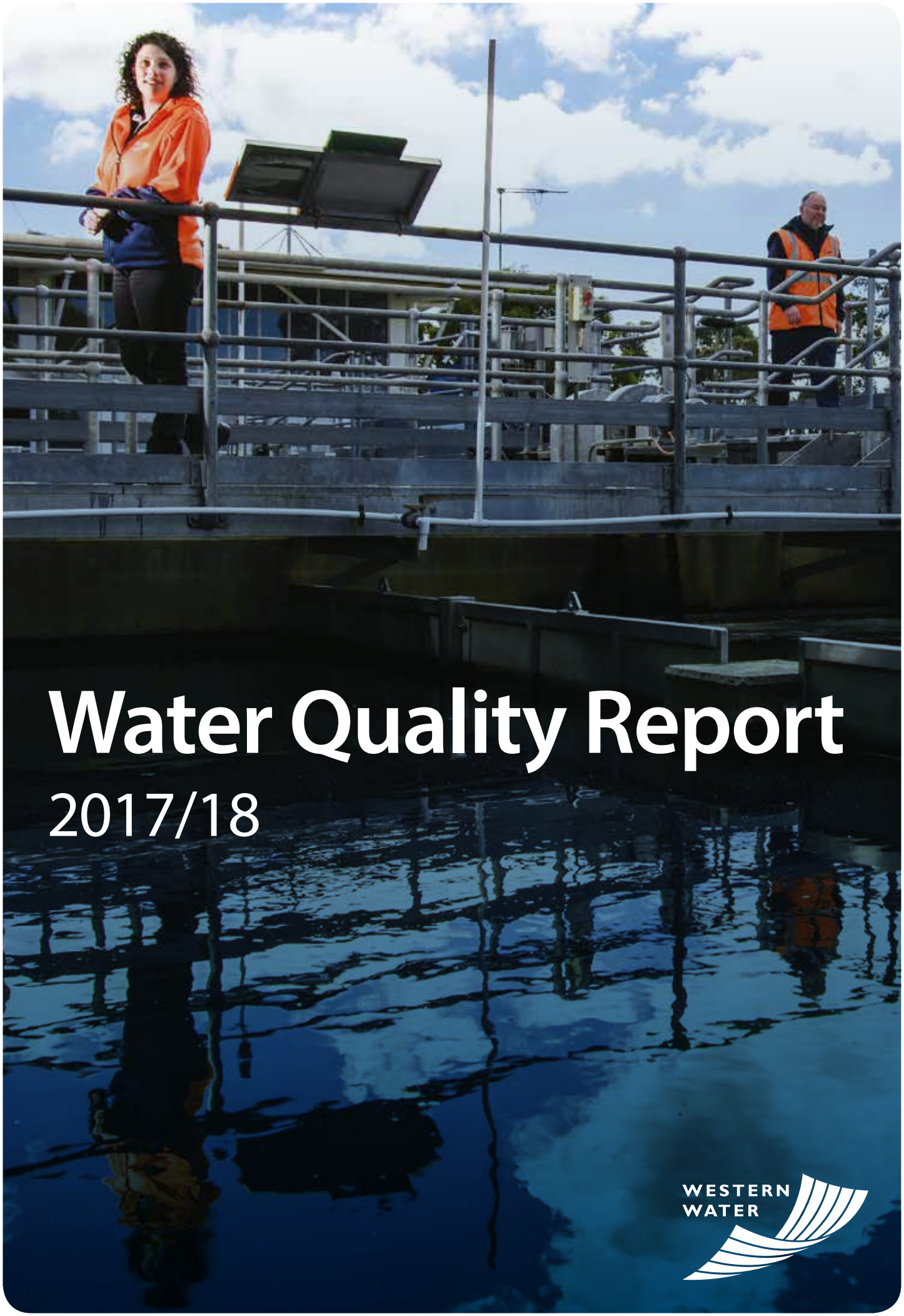


Water Quality Report

2017/18

WESTERN WATER

Contents

Introduction

About Western Water

In 2017/18, Western Water provided water, recycled water and sewerage services to 69,371 properties across a region of 3,000 square kilometres to the north-west of Melbourne.

Serviced properties grew by 5.5% this year – particularly within the new residential estates in and around Melton, Sunbury and Bacchus Marsh. Average property growth rates over the next ten years are expected to exceed 4.6% per annum.

With an average of 2.6 people per household, the service region's population is calculated at 160,339 – up from 153,358 reported last financial year.

Highlights

- Safely delivered 15,284 million litres of drinking water to 64,981 properties
- Passed the Department of Health and Human Services (DHHS) biennial drinking water quality audit
- Sourced 35% of all drinking water supplied from local reservoirs compared to 24% the year before due to good supplies of water available
- Fully complied with the requirements of the *Safe Drinking Water Act 2003* and the drinking water quality standards specified in the Safe Drinking Water Regulations 2015 (SDWR) across the distribution network
- Introduced the Waternamics data management application to support operational activities
- Completed a regional flushing program across the entire Sunbury area
- Collaborated with other water corporations, local councils, traditional owners and the Department Environment, Land, Water and Planning (DELWP) through regional Integrated Water Management Forums
- Engaged with close to 6,000 customers in the development of Western Water's Price Submission 2018–20
- Continued collaboration with the Intelligent Water Network, trialling new technologies to improve water systems management

Table 1: Drinking water supply system

	2016/17	2017/18
Connected water customers	62,234	64,981
• Residential	59,118	61,811
• Non-residential	3,116	3,170
Water consumption (ML)	13,775	15,284
• Residential (ML)	10,584	11,382
• Non-residential (ML)	1,971	2,158
Water losses (ML)	1,220	1,744
Water filtration plants	7	7
Water mains[1] (km)	2,020	2,123

[1] *Total includes recycled water mains.*

Manner of establishment and responsible Minister

Established under the *Water Act 1989*, Western Region Water Corporation (trading as Western Water) is one of Victoria's 13 regional urban water corporations.

The responsible Minister for the reporting period, 1 July 2017 to 30 June 2018, was the Hon. Lisa Neville MP, Minister for Water. Western Water is responsible to the Minister for Water via DELWP. The Department of Treasury and Finance (DTF) also has a shareholder governance role.

DHHS sets and supervises water quality standards, while the Environment Protection Authority (EPA) governs environmental standards, particularly for wastewater discharge, recycled water and biosolids management.

The Essential Services Commission (ESC), the Victorian Government's economic regulator for essential utility services, regulates Western Water's prices, service standards and market conduct. The Energy and Water Ombudsman Victoria (EWOV) receives, investigates and resolves escalated enquiries and complaints against electricity and water suppliers across Victoria.

Drinking water regulations

Western Water is governed by Victoria's *Safe Drinking Water Act 2003* and SDWR, which provide a comprehensive regulatory framework for the provision of drinking water to customers.

The framework encompasses a risk-based approach to the management of drinking water from water catchment to the customer's tap, with linkages to the Australian Drinking Water Guidelines 2011 (ADWG) where applicable.

The DHHS Water Unit in the Health Protection Branch is responsible for administering the regulatory framework.

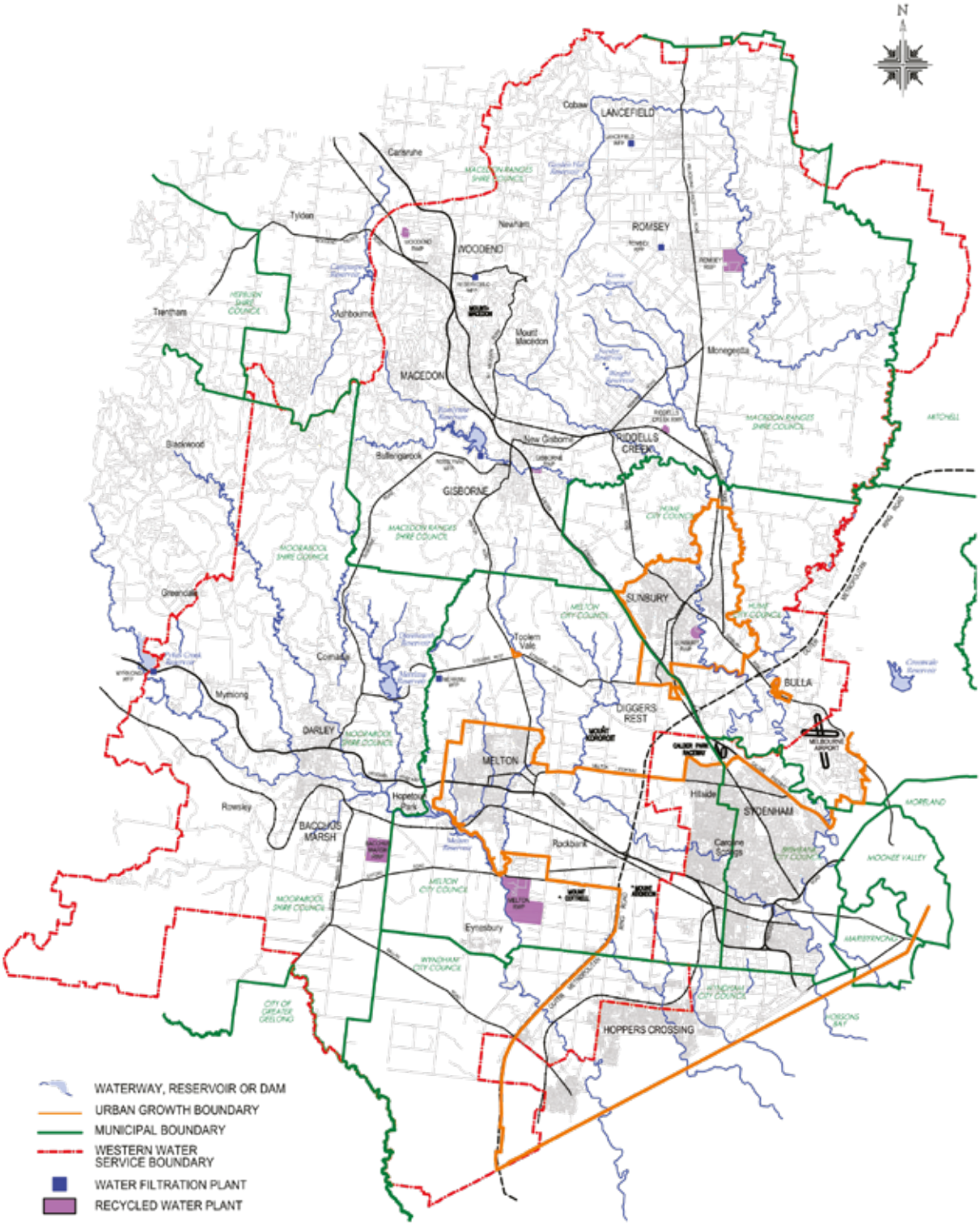
35%

Supplied water sourced from local reservoirs compared to 24% the year before

6,000

Customers engaged in Western Water's Price Submission 2018–20

Service area map



Foreword from the Acting Managing Director

Western Water continues to meet the combined challenges of climate change and unprecedented levels of population growth by ensuring safe, quality drinking water services to the 69,400 properties across our service region. For more than two decades, we have identified innovative and customer focused solutions for the communities we serve, demonstrated in stable, high levels of customer satisfaction with our services.

During 2017/18, Western Water safely delivered 15,284 million litres of drinking water to a population of almost 160,000.

Securing water for the future

A significant achievement for Western Water has been the interconnected water supply system we operate which allows us to ensure safe drinking water supplies to all the towns we service. Over the past year, our largest towns have received water from the Melbourne supply system while our smaller towns have received water from closer to home.

Using external water supplies is an essential component of our water management planning as the population continues to grow in a variable climate. At the end of the year, our customer base had grown by 4.6% while the combined capacity in our largest reservoirs had fallen to 34%.

Our Urban Water Strategy is now being implemented to ensure long term water supply security for our customers, and we are investing significant resources in developing regional integrated water management plans across the region to make the most of all potential water resources and preserve drinking water as much as possible.

Committed to drinking water quality

Western Water is aware of the responsibility it bears to provide safe, affordable drinking water to the people living and working in our service region. Our efforts were rewarded this year as we successfully passed the DHHS biennial drinking water quality audit.

This report reflects our commitment to meeting our drinking water quality responsibilities by addressing the twelve elements of the Framework for Management of Drinking Water Quality.

Western Water aims to further improve water quality for customers. Innovative solutions can provide a step change in how we provide our services and we continue to support and trial projects through the water industry's Intelligent Water Networks program. One solution, Waternamics, is providing significant benefits in managing and integrating water supply system data allowing us to identify and fix issues more quickly and reduce times for priority faults.

I would like to take this opportunity to thank all Western Water staff involved in the production and supply of our drinking water for their professional and committed approach over the past year.

It is with pleasure that I submit Western Water's 2017/18 Water Quality Report to customers, stakeholders and regulators.

Rob Murphy
Acting Managing Director
October 2018

20+

Years of identifying innovative and customer focused solutions… demonstrated in stable, high levels of customer satisfaction with our services

4.6%

Growth in customer base

1 Commitment to drinking water management

Western Water closely monitors the quality of drinking water supplies to ensure compliance with standards set out in the SDWR. We also adopt other industry guidelines associated with health and aesthetics of drinking water including the ADWG. Together, these are used to set the physical, chemical, radiological and microbiological performance targets ensuring our water quality targets are more than adequate.

Drinking water policy

Western Water's Drinking Water Policy, contained in Appendix 1, reflects current practice in the delivery of safe drinking water, with procedures and initiatives to support policy implementation. This includes the continual application of the Drinking Water Quality Management System (DWQMS), and associated Hazard Analysis and Critical Control Points (HACCP) Plans to manage and protect water quality.

The policy also outlines our aim to continuously improve processes and meet the requirements of the *Safe Drinking Water Act 2003* and subordinate legislation. It is displayed on noticeboards in the Sunbury office and at all water filtration plants, and is included in inductions for new staff.

Implementation

Western Water implements this policy through:

- application of the DWQMS
- delivery of strategic planning actions and initiatives
- communicating policy content and intent to our employees, customers and stakeholders
- educating customers and stakeholders on use of water as a precious resource
- maintaining a high standard of asset management practices, and
- undertaking regulatory audits, certification audits and internal audits.

Regulatory and formal requirements

Western Water maintains a register of regulatory and other formal requirements for the delivery of drinking water through its DWQMS (refer to the full list in Appendix 2). This includes Federal and Victorian legislation, codes of practice, standards, service level agreements, contracts and operating agreements that are relevant to the delivery of safe drinking water.

Western Water ensures responsibilities in relation to drinking water are understood by referencing these regulatory and formal requirements in applicable policies, procedures, work instructions, position descriptions and individual performance reviews. A review of requirements HACCP team to ensure changes are reflected throughout all systems. This HACCP system was audited during the reporting period, validating our multi-barrier approach to protecting drinking water quality.

Engaging stakeholders

Ensuring Western Water has sustainable, resilient water services systems requires a consultative, collaborative approach with all stakeholders. In addition, it is critical that we engage customers, the community and others in our integrated water management approach, and encourage all to make optimum use of the full range of water resources.

Community and stakeholder engagement

Western Water is committed to building positive, cooperative relationships with all stakeholders that have the potential to either affect or be affected by our operations. These are included in the corporation's emergency contact list, which is updated regularly.

Recognising that we must embrace customer-friendly channels, Western Water's online customer panel now includes 30,000 members. They are kept well informed of water quality issues and changes and, when required, participate in consultation and engagement. Water Matters, our online Have Your Say consultation site, extends engagement opportunities with customers, the wider community and stakeholders.

Major external stakeholders include regulatory bodies such as the DHHS, EPA, DELWP and the ESC as well as suppliers, Melbourne Water and Southern Rural Water (SRW). These organisations are actively engaged through regular meetings and/or reporting. Other significant external stakeholders are those contractors who provide analytical services or water treatment chemical supplies.

Internal stakeholders including management, office, plant and field workers are engaged regularly through the HACCP team and the monthly reporting program.

2 Assessment of the drinking water supply system

Water supply system analysis

Western Water addresses multiple challenges to provide our customers with quality drinking water. One of the most significant challenges we have faced in the past two decades has been ensuring water supply security. The impact of the Millennium Drought, combined with long term, sustained population growth, resulted in significant demand for water from dwindling local supplies. As a result, Western Water became reliant on water sourced from Melbourne's water system.

Our Integrated Water Management Strategy will ensure long term sustainability of water supplies in the region, while the connection to the Melbourne supply system will remain critical for supply security.

Currently the major towns of Sunbury and Melton are being supplied with Melbourne water while Bacchus Marsh and towns in the Macedon Ranges are receiving local supplies. In the past year, 65% of drinking water supplied in Western Water's service area was sourced from the Melbourne system. Low rainfall has seen local reservoirs reduce to a combined total capacity of 34%.

Water supply system

Western Water utilises a cross-disciplinary team to develop the risk assessment of water supply systems including office and plant staff. Where significant changes to risks are identified, the assessment process is assisted by external consultants.

Flow diagrams have been constructed of all water supply systems and these are checked periodically to ensure they reflect actual system arrangements. The DWQMS includes key documentation developed from assessment and analysis of water supply systems with a periodic review of water supply systems.

Water sampling localities

There are six water supply systems in Western Water's region:

- Rosslynne/Sunbury
- Merrimu
- Romsey
- Lancefield
- Woodend, and
- Myrniong.

For water quality monitoring, these supply systems are divided into 19 water sampling localities, formally published by DHHS in the Government Gazette. Each locality is determined by the origin of the water, the location of treatment and storage facilities, and the associated delivery system. These localities form the basis of our water sampling program.

Table 2: Residential population by water sampling locality and town

Water sampling locality	Towns[1]	Residential population[2] 2016/17	2017/18
Bulla	Bulla, Oaklands Junction	680	680
Darley	Darley, Pentland Hills	8,110	8,310
Diggers Rest	Diggers Rest	3,220	3,940
Eynesbury	Eynesbury	2,360	2,400
Gisborne	Gisborne, New Gisborne, Bullengarook	10,260	10,440
Lancefield	Lancefield	2,060	2,120
Lerderderg	Bacchus Marsh, Merrimu, Coimadai, Rowsley	8,180	8,380
Macedon	Macedon	1,590	1,630
Maddingley	Maddingley, Parwan	3,740	3,980
Melton South	Brookfield, Cobblebank, Grangefields, Melton, Melton South, Strathtulloh, Weir Views	32,040	32,450
Merrimu	Harkness, Melton West, Kurunjang, Long Forest	26,830	27,980
Mount Macedon	Mount Macedon	1,410	1,420
Myrniong	Myrniong	250	260
Riddells Creek	Riddells Creek	3,400	3,530
Rockbank	Aintree, Bonnie Brook, Caroline Springs, Deanside, Fieldstone, Fraser Rise, Mount Cottrell, Plumpton, Rockbank, Thornhill Park, Truganina	2,280	4,210
Romsey	Romsey, Kerrie, Monegeetta	4,500	4,720
Sunbury	Sunbury, Clarkefield, Wildwood	36,790	37,750
Toolern Vale	Toolern Vale	440	450
Woodend	Woodend	5,220	5,390
Total		**153,360**	**160,340**

[1] *There have been changes to the towns within localities in line with new suburb naming in Melton during the year.*

[2] *Population estimates are based on the number of water connections to residential properties multiplied by the average number of persons per residential property for each locality and rounded to the nearest 10.*

Assessment of the drinking water supply system (continued)

Drinking water sources

Most towns in Western Water's service region are connected to at least two drinking water sources – Melbourne water and local reservoirs. The major local reservoirs are Rosslynne Reservoir, near Gisborne, and Merrimu Reservoir, near Bacchus Marsh.

In addition, a number of smaller local reservoirs supply water to some towns in the Macedon Ranges and Pykes Creek Reservoir supplies the community of Myrniong.

Local water sources are used for drinking water supply whenever possible but are not sufficient to meet the demands of the region's growing population. As a result, 65% of drinking water supplied to the region this financial year has been sourced from the Melbourne supply system.

At 30 June 2018, local storages held a combined capacity of 34%. The ongoing impacts of climate change and strong population growth mean that the region's future water supply security is dependent on Western Water maintaining access to Melbourne water supplies.

Melbourne water supplies

Western Water has a bulk entitlement with Melbourne Water to access water from the Melbourne Headworks system. As demonstrated this year, this entitlement is critical for the region's drinking water supplies.

Water in the Melbourne system is sourced from protected natural catchments (Upper Yarra Thomson and the Yarra Valley tributaries) and transferred from the Silvan Reservoir directly or via the Greenvale Reservoir filled by Silvan. These sources feed the Sunbury/Rosslynne supply system from Loemans Road Pump Station, and the Merrimu supply system via the Hillside Pump Station.

Western Water applies the same level of water restrictions as Melbourne to all customers in our region. This is a condition of the bulk entitlement agreement with Melbourne Water. Details of supply systems for all towns are outlined in Table 4.

Smaller town supply systems

Woodend, Romsey, Lancefield and Myrniong each have their own local supply systems with additional water supplemented from bulk entitlements in nearby systems. In times of drought, the bulk entitlement from Melbourne supplements these local supplies via the interconnected water transfer network.

Woodend

Woodend receives treated water from two local sources: Campaspe Reservoir via the Marriages Water Filtration Plant, near Woodend, and the Graham Brock Reservoir via Reservoir C Water Filtration Plant, on Mt Macedon.

During 2017/18, Woodend was supplied with 285ML from Campaspe Reservoir and a further 203ML from the Graham Brock Reservoir which received 180ML from the Macedon bulk entitlement. Woodend can also receive a potable supply from the Rosslynne system during times of low local storages or water quality events. 76 ML was supplied from the Rosslynne system during the year.

Romsey

Romsey receives treated water from the Romsey Water Filtration Plant, which is supplied with water from Kerrie Reservoir. Supplementary water can be sourced from Wright Reservoir in Riddells Creek.

In the past year, Romsey received 378ML from Kerrie Reservoir. Extra inflows were sent to Romsey from the Riddells Creek and Maribyrnong bulk entitlements this year and bore water was also used to supplement surface water storages for Romsey.

Myrniong

Myrniong receives its water supply from Pykes Creek Reservoir after treatment at the Myrniong Water Filtration Plant.

A total of 55ML was taken from the storage during the reporting period in compliance with its bulk entitlement. Significant inflows had resulted in a storage increase during the year.

Lancefield

The Lancefield Water Filtration Plant can receive and treat surface water, bore water or a mixture of both.

In 2017/18, 152ML of water was taken from Garden Hut Reservoir at Lancefield. The transfer network from Romsey to Lancefield also allowed for water to be transferred from the Romsey, Riddells Creek and Maribyrnong bulk entitlements during the year.

Assessment of water quality data

Western Water collects extensive history of water quality at water source, treatment plants and customer taps. Samples are scheduled and collected by an independent National Authority of Testing Association (NATA) accredited laboratory with results sent directly to our Aquantify database to allow for investigation into trends and emerging water quality issues.

The Aquantify database includes an automatic notification process for any results that are outside defined limits. The contracted laboratory is required to immediately notify Western Water of any health-related exceedances detected in drinking water samples. In the case of drinking water samples, the limits are based upon the ADWG 2011.

Western Water uses water quality data obtained from the Aquantify database to review trends and data from Supervisory Control and Data Acquisition (SCADA) to monitor trends of water systems on an as needed basis.

Table 3: Major reservoir levels (% capacity)

	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Rosslynne Reservoir	3%	5%	66%	72%	85%	76%	44%	15%	38%	24%
Merrimu Reservoir	10%	9%	85%	78%	76%	63%	29%	10%	51%	37%

Table 4: Drinking water sources

Towns supplied	Reservoir	Catchment
Melton, Melton South, Eynesbury, Hopetoun Park, Rockbank, Toolern Vale, Bacchus Marsh, Long Forest, Darley, Pentland Hills, Merrimu, Coimadai, Maddingley, Parwan, Balliang, Balliang East	Greenvale Reservoir	Yan Yean, Thomson and Upper Yarra Catchment
	Merrimu Reservoir	Lerderderg River, Goodman Creek, Pyrites Creek Catchments
	Djerriwarrh Reservoir	Djerriwarrh Catchment
Gisborne, New Gisborne, Gisborne South, Bullengarook, Mount Macedon, Macedon, Riddells Creek	Greenvale Reservoir	Yan Yean, Thomson and Upper Yarra Catchment
	Rosslynne Reservoir	Jacksons Creek Catchment
Sunbury, Goonawarra, Jacksons Hill, Clarkefield, Bulla, Oaklands Junction, Diggers Rest	Greenvale Reservoir	Yan Yean, Thomson and Upper Yarra Catchment
	Rosslynne Reservoir	Upper Maribyrnong Catchment
Woodend	Graham Brock Reservoir and Reservoir C	Falls/Smokers Creek and Graham Brock Reservoir and Reservoir C Catchments
	Campaspe Reservoir	Campaspe River Catchment
	Rosslynne Reservoir	Upper Maribyrnong Catchment
	Greenvale Reservoir	Yan Yean, Thomson and Upper Yarra Catchment
Myrniong	Pykes Creek Reservoir	Werribee River and Pykes Creek Catchment
	Greenvale Reservoir (when carting)	Yan Yean, Thomson and Upper Yarra Catchment
	Merrimu Reservoir (when carting)	Lerderderg River, Goodman Creek, Pyrites Creek Catchments
Romsey, Kerrie, Monegeeta	Kerrie Reservoir	Upper Bolinda Creek
	Romsey Bore	Local aquifer
	Greenvale Reservoir	Yan Yean, Thomson and Upper Yarra Catchment
	Rosslynne Reservoir	Upper Maribyrnong Catchment
Lancefield	Garden Hut Reservoir	Deep Creek Catchment
	Monument Creek Weir	Monument Creek Catchment
	Bore Number 3	Local aquifer
	Kerrie Reservoir	Upper Bolinda Creek
	Romsey Bore	Local aquifer
	Greenvale Reservoir	Yan Yean, Thomson and Upper Yarra Catchment
	Rosslynne Reservoir	Upper Maribyrnong Catchment

Hazard identification and risk management

Western Water uses a risk framework based on ISO 31000:2009 Risk Management – Principles and Guidelines for the management of water quality hazards and risk assessments.

In accordance with the regulatory framework, Western Water manages the quality of drinking water through implementation of a DWQMS based on the HACCP principles.

3 Preventative measures for drinking water supply

Western Water operates its drinking water supply systems under the Victorian *Safe Drinking Water Act 2003*, administered by DHHS. Western Water is required to manage health risks associated with drinking water, effectively monitor the water and undergo annual audits of our management systems.

A number of processes have been adopted to ensure delivery of safe, high quality drinking water supplies to customers. This is achieved through the multiple barrier from catchment to tap approach, including various water treatment methods, which are covered within the HACCP system.

The most recent independent external audit of Western Water's risk management plan took place in May 2018 and confirmed Western Water is fully compliant with the *Safe Drinking Water Act 2003* risk management plan requirements. The next audit is expected to take place in mid-2020.

Preventative measures and multiple barriers approach

The adoption of preventative strategies for the protection of drinking water supplies is one of the key elements of the Framework for Management of Drinking Water Quality, developed under the ADWG. A key aspect of this risk-based approach to the production of safe drinking water is the use of multiple water treatment processes, also known as the multiple barrier approach.

At Western Water, drinking water provided to customers is subject to a multiple barrier approach to ensure safe and aesthetically acceptable supplies. This demands a highly skilled workforce and requires constant vigilance and attention to detail. Each water quality barrier in place at Western Water is discussed in detail below, including:

- implementation of the Guidelines for Planning Permits in Open Potable Water Supply Catchments and liaison with storage managers to support protection of catchments and reservoirs in accordance with the Department of Sustainability and Environment Guidelines, November 2012
- operation of water treatment and disinfection systems to meet water quality standards and improve aesthetics
- protection of water quality through a fully enclosed water distribution network to prevent possible contamination after treatment, including regular maintenance
- implementation of management systems (QMS, Emergency Management Systems (EMS), Occupation Health and Safety (OH&S) and HACCP) procedures that are audited and reviewed regularly, and followed by experienced operators, and
- delivery of training and competency assessment of operators through registered training organisations.

Catchment protection

Western Water works alongside storage managers, SRW and Melbourne Water, to support effective water quality management from catchment to customer.

Protected reservoirs and storage tanks

The amount of time water is held in surface water supply reservoirs is a key element to maintaining good water quality as longer detention time allows sediment to settle. This improves water clarity and enables longer exposure to solar radiation, which aids in the disinfection process.

In addition to the region's three major storage reservoirs – Rosslynne, Merrimu and Pykes Creek (managed by SRW), Western Water owns 17 smaller storages, most of which are located in or near the Macedon Ranges. Western Water's storages are protected through restricting access. Water quality at reservoirs is also monitored to ensure safety.

A total of 30 water storage tanks and 37 pump stations are used to supply water to customers throughout the water reticulation system. The tanks are typically constructed of concrete or metal and are fully enclosed. These sites are regularly tested to ensure water safety and security.

Alternative sources of supply

Western Water's extensive interconnection to the Melbourne supply system has ensured there is capacity in all the region's towns to access alternate water supply sources through the bulk entitlement. In the case of Myrniong, this access would involve carting water.

Water treatment practices

Drinking water sourced from unprotected catchments – such as the local source water storages available to Western Water – requires both filtration and disinfection due to the surrounding agricultural and urban activity. To ensure the provision of safe and healthy drinking water at customer taps, all water is disinfected at the point where it enters the supply system and again at specified points along the delivery system.



However, drinking water sourced from the Melbourne Headworks system comes from highly protected catchments which have long detention time in reservoirs. As a result, disinfection alone is sufficient to ensure water quality. Melbourne Water carries out primary disinfection. Western Water booster stations chlorinate the water as it enters the local network.

Filtration

Western Water operates seven water filtration plants (WFPs) and an additional 14 water treatment facilities which booster chlorinate the water. Five WFPs employ dissolved air flotation filtration (DAFF) while Merrimu WFP uses the traditional sedimentation-filtration process and Romsey uses microfiltration.

Each process efficiently removes potential pathogens and, coupled with disinfection, maintains a healthy drinking water supply with minimal impact on taste and odour. In addition, all filtration processes deliver high aesthetic water quality with minimal chemistry added. Typically, they provide turbidity values of <0.3 Nephelometric Turbidity Units (NTU) and true colour of <5 Platinum-cobalt Units (PCU).

Chemical treatment and disinfection

Western Water uses both chlorination and chloramination to disinfect water supplies. The method used depends on the supply system. This process kills any bacteria or viruses and provides disinfection residual to maintain water quality as it travels from the WFP through the distribution system. In addition, Melbourne Water adds fluoride to the supply from the Melbourne system. Lime, carbon dioxide or sodium carbonate may also be added to the water to adjust the pH level. Powder Activated Carbon is also utilised to combat taste and odours produced by high concentrations of naturally occurring organic carbon.

Fluoridation

Fluoride is a naturally occurring element that is found in rocks, soils, water and plants. One milligram of fluoride for every litre of water has been shown to provide maximum dental benefits to the community and this is the 'optimal' level for temperate climates such as Victoria.

Western Water now supplies fluoridated local water from both Merrimu and Rosslynne WFPs.

Construction was completed on the fluoridation plant at Rosslynne WFP in 2014, made possible with financial assistance from DHHS. None of Western Water's smaller WFPs currently add fluoride to their water supply.

Fluoride (dosed as sodium hexafluorosilicate or hydro-fluorosilic acid) is added by Melbourne Water before delivery to Western Water's supply region in line with the requirements of the *Health (Fluoridation) Act 1973*.

The table below lists the towns which receive a fluoridated supply. Supplies to Lancefield, Myrniong, Romsey and Woodend are only fluoridated when local supplies are supplemented with water from Melbourne or Rosslynne Reservoir. During the reporting period, some water from Rosslynne supply system was used to top up local supplies for Romsey and Lancefield resulting in low levels of fluoride present in their water supply.

Table 5: Fluoridated and non-fluoridated water supply by town

Fluoridated water supply	Non-fluoridated water supply
Bulla	Lancefield[1]
Darley	Myrniong[2]
Diggers Rest	Romsey[1]
Eynesbury	Woodend[3]
Gisborne	
Lerderderg	
Macedon	
Maddingley	
Melton South	
Merrimu	
Mount Macedon	
Riddells Creek	
Rockbank	
Sunbury	
Toolern Vale	

[1] *Lancefield and Romsey received a small proportion of fluoridated water during 2017/18 when Rosslynne Reservoir water was mixed with local water supplies to ensure supply security.*

[2] *Myrniong received some fluoridated water supply during the investigation into the Pykes Creek Reservoir septic leak incident (further details can be found in Section 6).*

[3] *Woodend received fluoridated water from Rosslynne Reservoir for a few weeks in March while Marriages Water Filtrations Plant was undergoing maintenance.*

Preventative measures for drinking water supply (continued)

pH correction

Acidity in water is corrected to provide a neutral pH at different stages of the treatment process to ensure added chemicals are effective and that there are minimal impacts on pipes and associated fittings within the distribution network.

Water's pH level may be corrected by adding lime and carbon dioxide or sodium carbonate at the start of the treatment process to assist with coagulation. The pH may be adjusted again at the end of the process to ensure effective disinfection and limit final water corrosiveness. The average pH of water should be maintained within the ADWG specified range of 6.5–8.5 pH units for aesthetic purposes.

Table 6: Water treatment chemicals and processes by sampling locality

Locality	Population[1] supplied	System	Treatment process	Added substances	Comments
Melton South, Lerderderg, Maddingley, Darley, Merrimu, Rockbank, Toolern Vale, Eynesbury	88,160	Merrimu system (Merrimu Reservoir via Merrimu Water Filtration Plant)	Coagulation, Clarification/ filtration, Fluoridation, Chlorination Additional chlorination by booster chlorinators along reticulation system as required	Aluminium Chlorohydrate, Polyelectrolyte, Chlorine gas, Sodium Silicofluoride, Sodium Hypochlorite[3]	Melton and Melton South have been supplied with Melbourne water since June 2016. Other towns in the Bacchus Marsh area of the Merrimu system have been supplied from Merrimu Reservoir. In April 2017, there was a switch to Melbourne supply and then back to Merrimu supply in June 2017 to address low levels in the Merrimu Reservoir. Booster chlorinators exist in Melton South, Rockbank, Merrimu, Darley, Maddingley and Lerderderg localities.
		Merrimu system (Greenvale Reservoir via Hillside Pump Station)	Fluoridation and primary chlorination by Melbourne Water Secondary chlorination at Hillside Pump Station Additional chlorination by booster chlorinators along reticulation system as required	Sodium Hexafluorosilicate, Chlorine gas, Sodium Hypochlorite[3]	
Gisborne, Macedon, Mount Macedon, Riddells Creek	17,020	Rosslynne system (Rosslynne Reservoir via Rosslynne Water Filtration Plant)	Oxidation, Absorption Coagulation, pH correction Dissolved Air Flotation Filtration Fluoridation Chlorination Additional chlorination	Aluminium Sulphate, Potassium Permanganate (as required), Powder Activated Carbon, Polyelectrolyte, Lime, Carbon Dioxide, Fluorosilicic Acid, Chlorine Gas, Sodium Hypochlorite[4]	During 2017/18 Rosslynne treated water was supplied to Gisborne, Riddells Creek, Macedon and Mt Macedon. Sunbury, Bulla and Diggers Rest remain on Melbourne water supply. Both supplies are further chlorinated at Gisborne, Bulla, Sunbury, Macedon, Mount Macedon and Riddells Creek.
			Fluoridation and primary chlorination by Melbourne Water Secondary disinfection (chlorination) at Loemans Rd Pump Station/Riddell Rd Tank Additional chlorination by booster chlorinators along reticulation system as required	Sodium Hexafluorosilicate[2], Sodium Hypochlorite[3,4]	
Sunbury, Bulla, Diggers Rest	40,690	Sunbury system (Greenvale Reservoir via Loemans Road Pump Station)	Fluoridation and primary chlorination by Melbourne Water or at Rosslynne Water Filtration Plant Secondary disinfection (Chloramination or chlorination) at Loemans Rd Pump Station/ Riddell Rd Tank	Sodium Hexafluorosilicate[2], Sodium Hypochlorite[3,4]	

Table 6: Water treatment chemicals and processes by sampling locality (continued)

Locality	Population[1] supplied	System	Treatment process	Added substances	Comments
Woodend	5,220	Woodend system (Campaspe Reservoir via Marriages Water Filtration Plant and Graham Brock Reservoir, Reservoir C & Greenvale Reservoir via Reservoir C Water Filtration Plant)	Coagulation pH correction Dissolved Air Flotation Filtration Chlorination Fluoridation by Melbourne Water[5] Fluoridation by Rosslynne	Powdered Activated Carbon (as required at Marriages Water Filtration Plant), Aluminium Sulphate, Polyelectrolyte, Sodium Carbonate ('Soda Ash'), Sodium Hypochlorite, Sodium Hexafluorosilicate[5], Fluorosilicic Acid[5]	Drinking water is supplied from two ends of the system – the Marriages Basin and Reservoir C Contact tank. Supply is fully treated at the Marriages Water Filtration Plant and Reservoir C Water Filtration Plant. If required, Woodend's water supply can be sourced from Rosslynne or Melbourne during dry periods.
Romsey	4,720	Romsey system (Kerrie Reservoir, Romsey Bore & Greenvale Reservoir via Romsey Water Filtration Plant)	Microfiltration Chloramination Fluoridation by Melbourne Water[6] Fluoridation by Rosslynne Additional chlorination by booster chlorinators along reticulation system as required	Poly Aluminium Chlorohydrate (as required), Sodium Hypochlorite, Sodium Hydroxide, Aqueous Ammonia, Sodium Hexafluorosilicate[6], Fluorosilicic Acid[6]	Drinking water is supplied from Kerrie Reservoir and Wright Reservoir and local groundwater. If required, Romsey's untreated water supply can be sourced from Rosslynne or Melbourne during dry periods.
Lancefield	2,120	Lancefield system (Garden Hut Reservoir, Lancefield Basin and groundwater)	Coagulation pH, Correction Filtration Dissolved Air Flotation Chlorination Fluoridation by Melbourne Water[7] Fluoridation by Rosslynne	Aluminium Chlorohydrate (as required), Polyelectrolyte, Sodium Hydroxide (Caustic Soda), Potassium Permanganate, Powdered Activated Carbon (PAC), Sodium Hypochlorite, Sodium Hexafluorosilicate[7], Fluorosilicic Acid[7]	Drinking water is supplied from Garden Hut Reservoir and local groundwater. The Lancefield system is also connected to Romsey via a source water pipeline which allows transfer of water from Kerrie Reservoir into the Lancefield Basin.
Myrniong	260	Pykes Creek Reservoir	Coagulation, Oxidation, pH correction, Dissolved Air Flotation Filtration, Chlorination Fluoridation by Melbourne Water[8] Fluoridation by Merrimu	Powdered Activated Carbon (as required), Potassium Permanganate, Aluminium Sulphate, Polyelectrolyte, Sodium Carbonate ('Soda Ash'), Chlorine gas, Sodium Hypochlorite, Sodium Hexafluorosilicate[8], Sodium Silicofluoride	Drinking water is supplied from Pykes Creek Reservoir. When necessary, additional water can be carted to Myrniong from Bacchus Marsh (Lerderderg locality).

[1] *Population estimates are based on the number of water connections to residential properties multiplied by the average number of persons per residential property for each locality and rounded to the nearest 10.*

[2] *Chemicals may be added by Melbourne Water for treatment, chlorination and fluoridation.*

[3] *Chemicals added by Western Water for additional disinfection at entry point from Melbourne Water mains.*

[4] *Chemicals added by Western Water throughout the distribution system to increase chlorine residual levels.*

[5] *When receiving water from the Mount Macedon system, and that water has been supplemented with Melbourne Water or Rosslynne Reservoir.*

[6] *When receiving water from Melbourne Water or Rosslynne system through transfer to Wright Reservoir.*

[7] *When receiving water from the Romsey/Lancefield pipeline, and that water has been supplemented with Melbourne Water supply or Rosslynne system water supply via Wright Reservoir.*

[8] *When receiving water from Melbourne Water through water carting from Bacchus Marsh (Merrimu System, supplied by Merrimu WFP or supplemented with Melbourne Water supply).*

Preventative measures for drinking water supply (continued)

Water distribution network maintenance

The maintenance of the water distribution network, particularly pipes and tanks, is essential to ensure water quality from source to customer taps.

Distribution pipe cleaning and maintenance

In 2017/18, Western Water supplied 64,981 connected properties with drinking water through 2,123km of water mains.

The extensive reticulation system is maintained through renewals, repairs and operational actions such as valve exercising, mains flushing, mains cleaning, and flow and condition monitoring and assessment. These actions help reduce water losses through leakage and bursts and assist in maintaining water quality. The number of water main bursts during 2017/18 remains at low levels, refer to Table 7.

Table 7: Water main bursts per 100km

	2013/14	2014/15	2015/16	2016/17	2017/18
Bursts per 100km	14.0	12.1	13.3	12.3	12.2

64,981

Properties connected with drinking water

Critical control points

Western Water utilises HACCP, an internationally recognised food industry standard based on risk prevention and management in food processing applications. The HACCP system is used to manage significant risks at key points in harvesting, treatment and distribution of drinking water, using the developed Victorian legislative Risk Management Plans (RMPs) and Quality Management Plans (QMPs) as supporting tools.

Western Water's HACCP system provides comprehensive documentation and a framework for field monitoring and maintenance, with a number of HACCP plans relating to each system providing critical and alert limits for system controls, monitoring audits and maintenance guides for disinfection equipment, maintenance and inspection of plants, pump stations and tanks, equipment calibration and staff accountability. The most recent HACCP certificate is included in Appendix 3.

Storage tank integrity and cleaning

Western Water has a routine cleaning program for storage tanks in the distribution system involving the use of specialised underwater cleaning equipment by scuba divers to remove any sediment accumulated at the bottom of the tank. All storage tanks are covered and checked regularly to minimise contamination from birds or animals as well as dirt, leaves and other matter.

Backflow prevention

A dedicated backflow prevention officer helps target and reduce the likelihood of backflow occurrences in the system. This backflow role is part of Western Water's HACCP team and potential detections are assessed by a risk based process within the HACCP system. Backflow auditing is performed by Western Water staff.

4 Operational procedures and process control

Operational procedures

Western Water understands that formal operational procedures are critical to ensure the consistent delivery of quality drinking water across the region. Standard operating procedures (SOPs) and work instructions (WIs) can be used and referenced for maintenance tasks, specific or more complex tasks, or may exist as a standalone single reference for the agreed best practice for undertaking routine operational tasks. Whenever necessary, SOPs are reviewed and updated in line with risk management requirements.

Current procedures and work instructions available at Western Water include:

- Powder Activated Carbon Loading
- Fluoride Handling
- Fluoride Dosing System Maintenance
- Fluoride Chemical Delivery Procedure
- Clean In Place Procedure
- Flow Tests for Chemical Dosing Pumps
- Chlorine Strength Test Work Instructions
- Calibration Procedures and Schedules
- Tank Inspection Procedures
- Internal Auditing Procedure and Scheduling, and
- Non-Conformance Procedures.

Western Water's Integrated Management System (IMS) addresses and links various business practices including OH&S, QMS, HACCP, EMS and Risk Management. As issues, events, audits, incidents or improvement actions are required, they are captured to a common system for coordinated monitoring and follow up.

Operational monitoring and process control

Operational monitoring is conducted at all WFPs across the region. Section 5 details the results of microbiological water quality monitoring in 2017/18.

Western Water employs online monitoring equipment which includes chlorine, fluoride, conductivity, turbidity and pH sensors. All WFPs use fully automated, continuously operating SCADA technology to remotely monitor and control the processes.

Alert and critical limits obtained from HACCP plans are integrated into treatment plant control systems. This results in plants automatically shutting down and triggering alarms to plant operators if water quality fails critical limits.

5 Verification of drinking water quality

The Water Unit at DHHS regulates the safety of drinking water supplied by all Victorian water corporations. No undertakings, exemptions or variations apply to Western Water potable supply during 2017/18.

Drinking water quality monitoring

Western Water closely monitors the quality of drinking water to ensure compliance with the SDWR. In addition to meeting standards for the key water quality parameters highlighted in the Safe Drinking Water legislation, Western Water also aims to ensure that the water provided to customers meets the ADWG.

These guidelines provide a benchmark for a large range of biological, radiological, physical and chemical parameters, and also detail the use and development of Western Water's Drinking Water RMP.

The health and aesthetic quality of drinking water supplied to customers is ensured through a rigorous process of water quality monitoring and reporting. Monitoring includes continuous measurement of key parameters via online instruments (linked to alarm systems and graphic displays), daily operational checks by filtration plant staff, and external independent monitoring.

To assess the quality of our water supplies, daily routine monitoring is undertaken, validating compliance with the Safe Drinking Water Legislation. Water samples are collected in each of our 19 water sampling localities, at the reservoirs, WFPs and various points throughout the supply system including water storage tanks and customer taps.

Samples are tested for a range of microbiological, physical, chemical, algal and radiological parameters. All regulatory testing is undertaken through an independent laboratory accredited by the NATA as required by the SDWR.

Non-routine testing is also used to investigate water quality trends, source variation issues, customer complaints or any suspected contamination issues. Non-routine testing may either be done by external NATA accredited laboratories or by operational testing, depending on the nature of the issue and the water quality information required.

The water treatment chemicals used to treat our drinking water are all delivered by approved chemical suppliers. Chemical quality is verified through the quality systems built into the chemical supply contract, which ensures the approved chemicals are used throughout the treatment process within specifications.

Drinking water quality compliance

During 2017/18, all water localities complied with the microbiological requirements that 100% of drinking water samples collected during the reporting period must have zero *Escherichia coli* (*E.coli*) organisms per 100 millilitres, with the exception of any false positive samples as determined by the SDWR. Further details are presented in Section 6 Incident Management and Emergency Response.

Table 8 provides a snapshot of Western Water's compliance on key health and aesthetic parameters for drinking water quality, as required by the SDWR and ADWG. *E.coli* and Trihalomethanes are core indicators of drinking water health, and turbidity, pH level and true colour are core indicators of drinking water aesthetics.

In June 2018, Western Water successfully passed its sixth Regulatory Audit for its Drinking Water RMP under the *Safe Drinking Water Act 2003*. The next audit is scheduled for mid-2020.

Some highlight achievements noted by the auditor included:

- compliance with a good HACCP system and supporting systems including SCADA (online plant control system)
- quantification of microbial pathogen risks and documented controls based on requirements of the Health Based Targets, including source water assessments. There were no significant gaps between treatment capability and source category, actions identified can be addressed in due course
- the drinking water sampling program is well-explained and intelligently designed to prioritise monitoring and alert to issues in water quality where they occur
- the plants inspected during the audit provided historical evidence of treatment performed within the critical limits of the HACCP system, other than by agreed and defensible exception
- the Field Services team have robust processes in place for working practices including good storage facilities for maintaining spare parts
- improvements to chlorine residual in the network to ensure residual is maintained in adequate levels to the extents of the network was noted
- tank inspections and cleaning are ensuring tanks are maintained and kept in good condition
- backflow prevention program, including documentation of devices in the network and tracking of inspections, is well underway

- the Drinking Water RMP is well documented, presented and up-to-date. The requirements of the ADWG are presented alongside the requirements of the SDWA and SDWR
- training program is ensuring operators and field staff are knowledgeable of drinking water quality requirements, and
- there is clarity of responsibility, good ownership and good teamwork across Western Water in all areas audited for drinking water.

Opportunities for improvement noted by the auditor included:

- for some critical limits as part for the HACCP system, there would be value in displaying these on the SCADA system with greater clarity
- the reasoning for selecting the values for critical and alert limits in HACCP could be documented
- the storage facilities for field staff who repair the water network assets to be suitably sized, and locations selected to include consideration of potential contamination sources and appropriate controls to prevent contamination of stored fittings, and
- consider labelling the sample taps used at the plants of laboratory sampling, for clarity of the correct sample tap locations.

Full details of Western Water's drinking water quality standard compliance are contained in Appendix 4, with all parameters measured compliant during the year including:

- *E.coli*
- chlorine-based disinfection by-product chemicals
  - trihalomethanes
- other parameters
  - turbidity
  - fluoride, as per Code of Practice for Fluoridation of Drinking Water Supplies 2018, and
- examples of other chemicals not specified in the standards but may pose a risk to human health are listed in Table 8.

Table 8: Drinking water quality compliance

Parameter	2015/16	2016/17	2017/18
Arsenic, Filtered[2]	100%	100%	100%
Barium, as Ba	100%	100%	100%
Barium, Filtered	100%	100%	100%
Benzo(a)pyrene[2]	100%	100%	100%
Berylium, Filtered	100%	100%	100%
Beryllium, as Be	100%	100%	100%
BHC (alpha)	100%	100%	100%
BHC (beta)	100%	100%	100%
BHC (delta)	100%	100%	100%

Table 8: Drinking water quality compliance (continued)

Parameter	2015/16	2016/17	2017/18
Bicarbonate Alkalinity as CaCO3	100%	100%	100%
Boron	100%	100%	100%
Boron, Filtered	100%	100%	100%
Bromate	100%	100%	100%
Bromobenzene	100%	100%	100%
Bromodichlormethane	100%	100%	100%
Bromoform	100%	100%	100%
Cadmium	100%	100%	100%
Cadmium, Filtered	100%	100%	100%
Calcium[2]	100%	100%	100%
Carbon tetrachloride[2]	100%	100%	100%
Carbonate Alkalinity as CaCO3	100%	100%	100%
Chlordane, Total[2]	100%	100%	100%
Chlorine	100%	100%	100%
Chlorine, Free	100%	100%	100%
Chloroacetic acid	100%	100%	100%
Chlorobenzene	100%	100%	100%
Chloroform	100%	100%	100%
Chromium	100%	100%	100%
Chromium, Filtered	100%	100%	100%
cis-1.2-Dichloroethene	100%	100%	100%
cis-1.3-Dichloropropylene	100%	100%	100%
cis-Chlordane	100%	100%	100%
Cobalt, as Co	100%	100%	100%
Cobalt, Filtered	100%	100%	100%
Coliforms, Total[2]	100%	100%	100%
Colour, true[2]	100%	100%	100%
Copper[2]	100%	100%	100%
Copper, Filtered[2]	100%	100%	100%
Cyanide	100%	100%	100%
Dibromochloromethane	100%	100%	100%
Dibromomethane	100%	100%	100%
Dichloroacetic acid	100%	100%	100%
1,1-Dichloroethene[2]	100%	100%	100%
1,2-Dichloroethane[2]	100%	100%	100%
1.1-Dichloropropylene	100%	100%	100%
1.1.1.2- Tetrachloroethane	100%	100%	100%
1.1.1-Trichloroethane	100%	100%	100%
1.1.2.2-Tetrachloroethane	100%	100%	100%
1.1.2-Trichloroethane	100%	100%	100%
1.1-Dichloropropylene	100%	100%	100%
1.2.3-Trichlorobenzene	100%	100%	100%
1.2.3-Trichloropropane	100%	100%	100%
1.2.4-Trichlorobenzene	100%	100%	100%
1.2.4-Trimethylbenzene	100%	100%	100%
1.2-Dibromo-3-chloropropane	100%	100%	100%

Verification of drinking water quality (continued)

Table 8: Drinking water quality compliance (continued)

Parameter	2015/16	2016/17	2017/18
1.2-Dibromoethane (EDB)	100%	100%	100%
1.2-Dichlorobenzene	100%	100%	100%
1.2-Dichloropropane	100%	100%	100%
1.3.5 - Trimethylbenzene	100%	100%	100%
1.3-Dichlorobenzene	100%	100%	100%
1.3-Dichloropropane	100%	100%	100%
1.4-Dichlorobenzene	100%	100%	100%
2,4,6-Trichlorophenol	100%	100%	100%
2,4-D[2]	100%	100%	100%
2.3.4.6-Tetrachlorophenol	100%	100%	100%
2.4.5-T	100%	100%	100%
2.4.5-Trichlorophenol	100%	100%	100%
2.4-Dichlorophenol	100%	100%	100%
2.6-Dichlorophenol	100%	100%	100%
2-Chlorophenol	100%	100%	100%
2-Chlorotoluene	100%	100%	100%
4,4'-DDT	100%	100%	100%
4.4'-DDD	100%	100%	100%
4.4'-DDE	100%	100%	100%
4-Chloro-3-Methylphenol	100%	100%	100%
4-Chlorotoluene	100%	100%	100%
Aldrin[2]	100%	100%	100%
Alkalinity, Total as CaCO3[2]	100%	100%	100%
Aluminium, filtered2	100%	100%	100%
Aluminium, Total as Al[2]	100%	100%	100%
Ammonia[2]	100%	100%	100%
Antimony	100%	100%	100%
Antimony, Filtered	100%	100%	100%
Arsenic	100%	100%	100%
Dissolved Organic Carbon[2]	100%	100%	100%
Dissolved Oxygen (Field)[2]	100%	100%	100%
Electrical Conductivity @ 25C[2]	100%	100%	100%
Endosulfan I	100%	100%	100%
Endosulfan II	100%	100%	100%
Endosulfan sulfate	100%	100%	100%
Endrin	100%	100%	100%
Endrin aldehyde	100%	100%	100%
Endrin ketone	100%	100%	100%
Enterococci	100%	100%	100%
E.coli[2]	100%	99.8%[1]	100%
Ethylbenzene	100%	100%	100%
Faecal Streptococci[2]	100%	99.9%[1]	100%
Fluoride[2]	100%	100%	100%
Formaldehyde	100%	100%	100%
Hardness, as CaCO3[2]	100%	100%	100%
Heptachlor[2]	100%	100%	100%
Heptachlor Epoxide[2]	100%	100%	100%

Table 8: Drinking water quality compliance (continued)

Parameter	2015/16	2016/17	2017/18
Heterotrophic Plate Count, 22C	100%	100%	100%
Heterotrophic Plate Count, 37C	100%	100%	100%
Hexachlorobenzene[2]	100%	100%	100%
Hydroxide Alkalinity as CaCO3	100%	100%	100%
Iron, Filtered (Soluble)[2]	100%	100%	100%
Iron, total as Fe[2]	100%	100%	100%
Lead	100%	100%	100%
Lead, Filtered	100%	100%	100%
Lindane	100%	100%	100%
Magnesium, as Mg[2]	100%	100%	100%
Manganese, Filtered (Soluble)[2]	100%	100%	100%
Manganese, total as Mn[2]	100%	100%	100%
MCPA	100%	100%	100%
Mercury, as Hg[2]	100%	100%	100%
meta- & para-Xylene	100%	100%	100%
Methoxychlor[2]	100%	100%	100%
Methylene chloride	100%	100%	100%
Molybdenum, as Mo	100%	100%	100%
Monochloramine	100%	100%	100%
n-Butylbenzene	100%	100%	100%
Nickel	100%	100%	100%
Nickel, Filtered	100%	100%	100%
Nitrate[2]	100%	100%	100%
Nitrite[2]	100%	100%	100%
n-Propylbenzene	100%	100%	100%
ortho-Xylene	100%	100%	100%
Pentachlorophenol[2]	100%	100%	100%
pH[2]	100%	100%	100%
Phosphorus, Reactive as P[2]	100%	100%	100%
p-Isopropyltoluene	100%	100%	100%
Potassium, as K[2]	100%	100%	100%
sec-Butylbenzene	100%	100%	100%
Selenium[2]	100%	100%	100%
Selenium, Filtered[2]	100%	100%	100%
Silica, Non Reactive[2]	100%	100%	100%
Silica, Reactive[2]	100%	100%	100%
Silver, Filtered as Ag	100%	100%	100%
Silver, Total as Ag	100%	100%	100%
Simazine	100%	100%	100%
Sodium	100%	100%	100%
Strontium, Filtered	100%	100%	100%
Strontium, Total	100%	100%	100%
Styrene	100%	100%	100%
Sulphate[2]	100%	100%	100%
tert-Butylbenzene	100%	100%	100%
Tetrachloroethene[2]	100%	100%	100%
Thallium, Total	100%	100%	100%
Tin, Filtered	100%	100%	100%

Table 8: Drinking water quality compliance (continued)

Parameter	2015/16	2016/17	2017/18
Tin, Total as Sn	100%	100%	100%
Titanium, Filtered	100%	100%	100%
Titanium, Total	100%	100%	100%
Toluene	100%	100%	100%
trans-1.2-Dichloroethene	100%	100%	100%
trans-1.3-Dichloropropylene	100%	100%	100%
trans-Chlordane	100%	100%	100%
Trichloroacetic acid	100%	100%	100%
Trichloroethene	100%	100%	100%
Trihalomethanes	100%	99.8%[1]	100%
Turbidity[2]	100%	100%	100%
UV Transmission@254nm[2]	100%	100%	100%
Vanadium, as V	100%	100%	100%
Vanadium, Filtered	100%	100%	100%
Zinc	100%	100%	100%
Zinc, Filtered	100%	100%	100%

[1] *Figure has been updated in line with ESC reporting for FY16/17, based on the total number of customers serviced and the customers who received water that on the event occasion did not meet the Safe Drinking Water Act requirements.*

[2] *Parameter is tested on untreated water source, refer to Appendix 5.*

Drinking water aesthetics

Source water monitoring

One of the key components of Western Water's Drinking Water RMP is the extensive source water monitoring program aimed at increasing the understanding of the source water quality in reservoirs, bores and basins. It involves monitoring and identifying hazards, sources and events which could compromise drinking water quality in a catchment to consumer, multiple barrier approach.

Through an independent NATA accredited laboratory, a comprehensive source water monitoring program was undertaken during 2017/18. An overview of the parameters tested, frequency of testing at each sampling location for pesticides, chemicals (organics and in-organics), metals, physical and radiological parameters and their results are enclosed in Appendix 4.

Microbiological monitoring

In addition to the source water monitoring conducted by an independent NATA accredited laboratory, source water samples at various sampling locations were taken routinely for physical microbiological analysis by specialist biological scientists. This involves the determination of any flagellates, diatoms, algae and cyanobacteria (blue green algae) that were present in the source water sources.

General observations provided by these assessments in relation to any water discolouration, the levels of detritus and the presence of any odour in the source water provided valuable information in assessing the quality of the source water at various times during 2017/18. This information allows Western Water to monitor the changes in conditions of source water sources and their potential impacts towards drinking water quality.

Blue green algae

For Merrimu, Rosslynne and Pykes Creek Reservoirs, blue green algae (BGA) monitoring was conducted by Western Water and data was shared with water storage manager SRW. Regular results on BGA numbers in the three reservoirs allowed for the timely assessment of adverse impacts on our ability to treat and provide safe drinking water to customers.

Melbourne Water monitors water prior to the off-take entry point to Western Water's region. Monthly water quality reports are provided by Melbourne Water for Greenvale Reservoir. These include information on algal populations. Melbourne Water is required to notify Western Water of any major changes in treated water quality for supplies from the Melbourne system. These changes include any that have potential to impact on our ability to supply safe drinking water to customers and meet the ADWG.

During the reporting period, Western Water did not report any BGA blooms as a section 22 notification to DHHS.

Customer satisfaction

Western Water undertakes a major customer satisfaction study each May with 606 residential and 200 non-residential customers randomly selected from across our service area in 2018. The most recent survey found that water quality remains the major driver of customer satisfaction.

Verification of drinking water quality (continued)

Scoring a weighted average of 8.4 out of 10, customers' overall satisfaction with water quality remains high and has been stable over many years. Satisfaction with water taste has improved in the past year but remains the lowest of all water quality indicators, scoring 7.9 out of 10. Smell was also below the overall level at 8.2 out of 10 while satisfaction with colour and cleanliness were higher scoring 8.5 and 8.6 out of 10 respectively.

After years of gradual improvement in satisfaction, Lancefield customers no longer record the lowest levels of customer satisfaction with their overall service from Western Water. This has been a long term trend brought about by the introduction of water filtration and treatment many years ago and, more recently, the commitment to introducing bore water at no more than a third of the total supply mix, made possible following interconnection with Romsey supply system in recent years and, through it, the Rosslynne system.

Water quality complaints

Western Water's holistic approach to complaints management ensures any complaint is fully addressed from receipt to resolution, ensuring fast and effective resolution and minimal adverse customer impact. A range of actions are undertaken for water quality related complaints including verbal advice, further investigation, on-site inspection and testing, and works to improve water supply.

In accordance with the ADWG, Western Water adopted a benchmark for water quality complaints of 0.400 complaints per 100 customer properties. This benchmark was met again in 2017/18 with Western Water receiving 0.262 complaints per 100 customer properties as per DHHS reporting requirements.

During 2017/18, customer complaints about water quality increased by 11.5% compared to last year. The increase in complaints is believed to be primarily due to maintaining a consistent supply source to Sunbury and Melton localities, and increased sediment in Melton from the unfiltered Melbourne Water supply. However, planned maintenance – included air scouring of mains – resulted in some complaints in Sunbury.

Water quality complaints by locality

During the reporting period, 4 localities recorded 10 or more complaints. There were Melton South, Sunbury, Merrimu, and Gisborne. The main reason for complaint was coloured/dirty water due to sediment stirred-up in the mains. The locations of the coloured/dirty water were flushed via the hydrant locations in the mains.

The highest level of complaints per 100 customer properties (refer to Table 11) was recorded in Bulla due to accumulated sediments in the mains being stirred up. An ongoing routine flushing program for the Western Water service region is in development with Field Service teams. This will assist in determining the frequency some areas should be flushed and cleaned to prevent customer complaints.

The Mount Macedon and Riddells Creek localities rated second and third highest for water quality complaints. These were largely due to accumulated sediments in the mains getting stirred up with network demand or unplanned pipe bursts.

Table 9: Customer complaints

Complaint category	2016/17	2017/18
Water quality	145	170[1]
Other complaints	61	46
Total	**206**	**216**

[1] *While 170 water quality complaints were recorded for ESC, only 167 of these complaints were drinking water quality related. The other 3 quality complaints were related to recycled water.*

Table 10: Water quality complaints by type and locality

Complaint type	Complaints	Complaints per 100 properties	Localities by highest no. complaints 1st	2nd	3rd
Taste/odour	40	0.063	Darley	Macedon	Mt Macedon
Dirty/discoloured	119	0.186	Bulla	Diggers Rest	Riddells Creek
Illness	0	0.000	-	-	-
Other	8	0.013	Bulla	Sunbury	Gisborne

Table 11: Water quality complaints by locality

Locality	Complaints	Complaints per 100 customer properties[1]
Bulla	3	1.000
Darley	5	0.154
Eynesbury	8	0.518
Diggers Rest	4	0.428
Gisborne	17	0.388
Lancefield	0	0.000
Lerderderg	4	0.116
Macedon	2	0.304
Maddingley	0	0.000
Melton South	51	0.298
Merrimu	17	0.236
Mount Macedon	5	0.877
Myrniong	0	0.000
Riddells Creek	8	0.562
Rockbank	2	0.355
Romsey	4	0.207
Sunbury	32	0.209
Toolern Vale	0	0.000
Woodend	5	0.222

[1] *Based on the number of complaints per 100 customer properties supplied.*

Table 12: Water quality complaints per 100 customers[1]

	2013/14	2014/15	2015/16	2016/17	2017/18
Complaints per 100 customers	0.368	0.316	0.397	0.235	0.262

[1] *For this reporting format, a customer is one customer property. Complaints are tracked through internal business performance reporting.*

6 Incident management and emergency response

Communication protocols

Western Water's incident response procedures describe the protocols for communication to the public and other stakeholders in the event of a significant water quality event, such as the need to issue a boil water notice.

This is further supported by a Boil Water Notice Procedure which identifies the key stakeholders to be contacted and provides information on the appropriate communication methods for each stakeholder.

Incident and emergency management

As an essential service provider, incident and emergency management is vital to Western Water. We have systems and resources ready to respond to emergencies 24 hours a day, seven days a week with crews strategically located across our region including a Duty Officer roster system for Treatment Plants, Field Services and Business Services.

Each year several situations are escalated to an incident, in which case established response processes are followed to resolution. Once the incident has been de-escalated, it is analysed in detail via an incident debrief session to minimise any repeat by identifying the likely cause and additional controls that would apply. This process is particularly vital for large scale incidents that present major risks and/or offer useful learnings.

All *E.coli* detections, Turbidity and Total Trihalomethanes levels above the Standards reported to DHHS are investigated using the guidelines published by the Secretary's office in the SDWR under Schedule 2 Appendix 1.

All other water quality tested parameters are reported to DHHS based on exception to the ADWG or other appropriate guidelines, as per the SDWR.

All incidents that may affect public health, and as defined by Section 22 of the *Safe Drinking Water Act 2003*, are immediately reported to DHHS, and applicable paperwork provided within 24 hours of occurrence.

All incidents that confirm the non-conformance at the time of sampling the supplied drinking water are reported under Section 18 requirements of the *Safe Drinking Water Act 2003*, within 10 days of the initial report to DHHS by Western Water.

During 2017/18 there were no Section 18 reports issued to DHHS. There were five Section 22 notifications of potential issues, however the investigation findings did show the water sampled was not representative of the water supplied to customers.

Incidents reported under Section 22 *Safe Drinking Water Act 2003*

a. Blackwood Main, Myrniong (November 2017)

Issue – During routine sampling in November 2017 at the end of the Blackwood main in Myrniong, a laboratory result of 6orgs/100ml *E.coli* was reported (SDWR limit is 0orgs/100ml *E.coli*).

Actions – The laboratory was instructed to resample on the day of the reported exceedance. Further investigation showed the sample was taken during the planned Myrniong mains clean and the location of the Blackwood main sample point had been at low pressure at the time of sampling, resulting in a contaminated sample. Based on the resample at the same location, the initial sample was not representative of water supplied to customers at the time of sampling.

Outcome – communications between Western Water and the external laboratory were identified as a key issue during the investigation of the exceedance. Procedures have been developed to notify the laboratory in advance of sampling of any issues in the network that may affect collection of a suitable sample.

b. Gisborne South tank, Gisborne (November 2017)

Issue – A routine sample from the South Gisborne tank in November 2017 reported a result of 1org/100ml *E.coli* (SDWR limit is 0orgs/100ml *E.coli*).

Actions – The investigation showed the tank at the time of sampling had a good chlorine residual present and there were no downstream reports of *E.coli* on the same day of sampling at the tank. Resampling at the tank was performed on the day of reporting the initial exceedance, and the tank roof, hatch and sample tap were examined. The investigation identified the sample was likely contaminated by dust entering the bottle as it was filled. Based on the resample at the same location and all other network samples taken on the same day as the exceedance, it was found that the initial sample was not representative of water supplied to customers at the time of sampling.

Outcome – the tank has a booster chlorination system on site to maintain a good chlorine residual in the tank. Investigation determined ongoing maintenance of this system and regular inspections of the tank were recommended.

c. Merrimu 5ML tank, Merrimu Water Filtration Plant (February 2018)

Issue – A routine sample from the Merrimu 5ML tank in February 2018 reported a result of 1org/100ml *E.coli* (SDWR limit is 0orgs/100ml *E.coli*).

Actions – The investigation showed the tank at the time of sampling had a good chlorine residual present and there were no downstream reports of *E.coli* on the same day of sampling at the tank. Resampling at the tank was performed on the day of reporting the initial exceedance, and the tank roof, hatch and sample tap were examined. The investigation identified the sample was likely contaminated by dust entering the bottle as it was filled. Based on the resample at the same location and all other network samples taken on the same day as the exceedance, it was found that the initial sample was not representative of water supplied to customers at the time of sampling.

Outcome – The tank is located at the treatment plant, the primary disinfection process for treating the water. The investigation determined continued maintenance of the current primary disinfection process and regular inspections of the 5Ml tank were recommended.

d. Marriages Water Filtration Plant filter, Woodend (March 2018)

Issue – During March 2018, the Marriages WFP filter critical control point for turbidity exceeded the critical limit of 0.2NTU, due to a plant control program fault that did not automatically shut down the plant. The turbidity monitoring on a filter is performed to review if the filter is operating at its optimum, to prevent chlorine resistant bacteria and protozoa from the untreated water entering the drinking water network.

Actions – The plant was manually shut down and the treated water storage basin was tested for turbidity which was found to not exceed 0.15NTU due to dilution.

Additional sampling in the Woodend network, the treated basin and Campaspe Reservoir determined the risk of contamination in the drinking water supplied was low. Investigation of Campaspe Reservoir determined the filter turbidity increase was due to harmless green algae, resulting in blockages of the filter. An exception HACCP plan was developed and approved by DHHS to allow the Marriages WFP to continue operating and supplying drinking water to Woodend, until the Rosslynne treated water supply connection to Woodend was available for use (approximately 3 days). Additional optimisation of the plant coagulation process was performed to prevent additional filter turbidity exceedances. The plant control system was reviewed and the source of the fault was identified and resolved.

Outcome – The investigation of the plant control system identified opportunity to document the control system and plant alarms. An ongoing project to document all drinking water plant control systems is to be completed during 2018/19.

e. Dicksons Road tank, Darley (May 2018)

Issue – During routine laboratory sampling at the Dicksons Road tanks in May 2018, total chlorine was reported as 5.6mg/L (ADWG limit is 5mg/L total chlorine).

Actions – The downstream network fed from the tank did not report elevated chlorine levels. The tank was attended by an operator and some of the elevated chlorine water was flushed out of the tank. The tank was inspected and found to be oversized for supplying to this part of the network. The tank is manually dosed with slow release dissolving chlorine tablets. Due to the tank oversize, the investigation determined the tank had internal stratification causing elevated chlorine water to be located near the sample tap but low chlorine water to be supplied to the downstream network. Based on these findings, the water sampled reporting the exceedance was not representative of the water supplied to customers.

Outcome –The volume of storage at the tank was reduced to better suit the demand in this part of the Darley network, to improve water turnover in the tank and stabilise the chlorine dosing to the tank.

Incident management and emergency response (continued)

Incidents not reported under Section 22 *Safe Drinking Water Act 2003*

a. Pykes Creek Reservoir – Detection of elevated *E.coli* levels)

The presence of elevated *E.coli* levels in Pykes Creek Reservoir was detected in February and April of 2018 during routine monitoring by Western Water. After significant on-site investigation by SRW, the cause of the elevated *E.coli* levels was not apparent. The issue was referred to external experts and agencies during the detection period to assist in locating and addressing the source of the issue.

During the incident:

- as per SRW's Memorandum of Understanding with Western Water, SRW continued to receive and share water quality data with Western Water over the course of the incidents
- additional water quality sampling and testing was undertaken by SRW and Western Water to monitor the situation
- the storage was closed for public recreation during elevated *E.coli* levels, and re-opened when testing confirmed a return to safe levels
- specialist testing was undertaken to better understand potential contamination sources
- industry professionals/academics were engaged to provide advice on the issue
- the issue was reported to all relevant agencies i.e. DHHS, and regular updates were provided to internal and external stakeholders, and
- Western Water's water treatment plant continued to successfully treat and supply drinking water to Myrniong for the duration of the event.

Evidence gathered during the event indicated a strong possibility the *E.coli* in Pykes Creek Reservoir was a 'natural' bloom. SRW is convening a learning session with industry, regulators and academic experts to discuss future management of 'natural' *E.coli* blooms.

b. Fluoridation outage at Merrimu Water Filtration Plant (June 2018)

Issue – During June 2018, there was a fluoridation outage at the Merrimu WFP, due to a probe fault on the fluoride dosing system. DHHS notification was provided after the initial 72 hours of the outage, as required by the Code of Practice for Fluoridation of Drinking Water Supplies. The outage was a total of 76 hours.

Action – The probe at the Merrimu WFP fluoride plant was investigated and the fault was resolved. The fluoride level in the treated water storage tank (Merrimu 5ML tank) did not reduce below the critical low level of 0.6mg/L for more than 53 hours, the outage was unlikely to result in significant impacts to customers.

Blue green algae (BGA)

During 2017/18, there were no blue green algae notifications that impacted drinking water quality at Rosslynne Reservoir, Pykes Creek Reservoir, Merrimu Reservoir, local reservoirs or the Melbourne supply from Greenvale Reservoir.

Notifications of water blooms were received from the independent external laboratory as part of the biological monitoring at the treatment plants. However, numbers detected in the samples were very low, if present, and confirmed by online monitoring at the treatment plants.

Missed sampling at tanks

The sampling of drinking water and the drinking water sampling program meets two requirements – the Schedule 2 of the SDWR 2015 and to verify other water quality issues highlighted as a risk to drinking water in the ADWG.

The external laboratory provider performs this sampling and testing on Western Water's behalf, and the results are reported to Western Water, and then to DHHS if an exceedance of the tested parameter limit occurs.

During August 2017 (8th, 15th, 22nd and 29th), there were four weekly samples not sampled due to access issues affecting the Myrniong Water Filtration Plant Clear Storage Water Tank. While all other testing was performed in the Myrniong locality during the missed sampling period, this tank was missed and not tested for the following parameters:

- chlorine, free and total (weekly)
- ammonia (weekly)
- nitrate (weekly)
- nitrite (weekly)
- aluminium, total and soluble (weekly)
- iron, total and soluble (weekly)
- manganese, total and soluble (weekly)
- total coliforms (weekly)
- *E.coli* (weekly)
- true colour (weekly)
- electrical conductivity (weekly)
- pH (weekly), and
- turbidity (weekly.

The investigation of this tank during the missed sampling period found the water supplied to customers was safe to drink and the requirements of Schedule 2 in the SDWR 2015 were met.

The method of communication between the external laboratory samplers and Western Water was an area of focus as a corrective action. Issues affecting access of an asset are identified by the sampler in the field and escalated on the same day to Western Water. Once notified, the access issues are addressed in a timely manner by Western Water to ensure weekly sampling requirements as per the water sampling program are achieved.

During December 2017 to June 2018, sampling was missed on the Dodemaide Tank in the Lerderderg locality due to planned maintenance on the tank performed from October to December 2017. There was no notification by Western Water to the external laboratory provider of the tank's online status after the planned work was completed, which would have led to the sampling program resuming at the tank.

There were 27 weekly, 7 monthly and 1 quarterly samples missed during the missed sampling period, and the tank was not tested for the following parameters during this time:

- chlorine (weekly)
- pH (weekly)
- turbidity (weekly)
- true colour (weekly)
- electrical conductivity (weekly)
- *E.coli* (weekly)
- total coliforms (weekly)
- bromoform (monthly)
- chloroform (monthly)
- dibromochloromethane (monthly)
- dichlorobromomethane (monthly)
- total trihalomethane (monthly)
- Faecal streptococci (monthly)
- dissolved organic carbon (quarterly)
- calcium hardness (quarterly)
- hardness (quarterly)
- magnesium hardness (quarterly)
- UV absorbance (quarterly)
- alkalinity (quarterly)
- bicarbonate, as calcium carbonate (quarterly)
- carbonate, as calcium carbonate (quarterly)
- hydroxide, as calcium carbonate (quarterly)
- ammonia (quarterly)
- fluoride (quarterly)
- nitrate (quarterly)
- nitrite (quarterly)
- manganese, total and soluble (quarterly)
- aluminium, total and soluble (quarterly)
- calcium (quarterly)
- iron, total and soluble (quarterly), and
- magnesium (quarterly).

The investigation of this tank during the missed sampling period found the water supplied to customers was safe to drink and the requirements of Schedule 2 in the SDWR 2015 were met.

Incident management and emergency response (continued)

Additional changes to communication practices by Western Water include using the water quality database to document asset status checks and to provide more active notification to the external laboratory provider. There are ongoing investigations by Western Water to determine long term solutions to ensure active communication between Western Water and external laboratory providers to prevent missed samples due to notification oversights.

There will be times where an asset cannot be sampled in accordance with the water sampling program. This can be due to unplanned or emergency circumstances that make attending the asset high risk to the sampler (e.g. bushfires), or due to planned activities such as tank refurbishment. The routine water sampling performed around the network each week ensures that although an asset may not be accessible, the requirements of SDWR 2015 are achieved and the water is safe to drink.

7 Employee awareness and training

Western Water's water quality team are a significant asset to the business with their experience, skills and training, ensuring the ongoing safe delivery of drinking water across the region. We are committed to ensuring all employees are fully aware of their responsibilities and trained appropriately for our water supply systems.

During 2017/18, the water quality team consisted of eleven staff with three based in the Sunbury office, six based at Rosslynne WFP and another three based at Merrimu WFP.

There were two roles made permanent during the reporting period: a full time Water Quality Advisor (replacing the full time Water Quality Officer role) and a part time Aquantify (Water Information Management System) administrator (a change to a maternity leave, full time operator role). There was also a trainee operator placed within the Rosslynne WFP team for 12 months.

Employee awareness and involvement

Staff attend regular site/team meetings to remain up to date with the latest developments. Changes to existing policies and the introduction of new ones are also included in meeting agendas, and can be accessed on our intranet. Western Water reinforces key safety messages via safety alerts, the intranet and site/toolbox meetings. All water systems staff as well as the Board and Executive are considered accountable for implementation of Western Water's Drinking Water Policy.

Employee training

All water quality team members undertook training during the year with some attending the Water Industry Training Centre, Geelong and Chisholm Institute of TAFE. In addition to formal training, ongoing training and reskilling is required as procedures are revised due to new equipment or techniques. This ensures the safety of both employees and the community.

Water treatment operators were mapped across to the National Certification Framework for Water Operator, as part of DHHS recommendations to industry. Over the course of two years, the operators will be assessed to ensure the qualifications are documented in Western Water's training database, including the Recognised Prior Learning assessment process.

Employee awareness and training (continued)

Western Water's water quality team members took part in more than 100 different training opportunities during 2017/18. Courses and activities covered a range of specialised water treatment and general workplace training and learning opportunities.

The water treatment specialised training included:

- AIIMS Emergency Incident Workshop
- Bushfire Awareness
- Chlorine Changeover
- Defensive Driving
- Ferric Sulfate
- First Aid
- Lone Worker Procedure
- Taking water tank inspections into the future (Lunch and Learn)
- Manual Handling
- Monitor and control Dam Operations
- Conduct and Report Dam Safety Instrumentation Monitoring
- Monitor and Implement Dam Maintenance
- Inspect and Report on Concrete Dam Safety
- Inspect and Report on Embankment Dam Safety
- Operating Breathing Apparatus
- Providing CPR
- Radio Training, and
- Sodium Hydroxide Solution.

Staff also had the opportunity to participate in several learning and development opportunities over the year including:

- Developing the Melbourne 50-year Sewerage Strategy (Lunch and Learn)
- IWN Collaboration Conference 2018
- IWN Program Update (Lunch and Learn)
- Victorian Public Sector Young Leaders Conference, and
- Water Industry Operators Australia Conference.

Water industry operations

Western Water strongly encourages operational staff to obtain their certificate qualifications in water industry operations through the provision and funding of training opportunities, as well as linking the achievement of Certificate III to banding progression opportunities. Five employees from the water quality and outdoor teams took part in the Water Industry Operations Conference. Western Water continues its commitment to employee learning and development through a range of training advisory bodies, including:

- VicWater Industry Training Consultative Committee
- National Water Industry Training Forum
- Victorian Employers' Chamber of Commerce and Industry
- Water Services Association Australia's (WSAA) Water Quality Network
- Water Industry Training Centre
- Water Industry Operators Association of Australia, and
- Victorian Water Industry Advisory Committee.

100+

Participation in different training opportunities by Western Water's water quality team members

8 Community involvement and awareness

Western Water aims to engage and educate the community about the safe delivery of its quality water supply.

Community involvement

Western Water strives to be recognised as a responsible corporate citizen within the community and considers its community sponsorship program to be an important element of this strategy.

Western Water is committed to improving the biodiversity value of its properties and enhancing the environment across the region. Long standing partnerships with Pinkerton Landcare and Environment Group, Deep Creek Landcare and Friends of Toolern Creek are testimony to this commitment.

Consultation

Western Water's customer advisory network has expanded to include our online customer panel which provides a significant additional resource for community consultation including contacts for more than 30,000 customers.

Our communications and engagement capability has been expanded through the Water Matters consultation site where customers can join in discussions on critical topics and provide input for decision making. The site has been a cornerstone for Western Water's Price Submission engagement program and will continue to add value for ongoing consultation.

An important component of our ongoing consultation with customers about water quality is encouraging reporting of concerns through a variety of channels to enable us to better understand any issues presenting across the network.

Education programs

Western Water recognises that educating young people on crucial issues such as climate variability and water conservation creates a ripple effect reaching far beyond the classroom. Presentations, programs and teacher resources for children are offered at the preschool, prep, primary and secondary school levels.

Close to 12,000 students from across the region took part in Western Water preschool and primary school education presentations during the year. We also offered a community education presentation program aimed at migrants and adults with low literacy about the benefits of drinking tap water.

Tours and presentations

Western Water offers free tours and presentations to schools and community groups. Free guided tours are offered at our largest treatment plants at Gisborne and Merrimu. In 2017/18, educational tours and community presentations were conducted for a range of groups including primary, secondary, tertiary and community groups.

Sponsorship and grants

Western Water builds and strengthens local community relations through sponsorships and offering grants across the service region. We attended numerous community events to promote the health benefits and quality of our drinking water. In addition, our mobile water tanks are made available free of charge to various community activities across the region.

Community involvement and awareness (continued)

We strongly support the Choose Tap program providing bottles and key messages to local cafés, businesses, sporting groups and via drinking water fountains in public places. During 2017/18, we introduced Choose Tap grants, providing drinking water fountains in local schools. We also worked with several schools to develop the Water Only School initiative.

Publications

Apart from the annual Water Quality Report, Western Water's other current water treatment publications include the following factsheets:

- Bore water for drinking
- Drinking water for health
- Rosslynne WFP treatment
- T155 (Water use around the home, Saving water, plant selection)
- Water by agreement
- Water supply changes, and
- Your water supply.

Choose Tap

Grants introduced, providing drinking water fountains in local schools

Community awareness and communications

To ensure the community fully comprehends our issues and actions, Western Water produces a range of planned and reactive communication materials including the customer newsletter, email campaigns, factsheets, brochures, media stories, social media and customer letters.

Western Water's new social media communication channels, online consultation panel and growing SMS capability are increasing our means of communicating with customers about critical water quality issues. They go well beyond traditional channels by offering timely, direct, two-way communication.

Facebook and email have become significant communication channels for Western Water – particularly when customers have issues with their water quality or supply.

9 Research and development

Western Water is committed to improving understanding and delivery of quality drinking water. To this end, we have invested in new technologies specifically aimed at better water quality monitoring and delivery. In addition, we have created a link with WSAA and the American Water Research Foundation to access best practice water industry research on both a national and international scale.

Western Water participates in the state-wide Drinking Water Quality Network and the metropolitan retailers' network. These foster good working relationships across the industry.

Western Water has a small library of 170 core reference texts and research papers on water quality and other matters.

Research

Western Water continues to optimise WFP operations, and this starts with the untreated water in the reservoir. In July 2016, an online profile sampler was installed and commissioned at Merrimu Reservoir. The online profile sampler will test for a number of chemicals at different heights to provide data on quality changes. This will assist with predictive operation activities to prevent future and potential water quality issues.

The sampler will provide a better understanding of the source water characterisation and allow predictive actions to prevent potential water quality issues. The long-term capture of this data will influence how we can better manage the reservoirs. Following the success of this project, further samplers are planned for other storages.

Online Manganese monitoring at Rosslynne WFP

In March 2018, Western Water began successfully trialling the use of online monitoring of Manganese at Rosslynne WFP filtered water, to prevent aesthetic issues relating to Manganese such as black water events. Previously, this monitoring has been performed in the laboratory by operators. The use of online monitoring improves response times at the plant to optimise the treatment process.

Trihalomethane investigation at Rosslynne WFP

Rosslynne Reservoir refilled quickly during June to September 2016 which resulted in the water quality in the reservoir changing – particularly in organic type. The type of organics in the reservoir were difficult to remove through the existing treatment process. Because of chlorination used for disinfection at the plant, there were elevated levels of disinfection by-products namely Trihalomethanes.

Extensive investigation of the organics and quantities of Trihalomethane produced at the plant determined the issue is likely to persist for many years and the removal of organic type is a costly activity. The investigation included review of other water agencies in America and Europe to identify alternative technology.

The technology most suitable for the treatment of Trihalomethanes is a PAXTM system, using tank mixing and aeration to release the volatile compounds from the treated water to tank air space, and venting the air to external atmosphere. The project has undergone assessments of financial and environmental impacts, prior to design and installation during 2018.

Rapid microbial field testing

Western Water successfully trialled the use of rapid microbial testing in the field, using LuminUltra, for operational drinking water monitoring. The focus of the technology is the ease of use in the field and the timely response delivered to provide an indication of residual bacteria level in the water sample. The testing can assist in identifying locations where biofilm presence is above the desired level and corrective action such as flushing or additional chlorination can be implemented.

The LuminUltra technology was used during the extensive Sunbury, Bulla and Diggers Rest mains cleaning project in mid-2017. The results of monitoring demonstrated the mains clean was highly successful in removing build-up of inert biofilms in the pipelines. This data was presented in a WaterWorks article documenting the use of LuminUltra in the field, authored by Western Water.

Research and development (continued)

Intelligent Water Networks – ongoing trials

Western Water continues to take a lead role in the Intelligent Water Networks (IWN) program, a partnership between VicWater, the 19 water corporations and DELWP. IWN is investigating new technologies and innovations to meet common challenges such as population growth, ageing infrastructure and climate variability.

Several IWN projects are now underway at Western Water, designed to drive efficiency and system-wide cost reductions. These include augmented reality for plant inspections and training, maintenance of water mains and remote tank inspections using drones.

Waternamics data integration initiative

Like many water corporations, Western Water uses a number of different systems to manage information about customers, and our network of pipes, valves, pumps and tanks. Having information in different places means we are more likely to respond to an incident after it's been reported by a customer, rather than identifying them before they become an issue.

Western Water is trialling Waternamics, an IWN initiative, which is a new data integration system that is changing the way we view our network and improving the service we provide to customers. Waternamics was developed with the assistance of Veolia and IBM.

Waternamics pulls data from five existing systems into a single platform to obtain a comprehensive view of our network and customers in one place. This is helping us:

- identify issues and fix them before they impact on customers
- reduce the time it takes to respond to priority faults, and
- improve the speed of our response to customer enquiries and complaints.

The first phase of the project commenced in late 2017. Waternamics has helped with managing bursts, leaks and faults. It also assists with tracking water quality complaints and lab reporting.

Sharepoint online: Drinking Water RMP management

As with all water corporations, Western Water uses a system to manage the documentation associated with compliance systems such as the Drinking Water RMP. Due to rapid growth in the Western Water service region, and part of continuous improvement of the file management system, a new program called Sharepoint Online is being developed to effectively manage all stored Western Water documents.

The first stage of system development is scheduled for mid-2018, with Stage 2 following quickly in late 2018. The benefits of the Sharepoint system include the ease of managing the documents as part of the RMP system, to improve usability of the system, and enable effective reviews during auditing.

Industry knowledge

Western Water maintains active membership of industry groups such as Australian Water Association (AWA), Water Industry Operators Association (WIOA), WSAA, VicWater and the Institute of Water Administration (IWA) to ensure awareness, communication and involvement with our broader stakeholder groups.

As part of Western Water's membership of the WSAA, we support the WSAA research program, including international collaborative research. Working cooperatively with other WSAA members provides significant leverage in research dollars in a range of important water research areas including customer service, water quality, recycling and environmental impacts.

Staff participate in industry associations including the AWA Victoria Branch Committee and the IWA. Staff also attend seminars and conferences to access up to date industry knowledge.

10 Documentation and reporting

Management of documentation

Reporting water quality data and performance is an integral component of Western Water's Drinking Water QMS. All documentation is regularly reviewed and updated in line with HACCP for water supply systems and the internal QMS. This is part of our IMS.

HACCP documents reviewed and/or rewritten in 2017/18 include:

- Rosslynne WFP HACCP plan
- Lancefield WFP HACCP plan
- Customer Tap HACCP plan
- Booster site HACCP plan
- Reservoir C WFP HACCP plan
- Marriages WFP HACCP plan, and
- Product specification.

An annual review of the following sites was carried out:

- Swans Rd Booster Chlorinator
- Darley High Chlorinator
- Gisborne Rd Chlorinator
- Underbank Chlorinator
- Settlement Rd Booster Chlorinator
- Sandy Creek Booster Chlorinator
- Loemans Rd Entry Point
- Norton Rd Booster Chlorinator
- Salisbury Rd Booster Chlorinator
- Hillside Entry Point
- Shepherds Rd Tank and pump station
- McDonalds Rd Booster Chlorinator
- Greens Hill Tank
- Aitken St Chlorinator
- Romsey Water Filtration Plant
- Merrimu Water Filtration Plant
- Lancefield Water Filtration Plant
- Marriages Water Filtration Plant
- Reservoir C Water Filtration Plant
- Rosslynne Water Filtration Plant
- Myrniong Water Filtration Plant, and
- Customer tap.

Water quality excursions/non-conformances and incidents are reviewed by the HACCP team on a monthly basis, and are tracked and closed out using the IMS database. Western Water's centralised water quality database is provided by Aquantify. This system ensures automated data storage and generates automated emails advising of any water quality exceedances.

Reporting

Western Water uses the Balanced Scorecard (BSC) to manage and report on strategic business performance and ensure the business is progressing toward its strategic intent "strong communities, growing together".

Through BSC reporting, key objectives, actions and system performance are monitored by the Board, Executive and management on a monthly basis. Providing quality water services is a key objective of the BSC with actions including maintaining water quality practices and managing water main assets.

11 Evaluation and audit

Evaluating and auditing water QMSs ensures the successful management of water quality data and processes. This report is an integral part of the review and evaluation process.

Long term evaluation

Water quality data has been collected from various sites across Western Water's service area for over ten years including catchments, reservoirs, plants and customer taps. This data is used to develop trends of long term changes to water quality, which is essential to identify and understand risks to water quality. It also assists in identifying possible solutions.

Audit of drinking water quality management

Audits ensure that operational procedures and processes are in place so that accurate water quality data is collected and appropriate management systems are maintained. One external surveillance audit was conducted by a certified auditor in February 2016 achieving confirmation of the ongoing HACCP certification.

10+

Years of collecting water quality data from various sites, including catchments, reservoirs, plants and customer taps

In 2017/18, 26 internal audits on the Drinking Water HACCP System were undertaken by members of Western Water's HACCP team. The internal audits included review of Western Water's internal procedures and practices to ensure compliance with the requirements for ADWG and HACCP certification. The reports were noted in monthly HACCP meeting minutes and reported in the BSC and to the IMS Committee on a monthly basis.

Reports were also registered in the IMS database to ensure efficient close out of any opportunities for improvement in the HACCP system. An audit schedule is maintained and reviewed by the HACCP team to ensure ongoing compliance.

DHHS regulatory audit

Western Water successfully passed its sixth Regulatory Audit for Drinking Water Risk in June 2018. This result confirms Western Water's commitment to delivering quality and safe drinking water to customers. The audit was based directly on the ADWG and the requirements of the *Safe Drinking Water Act 2003* and the SDWT. The next audit is expected to be mid-2020.

Opportunities for improvement noted by the auditor are explained on page 15.

12 Review and continual improvement

Management reviews

Water quality is viewed as a vital performance issue for Western Water at the most senior level. The performance of the Drinking Water QMS is reviewed monthly by the management team which includes the Managing Director and five General Managers. All audit outcomes are assessed and resources allocated as necessary to resolve critical issues.

All water quality complaints logged in the customer management database are assigned to the relevant staff member who then follows the complaint from receipt to resolution in accordance with Western Water's Correspondence and Complaints Management Procedure. Should the customer be dissatisfied with the initial outcome, an internal dispute resolution process is introduced whereby the complaint is reviewed by management with appropriate actions taken as necessary. If a customer remains dissatisfied, they may be directed to an external dispute resolution forum such as the EWOV.

Drinking water quality management improvement plan

Western Water already has in place an extensive Drinking Water QMS. It is framed around the twelve elements of the ADWG. This assessment will ensure continual improvement measures are identified, and strengths and weaknesses in water quality risk management are well understood, by the Board, Executive, senior management and staff.

Water supply – capital works improvement

During 2017/18, Western Water invested close to $14 million in the region's water supply system. Highlights of our investment include:

- $11.7 million on new infrastructure projects including
  - $6,054K on Leakes Road water main in Rockbank
  - $1,468K on Rosslynne WFP water tank roof refurbishment in Gisborne
  - $911K on Bridge Road water main extension (bridge crossing) in Melton
  - $857K on Gisborne Road water main replacement in Bacchus Marsh, and
  - $586K on Loemans Road & Shephards Lane water pump station electrical upgrade in Sunbury
- $670K on minor renewal works at WFPs, tanks and pump stations
- $584K in water master planning and investigation projects
- $391K on network improvements, and
- $239K in security improvement at WFPs and pump stations.

Non-potable supply

Non-potable water is water that has not been treated to the standards considered acceptable for drinking water under the *Safe Drinking Water Act 2003*. It can include source (untreated) water direct from reservoirs as well as partially treated water. There are no regulated water declarations regarding the non-potable water supply customers of Western Water.

Western Water manages the supply of non-potable water through water by agreement contracts with individual customers. During 2017/18, Western Water had 15 non-potable water by agreement residential customers located across our system. Typically, they are customers who have made special arrangements for connection to Western Water's system between untreated source water and the treatment plant.

Western Water advises that this water is not suitable for either drinking or food preparation through the individual contracts as well as ongoing notification on all applicable customer bills in accordance with Section 25 of the Act.

Appendices

Appendix 1 – Drinking water policy

Western Water will continue to meet the requirements of the *Safe Drinking Water Act 2003* and subordinate legislation, as well as the Western Water Customer Service Charter.

Customers will be provided with safe (biologically, chemically, radiologically and physically), cost effective and reliable drinking water and associated services throughout our area of operations. Drinking water is defined as water intended for human consumption or purposes connected with human consumption.

Western Water will provide adequate resources for ongoing implementation and improvement of the Drinking Water Quality Management System (DWQMS). The DWQMS is based on sound risk management principles of AS4360.

Certification of its Hazard Analysis and Critical Control Point (HACCP) system will be maintained in order to provide a catchment-to-tap multi-barrier approach in line with international best practice.

Supply by Agreement customers will regularly be provided with advisory notices in order to ensure customers understand the fit-for-purpose implications.

Western Water will enhance the sustainability of drinking water supply through initiatives outlined in the Victorian Government's "Our Water Our Future" strategy.

Western Water supports Government policy regarding the introduction to fluoridation to all water supplies. Fluoridation of water will be maintained to all areas supplied from the Melbourne Water entitlement and intermittent fluoridated areas will be appropriately managed.

Western Water will communicate with customers to support the maintaining of public confidence in the safety of drinking water supply. This includes information on the impact of drought on water sources, water quality and water system maintenance.

Appendix 2 – Regulatory and formal requirements for drinking water

Related legislation, policies, systems and procedures include:

- *Safe Drinking Water Act 2003*, and Safe Drinking Water Regulations 2015
- *Health (Fluoridation) Act 1973*
- Code of Practice for Fluoridation of Drinking Water Supplies 2018
- *Food Act 1984*
- *Essential Services Commission Act 2001*
- *Environmental Protection Act 1970*
- *Water Efficiency Labelling and Standards Act 2005*
- Dangerous Goods (Storage and Handling) Regulations 2000
- NHMRC/ARMCANZ Australian Drinking Water Guidelines 2011
- Risk Management (AS/NZS ISO 31000)
- Relevant State Environment Protection Policies (SEPPs)
- Environmental Management Systems – ISO 14001
- Quality Management Systems – ISO 9001
- Occupational Health & Safety Management Systems – AS 4801
- Drinking Water Quality Management System
- HACCP Principles & Systems Procedures
- Integrated Management System procedures
- All relevant Western Water policies

Appendix 3 – Audit and HACCP Certificates

Risk management plan audit certificate

Safe Drinking Water Regulations 2015 - Regulation 10

Certificate Number: 152

Audit period: 10 June 2016 to 30 May 2018

To: Rebecca Chapman, Water Quality Advisor

Western Water, 36 Macedon Road, Sunbury, Vic 3429

Australian Business Number (ABN): 67 433 835 375

I, Dr Daniel Deere , after conducting a risk management plan audit of the water supplied by Western Water am of the opinion that -

Western Water has complied with the obligations imposed by section 7(1) of the ***Safe Drinking Water Act 2003*** during the audit period.

Signature of approved auditor: DADeere Date: 31 May 2018

Lloyd's Register
LRQA

CERTIFICATE OF APPROVAL

This is to certify that the HACCP System of:

Western Region Water Corporation
Trading as Western Water
36 Macedon Street
Sunbury, Victoria
Australia

has been approved by Lloyd's Register Quality Assurance Limited to the following Management System Standard:

HACCP Codex Alimentarius Annex to CAC/RCP 1-1969 (2009)

This certificate is applicable to:

Storage, treatment and distribution of drinking water.

Approval
Certificate No: MEL6029027

Inspection Date: 08 December 2015

Issue Date: 28 March 2016

Certificate Expiry: 21 March 2019

M. T. Lovato

Issued by: Lloyd's Register Quality Assurance Limited

Appendix 4 – Water quality compliance results

4.1 Compliance with drinking water quality standards

This section reports on 2017/18 compliance with the SDWR. The limits for all parameters tested by Western Water – as specified by various guides such as the ADWG – are outlined below in table A2. In some cases, a parameter does not have a limit specified but has been identified through risk assessments as a parameter of interest in case a limit is determined in the future.

Table A1: Drinking water quality standards

Parameter	Sampling frequency	Water quality standard
E.coli	Weekly	100% of all samples collected in any 12-month period to contain no *E.coli* per 100mL
Trihalomethanes	Monthly	Must not exceed 0.25 mg/L
Turbidity	Weekly	Samples in any 12-month period must be less than or equal to the 95th percentile of 5.0 Nephelometric Turbidity Units (NTU)

Table A2: Drinking water quality compliance

Parameter	Sampling frequency	Water quality standard
1,1-Dichloroethene	Various	should not exceed 0.03mg/L.
1,2-Dichloroethane	Various	should not exceed 0.06mg/L.
1.1-Dichloropropylene	Various	currently no recommended health guideline value set
1.1.1.2- Tetrachloroethane	Various	should not exceed 1mg/L.
1.1.1-Trichloroethane	Various	currently no recommended health guideline value set
1.1.2.2-Tetrachloroethane	Various	should not exceed 1mg/L
1.1.2-Trichloroethane	Various	currently no recommended health guideline value set
1.1-Dichloropropylene	Various	currently no recommended health guideline value set
1.2.3-Trichlorobenzene	Various	should not exceed 0.005mg/L
1.2.3-Trichloropropane	Various	should not exceed 0.007mg/L
1.2.4-Trichlorobenzene	Various	should not exceed 0.005mg/L
1.2.4-Trimethylbenzene	Various	currently no recommended health guideline value set
1.2-Dibromo-3- chloropropane	Various	currently no recommended health guideline value set
1.2-Dibromoethane (EDB)	Various	should not exceed 40mg/L
1.2-Dichlorobenzene	Various	should not exceed 0.001mg/L
1.2-Dichloropropane	Various	should not exceed 75mg/L
1.3.5 - Trimethylbenzene	Various	should not exceed 25mg/L
1.3-Dichlorobenzene	Various	currently no recommended health guideline value set
1.3-Dichloropropane	Various	currently no recommended health guideline value set
1.4-Dichlorobenzene	Various	should not exceed 0.0003mg/L
2,4,6-Trichlorophenol	Various	currently no recommended health guideline value set
2,4-D	Various	should not exceed 0.03mg/L.
2.3.4.6-Tetrachlorophenol	Various	currently no recommended health guideline value set
2.4.5-T	Various	should not exceed 0.1mg/L.
2.4.5-Trichlorophenol	Various	should not exceed 0.02mg/L
2.4-Dichlorophenol	Various	should not exceed 0.02mg/L
2.6-Dichlorophenol	Various	should not exceed 0.02mg/L
2-Chlorophenol	Various	should not exceed 0.2mg/L
2-Chlorotoluene	Various	should not exceed 1mg/L.

Table A2: Drinking water quality compliance (continued)

Parameter	Sampling frequency	Water quality standard
4,4'-DDT	Various	should not exceed 0.009mg/L.
4.4'-DDD	Various	currently no recommended health guideline value set
4.4'-DDE	Various	currently no recommended health guideline value set
4-Chloro-3-Methylphenol	Various	currently no recommended health guideline value set
4-Chlorotoluene	Various	should not exceed 1mg/L.
Aldrin	Various	should not exceed 0.0003mg/L.
Alkalinity, Total as CaCO3	Various	aesthetic limit is 200mg/L
Aluminium, filtered	Various	currently no recommended health guideline value set
Aluminium, Total as Al	Various	currently no recommended health guideline value set
Ammonia	Various	aesthetic limit is 0.5 mg/L
Antimony	Various	should not exceed 0.003mg/L.
Antimony, Filtered	Various	should not exceed 0.003mg/L.
Arsenic	Various	should not exceed 0.01mg/L
Arsenic, Filtered	Various	should not exceed 0.01mg/L
Barium, as Ba	Various	should not exceed 2mg/L.
Barium, Filtered	Various	limit based on Barium
Benzo(a)pyrene	Various	should not exceed 0.00001mg/L.
Berylium, Filtered	Various	should not exceed 0.06mg/L
Beryllium, as Be	Various	should not exceed 0.06mg/L
BHC (alpha)	Various	should not exceed 1.2mg/L
BHC (beta)	Various	should not exceed 1.2mg/L
BHC (delta)	Various	should not exceed 1.2mg/L.
Bicarbonate Alkalinity as CaCO3	Various	aesthetic limit is 200mg/L
Boron	Various	should not exceed 4mg/L.
Boron, Filtered	Various	Limit based on Boron.
Bromate	Various	should not exceed 0.02mg/L
Bromobenzene	Various	should not exceed 50mg/L
Bromodichlormethane	Various	should not exceed 0.25mg/L
Bromoform	Various	should not exceed 0.25mg/L
Cadmium	Various	should not exceed 0.002mg/L
Cadmium, Filtered	Various	Limit based on Cadmium
Calcium	Various	currently no recommended health guideline value set
Carbon tetrachloride	Various	should not exceed 0.003mg/L.
Carbonate Alkalinity as Ca-CO3	Various	aesthetic limit is 200mg/L
Chlordane, Total	Various	should not exceed 0.002mg/L
Chlorine, Total	Various	should not exceed 5 mg/L
Chlorine, Free	Various	Limit based on Chlorine, Total
Chloroacetic acid	Various	should not exceed 0.15 mg/L
Chlorobenzene	Various	should not exceed 0.01mg/L
Chloroform	Various	should not exceed 0.25mg/L
Chromium	Various	should not exceed 0.05mg/L
Chromium, Filtered	Various	should not exceed 0.05mg/L
cis-1.2-Dichloroethene	Various	should not exceed 0.06mg/L.
cis-1.3-Dichloropropylene	Various	should not exceed 0.03mg/L.
cis-Chlordane	Various	should not exceed 0.002mg/L
Cobalt, as Co	Various	should not exceed 0.02mg/L
Cobalt, Filtered	Various	Limit based on Cobalt

Appendix 4 – Water quality compliance results (continued)

Table A2: Drinking water quality compliance (continued)

Parameter	Sampling frequency	Water quality standard
Coliforms, Total	Various	currently no recommended health guideline value set
Colour, true	Various	should not exceed 15HU
Copper	Various	should not exceed 1mg/L
Copper, Filtered	Various	Limit based on Copper
Cyanide	Various	should not exceed 0.08 mg/L
Dibromochloromethane	Various	should not exceed 0.25mg/L
Dibromomethane	Various	should not exceed 0.04mg/L
Dichloroacetic acid	Various	should not exceed 0.1mg/L
Dissolved Organic Carbon	Various	currently no recommended health guideline value set
Dissolved Oxygen (Field)	Various	currently no recommended health guideline value set
Electrical Conductivity @ 25C	Various	aesthetic limit of 940µS/cm.
Endosulfan I	Various	should not exceed 0.02mg/L
Endosulfan II	Various	should not exceed 0.02mg/L
Endosulfan sulfate	Various	currently no recommended health guideline value set
Endrin	Various	should not exceed 0.00002mg/L
Endrin aldehyde	Various	should not exceed 0.01mg/L
Endrin ketone	Various	should not exceed 0.005mg/L
Enterococci	Various	Should not exceed 0 orgs/100ml
E.coli	Weekly	100% of all samples collected in any 12 month period to contain no *E.coli* per 100mL (reference Safe Drinking Water Regulations 2015)
Ethylbenzene	Various	should not exceed 0.003mg/L.
Faecal Streptococci	Various	Should not exceed 0 orgs/100ml
Fluoride	Various	should exceed the limit of 1.5 mg/L
Formaldehyde	Various	should not exceed 0.5mg/L
Hardness, as CaCO3	Various	aesthetic limit is 200 mg/L
Heptachlor	Various	should not exceed 0.0003mg/L
Heptachlor Epoxide	Various	should not exceed 0.0003mg/L
Heterotrophic Plate Count, 22C	Various	currently no recommended health guideline value set
Heterotrophic Plate Count, 37C	Various	currently no recommended health guideline value set
Hexachlorobenzene	Various	currently no recommended health guideline value set
Hydroxide Alkalinity as Ca-CO3	Various	aesthetic limit is 200mg/L
Iron, Filtered (Soluble)	Various	Limit based on Iron, total
Iron, total as Fe	Various	aesthetic limit 0.3 mg/L
Lead	Various	should not exceed 0.01 mg/L
Lead, Filtered	Various	Limit based on Lead, total
Lindane	Various	should not exceed 0.01mg/L.
Magnesium, as Mg	Various	currently no recommended health guideline value set
Manganese, Filtered (Solu- ble)	Various	limit based on Manganese, total
Manganese, total as Mn	Various	Aesthetic limit should not exceed 0.1mg/L, should not exceed 0.5mg/L
MCPA	Various	should not exceed 0.04 mg/L
Mercury, as Hg	Various	should not exceed 0.001 mg/L
meta- & para-Xylene	Various	should not exceed 0.02mg/L.
Methoxychlor	Various	should not exceed 0.3mg/L
Methylene chloride	Various	should not exceed 0.004mg/L.
Molybdenum, as Mo	Various	should not exceed 0.05mg/L
Monochloramine	Various	should not exceed 3 mg/L

Table A2: Drinking water quality compliance (continued)

Parameter	Sampling frequency	Water quality standard
Nickel	Various	should not exceed 0.02 mg/L
Nickel, Filtered	Various	Limit based on Nickel
Nitrate	Various	should not exceed 50 mg/L
Nitrite	Various	should not exceed 3 mg/L
n-Propylbenzene	Various	currently no recommended health guideline value set
ortho-Xylene	Various	should not exceed 0.02mg/L
Pentachlorophenol	Various	should not exceed 0.01mg/L.
pH	Various	aesthetic limits are no less than 6.5, and no greater than 8.5
Phosphorus, Reactive as P	Various	should not exceed 1mg/L
p-Isopropyltoluene	Various	currently no recommended health guideline value set
Potassium, as K	Various	currently no recommended health guideline value set
sec-Butylbenzene	Various	currently no recommended health guideline value set
Selenium	Various	should not exceed 0.01mg/L
Selenium, Filtered	Various	Limit based on Selenium
Silica, Non Reactive	Various	currently no recommended health guideline value set
Silica, Reactive	Various	currently no recommended health guideline value set
Silver, Filtered as Ag	Various	limit based on Silver
Silver, Total as Ag	Various	should not exceed 0.1mg/L.
Simazine	Various	should not exceed 0.02mg/L
Sodium	Various	aesthetic limit should not exceed 180 mg/L.
Strontium, Filtered	Various	limit based on Strontium
Strontium, Total	Various	should not exceed 1.5mg/L
Styrene	Various	should not exceed 0.004mg/L
Sulfate	Various	aesthetic limit should not exceed 250 mg/L.
tert-Butylbenzene	Various	currently no recommended health guideline value set
Tetrachloroethene	Various	should not exceed 0.05mg/L
Thallium, Total	Various	should not exceed 2mg/L
Tin, Filtered	Various	currently no recommended health guideline value set
Tin, Total as Sn	Various	currently no recommended health guideline value set
Titanium, Filtered	Various	currently no recommended health guideline value set
Titanium, Total	Various	currently no recommended health guideline value set
Toluene	Various	should not exceed 0.025mg/L
trans-1.2-Dichloroethene	Various	should not exceed 0.06mg/L
trans-1.3- Dichloropropylene	Various	should not exceed 0.03mg/L
trans-Chlordane	Various	should not exceed 0.002mg/L.
Trichloroacetic acid	Various	should not exceed 0.1mg/L
Trichloroethene	Various	currently no recommended health guideline value set
Trihalomethanes	Monthly	must not exceed 0.25 mg/L (reference Safe Drinking Water Regulations 2015)
Turbidity	Weekly	95th percentile limit of drinking water samples collected in the preceding 12 months must be less than or equal to 5.0 Nephelometric Turbidity Units (NTU) (reference Safe Drinking Water Regulations 2015)
UV Transmission@254nm	Various	currently no recommended health guideline value set
Vanadium, as V	Various	should not exceed 0.021mg/L
Vanadium, Filtered	Various	should not exceed 0.021mg/L
Zinc	Various	should not exceed 3mg/L
Zinc, Filtered	Various	limit based on Zinc

NB: where detailed result information of the listed parameters is not shown in the following tables, this information is available on request.

Appendix 4 – Water quality compliance results (continued)

4.1.2 *E.coli*

E.coli is abundant in human and animal faeces and is tested as a specific indicator of faecal contamination in the drinking water supply. Detection of *E.coli* can indicate a failure in water treatment, contamination of a water storage facility or possible infiltration of the enclosed system.

Treatment through disinfection removes *E.coli.* Western Water applies chemical disinfection by chlorination or chloramination in all its supply systems. A level of disinfection residual is maintained within the distribution system to prevent potential regrowth of microorganisms before reaching customer taps.

Table A3: *E.coli* results

Water sampling locality	Sampling frequency	No. of samples[1]	No. of samples detecting *E.coli*	No. of *E.coli* investigations completed	No. of false detections of *E.coli*	Max. result (true result) (orgs/mL)	Complying (Yes/No)	Compliance %, as per ESC reporting
Bulla	Weekly	108[6]	0	0	0	0	Yes	100%
Darley	Weekly	312	0	0	0	0	Yes	100%
Diggers Rest	Weekly	106	0	0	0	0	Yes	100%
Eynesbury	Weekly	153	0	0	0	0	Yes	100%
Gisborne	64/year	285[7]	1[10]	1	1	0	Yes	100%
Lancefield	Weekly	106	0	0	0	0	Yes	100%
Lerderderg[3]	64/year	237[2]	0	0	0	0	Yes	100%
Macedon	Weekly	159	0	0	0	0	Yes	100%
Maddingley	Weekly	156	0	0	0	0	Yes	100%
Melton South	112/year	268	0	0	0	0	Yes	100%
Merrimu	64/year	219	1[11]	1	1	0	Yes	100%
Mount Macedon	Weekly	212	0	0	0	0	Yes	100%
Myrniong	Weekly	251[2]	1[9]	1	1	0	Yes	100%
Riddells Creek	Weekly	159	0	0	0	0	Yes	100%
Rockbank	Weekly	208	0	0	0	0	Yes	100%
Romsey[4]	Weekly	318	0	0	0	0	Yes	100%
Sunbury[5]	112/year	463	0	0	0	0	Yes	100%
Toolern Vale	Weekly	103	0	0	0	0	Yes	100%
Woodend	64/year	245[8]	0	0	0	0	Yes	100%

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *The sampling requirements defined in Schedule 2 of the SDWR 2015 for the locality were met, however not all samples scheduled in the sampling program were collected in accordance to the Water Sampling Program. For details, refer to Section 6 Incident management and emergency response.*

[3] *Lerderderg positive E.coli sample was at the Gisborne Rd Tank 30/12/16, for further details refer to Section 6 Incident Management and Emergency Response. Note: the % Compliance was updated from 98% to 99.8% as part of 2016/17 ESC reporting, based on total number of samples collected in all localities during the audit period.*

[4] *Romsey positive E.coli sample was at the Romsey WTP Tank B 10/4/17, for further details refer to Section 6 Incident Management and Emergency Response. Note: the % Compliance was updated from 98% to 99.8% as part of 2016/17 ESC reporting, based on total number of samples collected in all localities during the audit period.*

[5] *Sunbury positive E.coli sample was at the William Rise Tank 23/11/16, for further details refer to Section 6 Incident Management and Emergency Response. Note: the % Compliance was updated from 98% to 99.8% as part of 2016/17 ESC reporting, based on total number of samples collected in all localities during the audit period.*

[6] *Bulla locality was fed via Shepherds Lane tank during 2017/18, to meet supply demands.*

[7] *Rosslynne 3ML tank offline for much of 2017/18 as part of refurbishment project.*

[8] *Supply via the Rosslynne network to Woodend, as part of incident response. For further details refer to Section 6 Incident management and Emergency Response.*

[9] *Detection of 6orgs/100ml at Blackwood Main in November 2017, refer to Section 6 Incident Management and Emergency Response for details and corrective actions.*

[10] *Detection of 1orgs/100ml at Gisborne South Tank in November 2017, refer to Section 6 Incident Management and Emergency Response for details and corrective actions.*

[11] *Detection of 1orgs/100ml at 5ML Merrimu Tank in February 2018, refer to Section 6 Incident Management and Emergency Response for details and corrective actions.*

4.2 Chlorine-based disinfection by-product chemicals

Western Water disinfects its drinking water supplies by either chlorination or chloramination. Chlorine-based disinfection by-products measured under the SWDR include total trihalomethanes. The following section reports the results for the 2017/18 monitoring program.

Total trihalomethanes

Trihalomethanes are present in drinking water principally as a by-product of disinfection from chlorination or chloramination, where chlorine reacts with organic material.

Trihalomethanes

Table A4: Trihalomethanes results

Water sampling locality	Sampling frequency	No. of samples[1,3]	No. of non-complying samples	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying (Yes/No)2
Bulla	Monthly	24[4]	0	0.11	0.02	0.04	Yes
Darley	Monthly	67	0	0.20	0.08	0.15	Yes
Diggers Rest	Monthly	12	0	0.09	0.02	0.05	Yes
Eynesbury	Monthly	23	0	0.08	0.03	0.05	Yes
Gisborne	Monthly	145[5,7]	0	0.15	0.04	0.08	Yes
Lancefield	Monthly	23	0	0.14	0.06	0.11	Yes
Lerderderg	Monthly	36[6]	0	0.20	0.09	0.13	Yes
Macedon	Monthly	77[7]	0	0.19	0.06	0.11	Yes
Maddingley	Monthly	23	0	0.17	0.09	0.14	Yes
Melton South	Monthly	45	0	0.07	0.02	0.04	Yes
Merrimu	Monthly	34	0	0.14	0.04	0.08	Yes
Mount Macedon	Monthly	107[7]	0	0.21	0.07	0.13	Yes
Myrniong	Monthly	42	0	0.13	0.03	0.07	Yes
Riddells Creek	Monthly	81[7]	0	0.19	0.06	0.12	Yes
Rockbank	Monthly	45	0	0.08	0.02	0.03	Yes
Romsey	Monthly	45	0	0.10	0.00	0.02	Yes
Sunbury	Monthly	71	0	0.14	0.01	0.06	Yes
Toolern Vale	Monthly	23	0	0.15	0.05	0.11	Yes
Woodend	Monthly	37	0	0.14	0.02	0.06	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the guideline values set out in the SDWR and ADWG for total trihalomethanes in drinking water based on health considerations should not exceed 0.25mg/L.*

[3] *Tanks and pump stations are sampled monthly, as of 2017/18.*

[4] *Bulla locality was fed via Shepherds Lane tank during 2017/18, to meet supply demands.*

[5] *Rosslynne 3ML tank offline for much of 2017/18 as part of refurbishment project.*

[6] *The sampling requirements defined in Schedule 2 of the SDWR 2015 for the locality were met, however not all samples scheduled in the sampling program were collected in accordance to the Water Sampling Program. For details, refer to Section 6 Incident management and emergency response.*

[7] *Additional samples tested as part of monitoring after 2016/17 incident issue, refer to Annual Drinking Water Quality report 2016/17 Section 6 Incident Management and Emergency Response.*

4.3 Ozone-based disinfection by-product chemicals

The ozone-based disinfection by-products bromate and formaldehyde are not deemed to be a significant risk in drinking water supplied by Western Water as the largest potential risk for the presence of these by-products in drinking water exceeding compliance levels is through ozonation.

Western Water does not use ozone-based chemicals for disinfection of drinking water. Accordingly, sampling and analyses for bromate and formaldehyde were not undertaken in the 2016/17 reporting period.

4.4 Turbidity

Turbidity is the measurement of the light scattering properties of water and is caused by the presence of fine suspended matter in the supply. Based on aesthetic considerations, the turbidity standard is set at 5 nephelometric turbidity units (NTU), which is the point where water may appear slightly discoloured in a glass.

The following table reflects the reporting period 1 July 2017 to 30 June 2018, under the SWDR.

A summary of the turbidity results for samples taken at customer taps in 2017/18 is listed below. It includes the statistical measure of the 95th percentile for samples taken for turbidity over a 12-month period.

Turbidity

Table A5: Turbidity results

Water sampling locality	Frequency of sampling	No. of samples[1, 2]	Max. NTU	Min. NTU	95th percentile	Complying (Yes/No)
Bulla	Weekly	105[3]	1.7	0.4	1.1	Yes
Darley	Weekly	312	2.1	0.1	0.2	Yes
Diggers Rest	Weekly	107	1.0	0.5	0.9	Yes
Eynesbury	Weekly	153	2.7	0.4	0.9	Yes
Gisborne	Weekly	255[4]	1.1	0.1	0.6	Yes
Lancefield	Weekly	106	0.2	0.1	0.1	Yes
Lerderderg	Weekly	223[5]	0.4	0.1	0.1	Yes
Macedon	Weekly	151	0.9	0.1	0.5	Yes
Maddingley	Weekly	156	0.3	0.1	0.2	Yes
Melton South	Weekly	208	1.1	0.4	0.8	Yes
Merrimu	Weekly	200	0.9	0.1	0.7	Yes
Mount Macedon	Weekly	201	13.0	0.1	0.6	Yes
Myrniong	Weekly	248[5]	0.7	0.1	0.3	Yes
Riddells Creek	Weekly	152	1.1	0.1	0.9	Yes
Rockbank	Weekly	204	1.9	0.4	1.2	Yes
Romsey	Weekly	313	0.4	0.1	0.1	Yes
Sunbury	Weekly	364	1.3	0.1	0.9	Yes
Toolern Vale	Weekly	103	0.2	0.1	0.1	Yes
Woodend	Weekly	220	1.8	0.1	0.2	Yes

NTU: nephelometric turbidity unit

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*
[2] *Tanks and pump stations are sampled monthly, as of 2017/18.*
[3] *Bulla locality was fed via Shepherds Lane tank during 2017/18, to meet supply demands.*
[4] *Rosslynne 3ML tank offline for much of 2017/18 as part of refurbishment project.*
[5] *The sampling requirements defined in Schedule 2 of the SDWR 2015 for the locality were met, however not all samples scheduled in the sampling program were collected in accordance to the Water Sampling Program. For details, refer to Section 6 Incident management and emergency response.*

4.5 Fluoride

Both the *Health (Fluoridation) Act 1973* and DHHS require that the average fluoride in fluoridated drinking water supplied by Western Water must not exceed a level of 1.2 mg/L for operational control, and a yearly average of no greater than 1.0mg/L. Fluoride levels in any individual sample from drinking water supplied must also not exceed 1.5 mg/L, according to the ADWG.

The following table reflects the reporting period 1 July 2017 to 30 June 2018 under the SDWR.

Fluoride is added to the drinking water to improve dental health. In supplies where fluoride is not added, naturally occurring sources, such as soils and rock, may impart fluoride to the water. For further information on water fluoridation, please visit the DHHS website for water fluoridation https://www2.health.vic.gov.au/public-health/water/water-fluoridation

Fluoride

Table A6: Fluoride results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)[3]	Complying (Yes/ No)
Bulla	Fortnightly	54[4]	0.9	0.6	0.8	Yes
Darley	Fortnightly	48	0.9	0.6	0.8	Yes
Diggers Rest	Fortnightly	36	0.9	0.8	0.8	Yes
Eynesbury	Fortnightly	91	1.0	0.7	0.8	Yes
Gisborne	Fortnightly	139[5]	1.1	0.3	0.8	Yes
Lancefield[2]	Quarterly	16	0.2	0.1	0.1	Yes
Lerderderg	Fortnightly	50[6]	0.9	0.3	0.8	Yes
Macedon	Fortnightly	36	0.9	0.7	0.8	Yes
Maddingley	Fortnightly	45	0.9	0.6	0.8	Yes
Melton South	Fortnightly	29	0.9	0.7	0.8	Yes
Merrimu	Fortnightly	61	1.0	0.7	0.8	Yes
Mount Macedon	Fortnightly	29	0.9	0.8	0.9	Yes
Myrniong[2]	Quarterly	16	0.1	0.1	0.1	Yes
Riddells Creek	Fortnightly	33	0.9	0.8	0.8	Yes
Rockbank	Fortnightly	83	0.9	0.2	0.8	Yes
Romsey[2]	Quarterly	52	0.3	0.2	0.2	Yes
Sunbury	Fortnightly	178	0.9	0.5	0.8	Yes
Toolern Vale	Fortnightly	30	0.9	0.6	0.8	Yes
Woodend[2]	Quarterly	44	0.9	0.1	0.2	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Non-fluoridated supplies (unless supplied with external water sources).*

[3] *Health (Fluoridation) Act 1973, fluoride added to an extent that must not results in an average optimum concentration in excess of one part fluoride per million parts of water. Hence, 1.0 mg/L.*

[4] *Bulla locality was fed via Shepherds Lane tank during 2017/18, to meet supply demands.*

[5] *Rosslynne 3ML tank offline for much of 2017/18 as part of refurbishment project.*

[6] *The sampling requirements defined in Schedule 2 of the SDWR 2015 for the locality were met, however not all samples scheduled in the sampling program were collected in accordance to the Water Sampling Program. For details, refer to Section 6 Incident management and emergency response.*

A4.6 Other chemicals not specified in Schedule 2 but which may pose a risk to human health

Besides those parameters tested under the SDWR, Western Water also tests for other substances that may pose a risk to human health. These results are measured in accordance with the ADWG. All results presented in this report are available to customers on request. Any further explanation on any parameters of concern is provided as required.

The following reports 2017/18 compliance against the health-related guideline values set out in ADWG or other cited guidelines for other parameters measured at customers' taps that may pose a risk to human health. All samples complied with the health-related guideline values for ADWG or other cited guidelines.

Chloroacetic acid

Chloroacetic acid is a by-product of the reaction between chlorine and naturally-occurring humic and fulvic acids in the drinking water supply.

Table A7: Chloroacetic acid results

Water sampling locality	Frequency of sampling[1]	No. of samples[2]	Mean (mg/L)	Max. (mg/L)	Min. (mg/L)	Complying (Yes/No)[3]
Bulla	Yearly	1	0.002	0.002	0.002	Yes
Darley	Yearly	1	0.002	0.002	0.002	Yes
Diggers Rest	Yearly	1	0.002	0.002	0.002	Yes
Eynesbury	Yearly	1	0.002	0.002	0.002	Yes
Gisborne	Yearly	1	0.003	0.003	0.003	Yes
Lancefield	Yearly	1	0.003	0.003	0.003	Yes
Lerderderg	Yearly	1	0.002	0.002	0.002	Yes
Macedon	Yearly	1	0.002	0.002	0.002	Yes
Maddingley	Yearly	1	0.002	0.002	0.002	Yes
Melton South	Yearly	1	0.002	0.002	0.002	Yes
Merrimu	Yearly	1	0.002	0.002	0.002	Yes
Mount Macedon	Yearly	1	0.004	0.004	0.004	Yes
Myrniong	Yearly	1	0.002	0.002	0.002	Yes
Riddells Creek	Yearly	1	0.002	0.002	0.002	Yes
Rockbank	Yearly	11[4]	0.002	0.002	0.002	Yes
Romsey	Yearly	1	0.002	0.002	0.002	Yes
Sunbury	Yearly	1	0.002	0.002	0.002	Yes
Toolern Vale	Yearly	1	0.002	0.002	0.002	Yes
Woodend	Yearly	1	0.002	0.002	0.002	Yes

[1] *Scheduled for monthly sampling under Safe Drinking Water Regulations 2005. During review of monitoring program in August 2015 this was reduced to yearly in accordance with SDWR.*

[2] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[3] *Compliance as measured against the guideline values set out in ADWG for total chloroacetic acid in drinking water based on health considerations should not exceed 0.15mg/L.*

[4] *Hillside pump station changed from monthly to annual reporting at the end of 2017/18 audit period.*

Dichloroacetic acid

Dichloroacetic acid is a by-product of the reaction between chlorine and naturally occurring humic and fulvic acids in the drinking water supply.

Table A8: Dichloroacetic acid results

Water sampling locality	Frequency of sampling[1]	No. of samples[2]	Mean (mg/L)	Max. (mg/L)	Min. (mg/L)[3]	Complying[4] (Yes/No)
Bulla	Yearly	1	0.006	0.006	0.006	Yes
Darley	Yearly	1	0.004	0.004	0.004	Yes
Diggers Rest	Yearly	1	0.009	0.009	0.009	Yes
Eynesbury	Yearly	1	0.011	0.011	0.011	Yes
Gisborne	Yearly	1	0.013	0.013	0.013	Yes
Lancefield	Yearly	1	0.020	0.020	0.020	Yes
Lerderderg	Yearly	1	0.004	0.004	0.004	Yes
Macedon	Yearly	1	0.009	0.009	0.009	Yes
Maddingley	Yearly	1	0.006	0.006	0.006	Yes
Melton South	Yearly	1	0.008	0.008	0.008	Yes
Merrimu	Yearly	1	0.008	0.008	0.008	Yes
Mount Macedon	Yearly	1	0.023	0.023	0.023	Yes
Myrniong	Yearly	1	0.003	0.003	0.003	Yes
Riddells Creek	Yearly	1	0.008	0.008	0.008	Yes
Rockbank	Yearly	11[5]	0.009	0.019	0.005	Yes
Romsey	Yearly	1	0.002	0.002	0.002	Yes
Sunbury	Yearly	1	0.015	0.015	0.015	Yes
Toolern Vale	Yearly	1	0.003	0.003	0.003	Yes
Woodend	Yearly	1	0.018	0.018	0.018	Yes

[1] *Scheduled for monthly sampling under SDWR. During review of monitoring program in August 2015 this was reduced to yearly in accordance with SDWR.*

[2] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[3] *A result of <0.005 mg/L is a result less than the detection limit for total dichloroacetic acid.*

[4] *Compliance as measured against the guideline values set out in ADWG for total dichloroacetic acid in drinking water based on health considerations should not exceed 0.1mg/L.*

[5] *Hillside pump station changed from monthly to annual reporting at the end of 2017/18 audit period.*

Appendix 4 – Water quality compliance results (continued)

A4.6 Other chemicals not specified in Schedule 2 but which may pose a risk to human health (continued)

Trichloroacetic acid

Trichloroacetic acid is a by-product of the reaction between chlorine and naturally occurring humic and fulvic acids in the drinking water supply.

Table A9: Trichloroacetic acid results

Water sampling locality	Frequency of sampling[1]	No. of samples[2]	Mean (mg/L)	Max. (mg/L)	Min. (mg/L)[3]	Complying[4] (Yes/No)
Bulla	Yearly	1	0.021	0.021	0.021	Yes
Darley	Yearly	1	0.014	0.014	0.014	Yes
Diggers Rest	Yearly	1	0.020	0.020	0.020	Yes
Eynesbury	Yearly	1	0.016	0.016	0.016	Yes
Gisborne	Yearly	1	0.008	0.008	0.008	Yes
Lancefield	Yearly	1	0.015	0.015	0.015	Yes
Lerderderg	Yearly	1	0.008	0.008	0.008	Yes
Macedon	Yearly	1	0.010	0.010	0.010	Yes
Maddingley	Yearly	1	0.015	0.015	0.015	Yes
Melton South	Yearly	1	0.018	0.018	0.018	Yes
Merrimu	Yearly	1	0.016	0.016	0.016	Yes
Mount Macedon	Yearly	1	0.015	0.015	0.015	Yes
Myrniong	Yearly	1	0.003	0.003	0.003	Yes
Riddells Creek	Yearly	1	0.009	0.009	0.009	Yes
Rockbank	Yearly	11[5]	0.013	0.027	0.006	Yes
Romsey	Yearly	1	0.002	0.002	0.002	Yes
Sunbury	Yearly	1	0.026	0.026	0.026	Yes
Toolern Vale	Yearly	1	0.010	0.010	0.010	Yes
Woodend	Yearly	1	0.015	0.015	0.015	Yes

[1] *Scheduled for monthly sampling under SDWR. During review of monitoring program in August 2015 this was reduced to yearly in accordance with SDWR.*

[2] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[3] *A result of <0.005 mg/L is a result less than the detection limit for total trichloroacetic acid.*

[4] *Compliance as measured against the guideline values set out in ADWG for total trichloroacetic acid in drinking water based on health considerations should not exceed 0.1mg/L.*

[5] *Hillside pump station changed from monthly to annual reporting at the end of 2017/18 audit period.*

Manganese

Table A10: Manganese (total as Mn) results

Water sampling locality	Sampling frequency	No. of samples[1,5]	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying[2] (Yes/No)
Bulla	Quarterly	13[3]	0.009	0.001	0.003	Yes
Darley	Quarterly	20	0.005	0.001	0.002	Yes
Diggers Rest	Quarterly	12	0.007	0.001	0.003	Yes
Eynesbury	Quarterly	23	0.017	0.002	0.004	Yes
Gisborne	Quarterly	107[4]	0.020	0.002	0.006	Yes
Lancefield	Quarterly	12	0.002	0.001	0.001	Yes
Lerderderg	Quarterly	21[6]	0.007	0.001	0.002	Yes
Macedon	Quarterly	40	0.011	0.001	0.004	Yes
Maddingley	Quarterly	16	0.008	0.001	0.002	Yes
Melton South	Quarterly	56[3]	0.009	0.001	0.003	Yes
Merrimu	Quarterly	36	0.020	0.001	0.002	Yes
Mount Macedon	Quarterly	57	0.013	0.002	0.004	Yes
Myrniong	Quarterly	67	0.020	0.001	0.006	Yes
Riddells Creek	Quarterly	42	0.014	0.001	0.004	Yes
Rockbank	Quarterly	56[3]	0.009	0.001	0.003	Yes
Romsey	Quarterly	48	0.041	0.001	0.007	Yes
Sunbury	Quarterly	96	0.016	0.001	0.003	Yes
Toolern Vale	Quarterly	4	0.002	0.001	0.001	Yes
Woodend	Quarterly	81	0.048	0.001	0.005	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the health related guideline values set out in ADWG for manganese in drinking water should not exceed 0.1 mg/L for aesthetics and 0.5mg/L for health limit.*

[3] *Testing at tanks where water is entering the locality network, manganese is considered as low risk.*

[4] *Rosslynne 3ML tank offline for much of 2017/18, as part of refurbishment project.*

[5] *All tanks and pump stations sampled for manganese during 2017/18.*

[6] *The sampling requirements defined in Schedule 2 of the SDWR 2015 for the locality were met, however not all samples scheduled in the sampling program were collected in accordance to the Water Sampling Program. For details, refer to Section 6 Incident management and emergency response*

Appendix 4 – Water quality compliance results (continued)

A4.6 Other chemicals not specified in Schedule 2 but which may pose a risk to human health (continued)

Lead

Table A11: Lead (total as Pb) results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Quarterly	4	0.001	0.001	Yes
Darley	Quarterly	4	0.001	0.001	Yes
Diggers Rest	Quarterly	4	0.001	0.001	Yes
Eynesbury	Quarterly	4	0.001	0.001	Yes
Gisborne	Quarterly	5	0.001	0.001	Yes
Lancefield	Quarterly	5	0.001	0.001	Yes
Lerderderg	Quarterly	6	0.001	0.001	Yes
Macedon	Quarterly	4	0.001	0.001	Yes
Maddingley	Quarterly	4	0.001	0.001	Yes
Melton South	Quarterly	4	0.001	0.001	Yes
Merrimu	Quarterly	4	0.001	0.001	Yes
Mount Macedon	Quarterly	4	0.001	0.001	Yes
Myrniong	Quarterly	4	0.001	0.001	Yes
Riddells Creek	Quarterly	4	0.001	0.001	Yes
Rockbank	Quarterly	4	0.001	0.001	Yes
Romsey	Quarterly	6	0.001	0.001	Yes
Sunbury	Quarterly	6	0.001	0.001	Yes
Toolern Vale	Quarterly	4	0.001	0.001	Yes
Woodend	Quarterly	6	0.001	0.001	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the health related guideline values set out in ADWG for lead in drinking water should not exceed 0.01 mg/L.*

Copper

Table A12: Copper (total as Cu) results

Water sampling locality	Frequency of sampling	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Quarterly	4	0.004	0.002	Yes
Darley	Quarterly	4	0.004	0.003	Yes
Diggers Rest	Quarterly	4	0.006	0.002	Yes
Eynesbury	Quarterly	4	0.007	0.005	Yes
Gisborne	Quarterly	4	0.009	0.002	Yes
Lancefield	Quarterly	4	0.005	0.003	Yes
Lerderderg	Quarterly	4	0.004	0.002	Yes
Macedon	Quarterly	4	0.008	0.001	Yes
Maddingley	Quarterly	4	0.014	0.002	Yes
Melton South	Quarterly	4	0.019	0.001	Yes
Merrimu	Quarterly	4	0.008	0.001	Yes
Mount Macedon	Quarterly	4	0.006	0.002	Yes
Myrniong	Quarterly	4	0.064	0.01	Yes
Riddells Creek	Quarterly	4	0.014	0.002	Yes
Rockbank	Quarterly	4	0.004	0.001	Yes
Romsey	Quarterly	4	0.048	0.005	Yes
Sunbury	Quarterly	4	0.005	0.004	Yes
Toolern Vale	Quarterly	4	0.034	0.002	Yes
Woodend	Quarterly	4	0.006	0.001	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the guideline values set out in ADWG for copper in drinking water should not exceed 2 mg/L based on health considerations, and 1mg/L base on aesthetic considerations.*

Appendix 4 – Water quality compliance results (continued)

A4.6 Other chemicals not specified in Schedule 2 but which may pose a risk to human health (continued)

Arsenic

Table A13: Arsenic results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Annually	1	0.001	0.001	Yes
Darley	Annually	1	0.001	0.001	Yes
Diggers Rest	Annually	1	0.001	0.001	Yes
Eynesbury	Annually	1	0.001	0.001	Yes
Gisborne	Annually	1	0.001	0.001	Yes
Lancefield	Annually	1	0.001	0.001	Yes
Lerderderg	Annually	1	0.001	0.001	Yes
Macedon	Annually	1	0.001	0.001	Yes
Maddingley	Annually	1	0.001	0.001	Yes
Melton South	Annually	1	0.001	0.001	Yes
Merrimu	Annually	1	0.001	0.001	Yes
Mount Macedon	Annually	1	0.001	0.001	Yes
Myrniong	Annually	1	0.001	0.001	Yes
Riddells Creek	Annually	1	0.001	0.001	Yes
Rockbank	Annually	2	0.001	0.001	Yes
Romsey	Annually	1	0.001	0.001	Yes
Sunbury	Annually	2	0.001	0.001	Yes
Toolern Vale	Annually	1	0.001	0.001	Yes
Woodend	Annually	1	0.001	0.001	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the health related guideline value set out in ADWG for arsenic in drinking water should not exceed 0.01 mg/L. The detection limit for arsenic is 0.001 mg/L.*

Chlorite

Chlorite is a by-product of chlorine dioxide disinfection. Western Water does not use chlorine dioxide as a disinfectant for drinking water. For this reason, is unlikely to be present in the drinking water supplied by Western Water as it does not occur naturally. As a result, sampling for chlorite was not undertaken in the 2016/17 reporting period.

Monochloramine

Sampling for monochloramine was conducted in all localities receiving water supply disinfected by chloramination. Routine sampling for monochloramine in some localities that are chlorinated occurred as the disinfection mode had changed, but the sampling regime had not.

Table A14: Monochloramine results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Mean. (mg/L)	Complying[2] (Yes/No)
Bulla	Weekly	35[3]	1.00	0.05	0.12	Yes
Diggers Rest	Weekly	36[3]	0.18	0.05	0.06	Yes
Romsey	Weekly	318	1.00	0.05	0.37	Yes
Riddells Creek	Weekly	9[3]	0.07	0.05	0.06	Yes
Sunbury	110 per year	122[3]	1.00	0.05	0.12	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*
[2] *Compliance as measured against the health related guideline value set out in ADWG for monochloramine in drinking water should not exceed 3 mg/L.*
[3] *Sampling for monchloriamine in these localities was reduced due to the change in disinfection method from chloramination to chlorination.*

Nickel

Table A15: Nickel (total as Ni) results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Annually	1	0.001	0.001	Yes
Darley	Annually	1	0.001	0.001	Yes
Diggers Rest	Annually	1	0.001	0.001	Yes
Eynesbury	Annually	1	0.001	0.001	Yes
Gisborne	Annually	2	0.001	0.001	Yes
Lancefield	Annually	2	0.001	0.001	Yes
Lerderderg	Annually	1	0.001	0.001	Yes
Macedon	Annually	1	0.001	0.001	Yes
Maddingley	Annually	1	0.001	0.001	Yes
Melton South	Annually	1	0.001	0.001	Yes
Merrimu	Annually	1	0.001	0.001	Yes
Mount Macedon	Annually	1	0.001	0.001	Yes
Myrniong	Annually	1	0.001	0.001	Yes
Riddells Creek	Annually	1	0.001	0.001	Yes
Rockbank	Annually	1	0.001	0.001	Yes
Romsey	Annually	1	0.001	0.001	Yes
Sunbury	Annually	1	0.001	0.001	Yes
Toolern Vale	Annually	1	0.001	0.001	Yes
Woodend	Annually	3	0.001	0.001	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*
[2] *Compliance as measured against the health related guideline value set out in ADWG for nickel in drinking water should not exceed 0.02 mg/L.*

Appendix 4 – Water quality compliance results (continued)

A4.6 Other chemicals not specified in Schedule 2 but which may pose a risk to human health (continued)

Chlorine

Table A16: Total Chlorine results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying[2] (Yes/No)
Bulla	Weekly	131[4]	1.8	0.05	0.67	Yes
Darley	Weekly	312	5.67[6]	0.05	0.64	Yes
Diggers Rest	Weekly	106	1.4	0.05	0.42	Yes
Eynesbury	Weekly	153	1.9	0.10	0.64	Yes
Gisborne	64/year	284[5]	1.6	0.05	0.98	Yes
Lancefield	Weekly	106	1.4	0.24	0.97	Yes
Lerderderg	64/year	237[3]	1.2	0.05	0.37	Yes
Macedon	Weekly	159	1.5	0.07	0.89	Yes
Maddingley	Weekly	156	1.5	0.17	0.75	Yes
Melton South	112/year	268	1.2	0.05	0.46	Yes
Merrimu	64/year	220	1.8	0.05	0.65	Yes
Mount Macedon	Weekly	212	1.7	0.23	0.85	Yes
Myrniong	Weekly	248[3]	3.9	0.05	0.70	Yes
Riddells Creek	Weekly	159	1.4	0.05	0.90	Yes
Rockbank	Weekly	208	1.4	0.09	0.82	Yes
Romsey	Weekly	324	1.2	0.07	0.66	Yes
Sunbury	112/year	439	2.0	0.06	0.79	Yes
Toolern Vale	Weekly	103	2.2	0.10	0.46	Yes
Woodend	64/year	237	1.6	0.08	0.84	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the health related guideline value set out in ADWG for chlorine in drinking water should not exceed 5 mg/L. Western Water has an internal benchmark of maximum 1.10 mg/L for total chlorine at its customer taps.*

[3] *The sampling requirements defined in Schedule 2 of the SDWR 2015 for the locality were met, however not all samples scheduled in the sampling program were collected in accordance to the Water Sampling Program. For details, refer to Section 6 Incident management and emergency response.*

[4] *Bulla locality was fed via Shepherds Lane tank during 2017/18, to meet supply demands.*

[5] *Rosslynne 3ML tank offline for much of 2017/18 as part of refurbishment project.*

[6] *External laboratory reported elevated chlorine at Dicksons Rd storage tank in May 2018, refer to Section 6 Incident Management and Emergency Response for details and corrective actions taken.*

Chromium

Table A17: Chromium (total as Cr) results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Annually	1	0.001	0.001	Yes
Darley	Annually	1	0.001	0.001	Yes
Diggers Rest	Annually	1	0.001	0.001	Yes
Eynesbury	Annually	1	0.001	0.001	Yes
Gisborne	Annually	1	0.001	0.001	Yes
Lancefield	Annually	1	0.001	0.001	Yes
Lerderderg	Annually	1	0.001	0.001	Yes
Macedon	Annually	1	0.001	0.001	Yes
Maddingley	Annually	1	0.001	0.001	Yes
Melton South	Annually	1	0.001	0.001	Yes
Merrimu	Annually	1	0.001	0.001	Yes
Mount Macedon	Annually	5	0.001	0.001	Yes
Myrniong	Annually	1	0.001	0.001	Yes
Riddells Creek	Annually	1	0.001	0.001	Yes
Rockbank	Annually	2	0.001	0.001	Yes
Romsey	Annually	1	0.001	0.001	Yes
Sunbury	Annually	2	0.001	0.001	Yes
Toolern Vale	Annually	1	0.001	0.001	Yes
Woodend	Annually	5	0.001	0.001	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality g/L.*
[2] *Compliance as measured against the health related guideline value set out in ADWG for chromium in drinking water should not exceed 0.05 mg/L.*

Appendix 4 – Water quality compliance results (continued)

A4.6 Other chemicals not specified in Schedule 2 but which may pose a risk to human health (continued)

Cyanide

Table A18: Cyanide results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Annually	1	0.005	0.005	Yes
Darley	Annually	1	0.005	0.005	Yes
Diggers Rest	Annually	1	0.005	0.005	Yes
Eynesbury	Annually	1	0.005	0.005	Yes
Gisborne	Annually	1	0.005	0.005	Yes
Lancefield	Annually	1	0.005	0.005	Yes
Lerderderg	Annually	1	0.005	0.005	Yes
Macedon	Annually	1	0.005	0.005	Yes
Maddingley	Annually	1	0.005	0.005	Yes
Melton South	Annually	1	0.005	0.005	Yes
Merrimu	Annually	1	0.005	0.005	Yes
Mount Macedon	Annually	1	0.005	0.005	Yes
Myrniong	Annually	1	0.005	0.005	Yes
Riddells Creek	Annually	1	0.005	0.005	Yes
Rockbank	Annually	2	0.005	0.005	Yes
Romsey	Annually	1	0.005	0.005	Yes
Sunbury	Annually	2	0.005	0.005	Yes
Toolern Vale	Annually	1	0.005	0.005	Yes
Woodend	Annually	1	0.005	0.005	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*
[2] *Compliance as measured against the health related guideline value set out in ADWG for cyanide in drinking water should not exceed 0.08 mg/L.*

Mercury

Table A19: Mercury results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Annually	1	0.0001	0.0001	Yes
Darley	Annually	1	0.0001	0.0001	Yes
Diggers Rest	Annually	1	0.0001	0.0001	Yes
Eynesbury	Annually	1	0.0001	0.0001	Yes
Gisborne	Annually	1	0.0001	0.0001	Yes
Lancefield	Annually	1	0.0001	0.0001	Yes
Lerderderg	Annually	1	0.0001	0.0001	Yes
Macedon	Annually	1	0.0001	0.0001	Yes
Maddingley	Annually	1	0.0001	0.0001	Yes
Melton South	Annually	1	0.0001	0.0001	Yes
Merrimu	Annually	1	0.0001	0.0001	Yes
Mount Macedon	Annually	1	0.0001	0.0001	Yes
Myrniong	Annually	1	0.0001	0.0001	Yes
Riddells Creek	Annually	1	0.0001	0.0001	Yes
Rockbank	Annually	2	0.0001	0.0001	Yes
Romsey	Annually	1	0.0001	0.0001	Yes
Sunbury	Annually	2	0.0001	0.0001	Yes
Toolern Vale	Annually	1	0.0001	0.0001	Yes
Woodend	Annually	1	0.0001	0.0001	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*
[2] *Compliance as measured against the health related guideline value set out in ADWG for mercury in drinking water should not exceed 0.001 mg/L.*

Nitrate

Table A20: Nitrate results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Monthly	25[4]	0.350	0.015	Yes
Darley	Monthly	32	0.270	0.068	Yes
Diggers Rest	Monthly	12	0.190	0.023	Yes
Eynesbury	Monthly	23	0.150	0.047	Yes
Gisborne[3]	Annually	14[5]	0.340	0.180	Yes
Lancefield	Monthly	24	0.130	0.012	Yes
Lerderderg	Monthly	21[6]	0.250	0.067	Yes
Macedon[3]	Annually	1	0.310	0.310	Yes
Maddingley	Monthly	16	0.260	0.077	Yes
Melton South	Monthly	12	0.140	0.026	Yes
Merrimu	Monthly	12	0.270	0.058	Yes
Mount Macedon[3]	Annually	5	0.330	0.240	Yes
Myrniong	Monthly	67[6]	0.410	0.210	Yes
Riddells Creek[3]	Annually	1	0.340	0.340	Yes
Rockbank	Monthly	16	0.160	0.012	Yes
Romsey	Monthly	36	0.220	0.038	Yes
Sunbury	Monthly	40	0.340	0.014	Yes
Toolern Vale	Monthly	16	0.250	0.075	Yes
Woodend	Monthly	36	0.260	0.003	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for that specific water sampling locality.*

[2] *Compliance as measured against the health related guideline value set out in ADWG for nitrate in drinking water should not exceed 50 mg/L.*

[3] *Disinfection mode changes from chloramination to chlorination meant that sampling for nitrite in these localities was reduced.*

[4] *Bulla locality was fed via Shepherds Lane tank during 2017/18, to meet supply demands.*

[5] *Rosslynne 3ML tank offline for much of 2017/18 as part of refurbishment project.*

[6] *The sampling requirements defined in Schedule 2 of the SDWR 2015 for the locality were met, however not all samples scheduled in the sampling program were collected in accordance to the Water Sampling Program. For details, refer to Section 6 Incident management and emergency response.*

Appendix 4 – Water quality compliance results (continued)

A4.6 Other chemicals not specified in Schedule 2 but which may pose a risk to human health (continued)

Nitrite

Table A21: Nitrite results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Monthly	24[4]	0.002	0.002	Yes
Darley	Monthly	32	0.002	0.002	Yes
Diggers Rest	Monthly	12	0.100	0.002	Yes
Eynesbury	Monthly	23	0.002	0.002	Yes
Gisborne[3]	Annually	14[5]	0.002	0.002	Yes
Lancefield	Monthly	24	0.002	0.002	Yes
Lerderderg	Monthly	21[6]	0.002	0.002	Yes
Macedon[3]	Annually	1	0.002	0.002	Yes
Maddingley	Monthly	16	0.002	0.002	Yes
Melton South	Monthly	12	0.002	0.002	Yes
Merrimu	Monthly	12	0.002	0.002	Yes
Mount Macedon[3]	Annually	5	0.002	0.002	Yes
Myrniong	Monthly	67[6]	0.002	0.002	Yes
Riddells Creek[3]	Annually	1	0.002	0.002	Yes
Rockbank	Monthly	16	0.002	0.002	Yes
Romsey	Monthly	36	0.210	0.002	Yes
Sunbury	Monthly	40	0.048	0.002	Yes
Toolern Vale	Monthly	16	0.002	0.002	Yes
Woodend	Monthly	36	0.002	0.002	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for that specific water sampling locality.*

[2] *Compliance as measured against the health related guideline value set out in ADWG for nitrite in drinking water should not exceed 3 mg/L.*

[3] *Disinfection mode changes from chloramination to chlorination meant that sampling for nitrite in these localities was reduced.*

[4] *Bulla locality was fed via Shepherds Lane tank during 2017/18, to meet supply demands.*

[5] *Rosslynne 3ML tank offline for much of 2017/18 as part of refurbishment project.*

[6] *The sampling requirements defined in Schedule 2 of the SDWR 2015 for the locality were met, however not all samples scheduled in the sampling program were collected in accordance to the Water Sampling Program. For details, refer to Section 6 Incident management and emergency response.*

Selenium

Table A22: Selenium results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Annually	1	0.001	0.001	Yes
Darley	Annually	1	0.001	0.001	Yes
Diggers Rest	Annually	1	0.001	0.001	Yes
Eynesbury	Annually	1	0.001	0.001	Yes
Gisborne	Annually	1	0.001	0.001	Yes
Lancefield	Annually	1	0.001	0.001	Yes
Lerderderg	Annually	1	0.001	0.001	Yes
Macedon	Annually	1	0.001	0.001	Yes
Maddingley	Annually	1	0.001	0.001	Yes
Melton South	Annually	1	0.001	0.001	Yes
Merrimu	Annually	1	0.001	0.001	Yes
Mount Macedon	Annually	1	0.001	0.001	Yes
Myrniong	Annually	1	0.001	0.001	Yes
Riddells Creek	Annually	1	0.001	0.001	Yes
Rockbank	Annually	2	0.001	0.001	Yes
Romsey	Annually	1	0.001	0.001	Yes
Sunbury	Annually	2	0.001	0.001	Yes
Toolern Vale	Annually	1	0.001	0.001	Yes
Woodend	Annually	1	0.001	0.001	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for that specific water sampling locality.*
[2] *Compliance as measured against the health related guideline value set out in ADWG for selenium in drinking water should not exceed 0.01 mg/L.*

Cadmium

Table A23: Cadmium results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Complying[2] (Yes/No)
Bulla	Annually	1	0.0002	0.0002	Yes
Darley	Annually	1	0.0002	0.0002	Yes
Diggers Rest	Annually	1	0.0002	0.0002	Yes
Eynesbury	Annually	1	0.0002	0.0002	Yes
Gisborne	Annually	2	0.0002	0.0002	Yes
Lancefield	Annually	2	0.0002	0.0002	Yes
Lerderderg	Annually	1	0.0002	0.0002	Yes
Macedon	Annually	1	0.0002	0.0002	Yes
Maddingley	Annually	1	0.0002	0.0002	Yes
Melton South	Annually	1	0.0002	0.0002	Yes
Merrimu	Annually	1	0.0002	0.0002	Yes
Mount Macedon	Annually	1	0.0002	0.0002	Yes
Myrniong	Annually	1	0.0002	0.0002	Yes
Riddells Creek	Annually	1	0.0002	0.0002	Yes
Rockbank	Annually	1	0.0002	0.0002	Yes
Romsey	Annually	1	0.0002	0.0002	Yes
Sunbury	Annually	1	0.0002	0.0002	Yes
Toolern Vale	Annually	1	0.0002	0.0002	Yes
Woodend	Annually	3	0.0002	0.0002	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for that specific water sampling locality.*
[2] *Compliance as measured against the health related guideline value set out in ADWG for cadmium in drinking water should not exceed 0.002 mg/L.*

A4.7 Drinking water aesthetics results

Western Water tests for parameters in the drinking water supply that may affect appearance or taste and odour, as well as those that may interact with pipes and fittings within the distribution system and within hot water services.

These results are measured in accordance with the aesthetic measures in the ADWG or other cited guidelines. Compliance calculations hereafter are based on mean results for samples taken throughout the year, as outlined in ADWG or other cited guidelines.

The following tables reflect the reporting period 1 July 2017 to 30 June 2018 under the SDWR.

Aluminium

Aluminium can be present in water through the natural leaching of soils and the use of aluminium salts as coagulants during the water treatment process. Acid-soluble aluminium concentrations in excess of 0.2 mg/L, caused by post-flocculation may lead to aesthetic problems such as 'milky coloured' water in the distribution system which may result in the precipitation of aluminium hydroxide depending on the pH level.

Total aluminium is measured quarterly at customer taps at all 19 localities whether or not aluminium is added as a coagulant as part of the water treatment process. Where aluminium is not used in the treatment process, any detection of aluminium will likely be due to naturally-occurring microscopic clay particles.

Table A24: Total aluminium results

Water sampling locality	Frequency of sampling	No. of samples[1]	Average (mg/L)	Max. (mg/L)	Min. (mg/L)[2]	Complying[3] (Yes/No)
Bulla	Quarterly	4	0.07	0.07	0.06	Yes
Darley	Quarterly	24	0.02	0.04	0.01	Yes
Diggers Rest	Quarterly	16	0.05	0.08	0.04	Yes
Eynesbury	Quarterly	26	0.06	0.1	0.04	Yes
Gisborne	Quarterly	60	0.05	0.08	0.03	Yes
Lancefield[4]	Quarterly	57	0.01	0.02	0.01	Yes
Lerderderg	Quarterly	25[5]	0.02	0.04	0.01	Yes
Macedon[4]	Quarterly	4	0.04	0.04	0.03	Yes
Maddingley	Quarterly	20	0.02	0.04	0.01	Yes
Melton South	Quarterly	4	0.05	0.06	0.05	Yes
Merrimu	Quarterly	38	0.03	0.08	0.01	Yes
Mount Macedon[4]	Quarterly	4	0.04	0.05	0.02	Yes
Myrniong[4]	Quarterly	70[5]	0.02	0.03	0.01	Yes
Riddells Creek[4]	Quarterly	4	0.03	0.04	0.03	Yes
Rockbank	Quarterly	71	0.05	0.08	0.01	Yes
Romsey	Quarterly	134	0.01	0.01	0.01	Yes
Sunbury	Quarterly	69	0.05	0.10	0.01	Yes
Toolern Vale	Quarterly	8	0.02	0.03	0.01	Yes
Woodend[4]	Quarterly	128	0.03	0.26[1]	0.01	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *A result of <0.01 mg/L is a result less than the detection limit for total aluminium.*

[3] *Compliance as measured against the guideline values set out in ADWG for acid soluble aluminium in drinking water based on aesthetic considerations should not exceed 0.2mg/L. There is no ADWG limit for total aluminium.*

[4] *Alum is added to these supplies.*

[5] *The sampling requirements defined in Schedule 2 of the SDWR 2015 for the locality were met, however not all samples scheduled in the sampling program were collected in accordance to the Water Sampling Program. For details, refer to Section 6 Incident management and emergency response.*

pH

Table A25: pH results

Water sampling locality	Sampling frequency	No. of samples[1]	Max	Min.	Mean	Complying[2] (Yes/No)
Bulla	Weekly	95[3]	9.5	7.1	7.7	Yes
Darley	Weekly	312	8.6	7.4	7.9	Yes
Diggers Rest	Weekly	106	7.8	7.2	7.4	Yes
Eynesbury	Weekly	153	7.7	7.4	7.5	Yes
Gisborne	Weekly	260[4]	8.5	6.9	7.3	Yes
Lancefield	Weekly	106	8.1	7.5	7.8	Yes
Lerderderg	Weekly	223[5]	8.0	7.3	7.7	Yes
Macedon	Weekly	137	9.0	7.0	7.6	Yes
Maddingley	Weekly	156	8.0	7.5	7.7	Yes
Melton South	Weekly	208	8.3	7.1	7.4	Yes
Merrimu	Weekly	180	8.4	7.1	7.6	Yes
Mount Macedon	Weekly	190	8.4	7.3	7.8	Yes
Myrniong	Weekly	242[5]	8.9	6.9	7.5	Yes
Riddells Creek	Weekly	149	8.5	7.0	7.6	Yes
Rockbank	Weekly	191	8.7	6.8	7.4	Yes
Romsey	Weekly	318	8.0	7.2	7.5	Yes
Sunbury	Weekly	299	9.4	7.1	7.5	Yes
Toolern Vale	Weekly	103	8.1	7.2	7.5	Yes
Woodend	Weekly	220	9.0	7.0	7.6	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the aesthetic guideline range set out in ADWG for pH in drinking water of 6.5–8.5, based on the mean result in each locality for the reporting period.*

[3] *Bulla locality was fed via Shepherds Lane tank during 2017/18, to meet supply demands.*

[4] *Rosslynne 3ML tank offline for much of 2017/18 as part of refurbishment project.*

[5] *The sampling requirements defined in Schedule 2 of the SDWR 2015 for the locality were met, however not all samples scheduled in the sampling program were collected in accordance to the Water Sampling Program. For details, refer to Section 6 Incident management and emergency response.*

Appendix 4 – Water quality compliance results (continued)

A4.7 Drinking water aesthetics results (continued)

Iron

Table A26: Iron (total) results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying[2] (Yes/No)
Bulla	Quarterly	16[3]	0.1	0.03	0.06	Yes
Darley	Quarterly	24	0.03	0.01	0.02	Yes
Diggers Rest	Quarterly	16	0.08	0.04	0.06	Yes
Eynesbury	Quarterly	27	0.24	0.04	0.10	Yes
Gisborne	Quarterly	126[4]	0.09	0.01	0.02	Yes
Lancefield	Quarterly	16	0.01	0.01	0.01	Yes
Lerderderg	Quarterly	25[5]	0.04	0.01	0.01	Yes
Macedon	Quarterly	4	0.07	0.01	0.04	Yes
Maddingley	Quarterly	20	0.01	0.01	0.01	Yes
Melton South	Quarterly	4	0.07	0.03	0.05	Yes
Merrimu	Quarterly	40	0.06	0.01	0.02	Yes
Mount Macedon	Quarterly	4	0.04	0.03	0.03	Yes
Myrniong	Quarterly	71[5]	0.09	0.01	0.02	Yes
Riddells Creek	Quarterly	4	0.1	0.02	0.04	Yes
Rockbank	Quarterly	60	0.09	0.02	0.05	Yes
Romsey	Quarterly	52	0.02	0.01	0.01	Yes
Sunbury	Quarterly	100	0.12	0.01	0.05	Yes
Toolern Vale	Quarterly	8	0.04	0.01	0.01	Yes
Woodend	Quarterly	85	0.23	0.01	0.01	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the aesthetic related guideline value set out in ADWG for the mean concentration of iron in drinking water not exceeding 0.3 mg/L.*

[3] *Bulla locality was fed via Shepherds Lane tank during 2017/18, to meet supply demands.*

[4] *Rosslynne 3ML tank offline for much of 2017/18 as part of refurbishment project.*

[5] *The sampling requirements defined in Schedule 2 of the SDWR 2015 for the locality were met, however not all samples scheduled in the sampling program were collected in accordance to the Water Sampling Program. For details, refer to Section 6 Incident management and emergency response.*

Total hardness

Table A27: Total hardness (as calcium carbonate) results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Ave. (mg/L)	Complying[2] (Yes/No)
Bulla	Quarterly	12[3]	20	15	18	Yes
Darley	Quarterly	24	95	60	78	Yes
Diggers Rest	Quarterly	12	17	13	15	Yes
Eynesbury	Quarterly	15	18	9	14	Yes
Gisborne	Quarterly	16[4]	120	19	97	Yes
Lancefield	Quarterly	16	97	45	62	Yes
Lerderderg	Quarterly	13[5]	89	62	77	Yes
Macedon	Quarterly	4	120	98	112	Yes
Maddingley	Quarterly	8	90	68	80	Yes
Melton South	Quarterly	4	24	17	20	Yes
Merrimu	Quarterly	4	61	14	28	Yes
Mount Macedon	Quarterly	4	120	99	110	Yes
Myrniong	Quarterly	15	140	85	110	Yes
Riddells Creek	Quarterly	9	120	96	107	Yes
Rockbank	Quarterly	8	20	10	15	Yes
Romsey	Quarterly	28	81	48	67	Yes
Sunbury	Quarterly	12	20	12	16	Yes
Toolern Vale	Quarterly	8	96	61	80	Yes
Woodend	Quarterly	28	100	14	34	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the aesthetic guideline value set out in ADWG for hardness as calcium carbonate in drinking water of 200 mg/L based on the mean result for the reporting period 2016/17. Note, the unit milligrams per litre (mg/L) is equivalent to parts per million (ppm). For conversion from mg/L to °dH (German Hardness), multiply mg/L by 0.056. Conversely, multiply °dH by 17.9 for conversion to mg/L or ppm.*

[3] *Bulla locality was fed via Shepherds Lane tank during 2017/18, to meet supply demands.*

[4] *Rosslynne 3ML tank offline for much of 2017/18 as part of refurbishment project.*

[5] *The sampling requirements defined in Schedule 2 of the SDWR 2015 for the locality were met, however not all samples scheduled in the sampling program were collected in accordance to the Water Sampling Program. For details, refer to Section 6 Incident management and emergency response.*

Appendix 4 – Water quality compliance results (continued)

A4.7 Drinking water aesthetics results (continued)

Calcium

Table A28: Total calcium (as Ca) results

Water sampling locality	Sampling frequency[1]	No. of samples[2]	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)[3]
Bulla	Quarterly	12[4]	7	5	5
Darley	Quarterly	24	14	6	9
Diggers Rest	Quarterly	12	5	3	4
Eynesbury	Quarterly	15	5	2	4
Gisborne	Quarterly	16[5]	27	5	22
Lancefield	Quarterly	16	13	7	9
Lerderderg	Quarterly	13[6]	11	7	9
Macedon	Quarterly	4	31	24	28
Maddingley	Quarterly	8	11	7	9
Melton South	Quarterly	4	7	4	5
Merrimu	Quarterly	4	7	4	5
Mount Macedon	Quarterly	4	30	24	27
Myrniong	Quarterly	15	27	11	20
Riddells Creek	Quarterly	9	27	22	25
Rockbank	Quarterly	8	7	3	4
Romsey	Quarterly	28	14	8	12
Sunbury	Quarterly	12	6	3	5
Toolern Vale	Quarterly	8	14	6	10
Woodend	Quarterly	28	22	2	5

[1] *Scheduled for monthly sampling during review of monitoring program in January 2013, subsequent review conducted in February 2014 reduced sampling frequency to quarterly.*

[2] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[3] *There is currently no recommended guideline value set out for the concentration of calcium in drinking water.*

[4] *Bulla locality was fed via Shepherds Lane tank during 2017/18, to meet supply demands.*

[5] *Rosslynne 3ML tank offline for much of 2017/18 as part of refurbishment project.*

[6] *The sampling requirements defined in Schedule 2 of the SDWR 2015 for the locality were met, however not all samples scheduled in the sampling program were collected in accordance to the Water Sampling Program. For details, refer to Section 6 Incident management and emergency response.*

Magnesium

Table A29: Total magnesium (as Mg) results

Water sampling locality	Sampling frequency[1]	No. of samples[2]	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)[3]
Bulla	Quarterly	12[4]	1.3	0.5	1.0
Darley	Quarterly	24	16.0	10.0	13.3
Diggers Rest	Quarterly	12	1.5	1.1	1.3
Eynesbury	Quarterly	15	1.4	0.8	1.1
Gisborne	Quarterly	16[5]	12.0	1.4	10.1
Lancefield	Quarterly	16	15.0	6.7	9.4
Lerderderg	Quarterly	13[6]	16.0	11.0	13.5
Macedon	Quarterly	4	12.0	8.1	10.1
Maddingley	Quarterly	8	16.0	11.0	13.8
Melton South	Quarterly	4	2.8	0.9	1.7
Merrimu	Quarterly	4	11.0	1.1	3.7
Mount Macedon	Quarterly	4	12.0	9.3	10.4
Myrniong	Quarterly	15	17.0	13.0	14.7
Riddells Creek	Quarterly	9	13.0	9.4	10.9
Rockbank	Quarterly	8	1.6	0.8	1.2
Romsey	Quarterly	28	11.0	6.9	9.1
Sunbury	Quarterly	12	1.5	1.0	1.3
Toolern Vale	Quarterly	8	16.0	11.0	13.6
Woodend	Quarterly	28	11.0	1.8	5.1

[1] *Scheduled for monthly sampling during review of monitoring program in January 2013. Subsequent review conducted in February 2014 reduced sampling frequency to quarterly.*

[2] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[3] *There is currently no recommended guideline value set out for the concentration of magnesium in drinking water.*

[4] *Bulla locality was fed via Shepherds Lane tank during 2017/18, to meet supply demands.*

[5] *Rosslynne 3ML tank offline for much of 2017/18 as part of refurbishment project.*

[6] *The sampling requirements defined in Schedule 2 of the SDWR 2015 for the locality were met, however not all samples scheduled in the sampling program were collected in accordance to the Water Sampling Program. For details, refer to Section 6 Incident management and emergency response.*

Appendix 4 – Water quality compliance results (continued)

A4.7 Drinking water aesthetics results (continued)

Ammonia

Table A30: Ammonia results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying[2] (Yes/No)
Bulla	Monthly	24[4]	0.250	0.002	0.013	Yes
Darley	Monthly	32	0.005	0.002	0.002	Yes
Diggers Rest	Monthly	12	0.075	0.002	0.008	Yes
Eynesbury	Monthly	23	0.002	0.002	0.002	Yes
Gisborne	Annually[3]	14[5]	0.003	0.002	0.002	Yes
Lancefield	Monthly	24	0.004	0.002	0.002	Yes
Lerderderg	Monthly	21[6]	0.005	0.002	0.002	Yes
Macedon	Annually[3]	1	0.002	0.002	0.002	Yes
Maddingley	Monthly	16	0.003	0.002	0.002	Yes
Melton South	Monthly	12	0.005	0.002	0.002	Yes
Merrimu	Monthly	12	0.005	0.002	0.002	Yes
Mount Macedon	Annually[3]	5	0.002	0.002	0.002	Yes
Myrniong	Monthly	67[6]	0.013	0.002	0.003	Yes
Riddells Creek	Annually[3]	1	0.002	0.002	0.002	Yes
Rockbank	Monthly	16	0.300	0.002	0.021	Yes
Romsey	Monthly	36	0.310	0.002	0.193	Yes
Sunbury	Monthly	40	0.250	0.002	0.012	Yes
Toolern Vale	Monthly	16	0.009	0.002	0.003	Yes
Woodend	Monthly	36	0.003	0.002	0.002	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the aesthetic guideline value set out in ADWG for the mean concentration of ammonia in drinking water should not exceed 0.5 mg/L. There is no health-based guideline for ammonia. The aesthetic consideration is to limit the corrosion of pipe and fittings and to reduce any nuisance growth of micro-organisms.*

[3] *Sampling for ammonia in these localities was reduced due to the change in disinfection method from chloramination to chlorination.*

[4] *Bulla locality was fed via Shepherds Lane tank during 2017/18, to meet supply demands.*

[5] *Rosslynne 3ML tank offline for much of 2017/18 as part of refurbishment project.*

[6] *The sampling requirements defined in Schedule 2 of the SDWR 2015 for the locality were met, however not all samples scheduled in the sampling program were collected in accordance to the Water Sampling Program. For details, refer to Section 6 Incident management and emergency response.*

True Colour

Table A31: True colour results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (TCU)	Min. (TCU)	Mean (TCU)	Complying[2] (Yes/No)
Bulla	Weekly	58[3]	8	2	3	Yes
Darley	Weekly	312	6	2	2	Yes
Diggers Rest	Weekly	106	6	2	3	Yes
Eynesbury	Weekly	153	8	2	3	Yes
Gisborne	Weekly	108[4]	4	2	2	Yes
Lancefield	Weekly	106	2	2	2	Yes
Lerderderg	Weekly	223[5]	4	2	2	Yes
Macedon	Weekly	53	4	2	2	Yes
Maddingley	Weekly	156	4	2	2	Yes
Melton South	Weekly	52	6	2	3	Yes
Merrimu	Weekly	126	6	2	2	Yes
Mount Macedon	Weekly	53	4	2	2	Yes
Myrniong	Weekly	146[5]	4	2	2	Yes
Riddells Creek	Weekly	53	4	2	2	Yes
Rockbank	Weekly	52	6	2	3	Yes
Romsey	Weekly	265	6	2	3	Yes
Sunbury	Weekly	115	6	2	3	Yes
Toolern Vale	Weekly	103	6	2	2	Yes
Woodend	Weekly	219[6]	8	2	2	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the aesthetic guideline value set out in ADWG for true colour in drinking water should not exceed 15 HU (True Colour Units – TCU).*

[3] *Bulla locality was fed via Shepherds Lane tank during 2017/18, to meet supply demands.*

[4] *Rosslynne 3ML tank offline for much of 2017/18 as part of refurbishment project.*

[5] *The sampling requirements defined in Schedule 2 of the SDWR 2015 for the locality were met, however not all samples scheduled in the sampling program were collected in accordance to the Water Sampling Program. For details, refer to Section 6 Incident management and emergency response.*

[6] *Supply via Rosslynne network to Woodend as part of incident management, refer to Section 6 Emergency and Incident reporting.*

Appendix 4 – Water quality compliance results (continued)

A4.7 Drinking water aesthetics results (continued)

Sodium

Table A32: Sodium (as Na) results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Mean (mg/L)	Complying[2] (Yes/No)
Bulla	Annually	1	5	5	5	Yes
Darley	Annually	1	37	37	37	Yes
Diggers Rest	Annually	1	5	5	5	Yes
Eynesbury	Annually	1	7	7	7	Yes
Gisborne	Annually	3	37	35	36	Yes
Lancefield	Annually	3	43	40	42	Yes
Lerderderg	Annually	1	41	41	41	Yes
Macedon	Annually	1	37	37	37	Yes
Maddingley	Annually	1	41	41	41	Yes
Melton South	Annually	1	6	6	6	Yes
Merrimu	Annually	1	6	6	6	Yes
Mount Macedon	Annually	1	38	38	38	Yes
Myrniong	Annually	2	50	45	48	Yes
Riddells Creek	Annually	1	36	36	36	Yes
Rockbank	Annually	1	6	6	6	Yes
Romsey	Annually	1	29	29	29	Yes
Sunbury	Annually	1	7	7	7	Yes
Toolern Vale	Annually	1	36	36	36	Yes
Woodend	Annually	5	45	23	36	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for the specific water sampling locality.*

[2] *Compliance as measured against the aesthetic (taste) guideline value set out in ADWG for the mean concentration of sodium in drinking water should not exceed 180 mg/L. No health-related guideline has been set for sodium. (Note: No health-based guideline value is proposed for sodium. Medical practitioners treating people with severe hypertension or congestive heart failure should be aware if the sodium concentration in the patient's drinking water exceeds 20.mg/LL)*

Zinc

Table A33: Zinc (total as Zn) results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Ave. (mg/L)	Complying[2] (Yes/No)
Bulla	Quarterly	4	0.003	0.001	0.002	Yes
Darley	Quarterly	4	0.003	0.002	0.003	Yes
Diggers Rest	Quarterly	4	0.002	0.001	0.002	Yes
Eynesbury	Quarterly	4	0.007	0.003	0.005	Yes
Gisborne	Quarterly	5	0.004	0.001	0.002	Yes
Lancefield	Quarterly	5	0.007	0.004	0.005	Yes
Lerderderg	Quarterly	4	0.002	0.002	0.002	Yes
Macedon	Quarterly	4	0.006	0.002	0.003	Yes
Maddingley	Quarterly	4	0.004	0.002	0.003	Yes
Melton South	Quarterly	4	0.005	0.001	0.003	Yes
Merrimu	Quarterly	4	0.003	0.002	0.002	Yes
Mount Macedon	Quarterly	4	0.006	0.002	0.004	Yes
Myrniong	Quarterly	4	0.003	0.001	0.002	Yes
Riddells Creek	Quarterly	4	0.003	0.002	0.003	Yes
Rockbank	Quarterly	4	0.002	0.001	0.002	Yes
Romsey	Quarterly	4	0.006	0.001	0.004	Yes
Sunbury	Quarterly	4	0.003	0.001	0.002	Yes
Toolern Vale	Quarterly	4	0.005	0.002	0.003	Yes
Woodend	Quarterly	6	0.006	0.002	0.003	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for that specific water sampling locality.*

[2] *Compliance as measured against the aesthetic (taste) guideline value set out in ADWG for the mean concentration of zinc in drinking water should not exceed 3 mg/L. No health-related guideline limits were set for zinc.*

Appendix 4 – Water quality compliance results (continued)

A4.7 Drinking water aesthetics results (continued)

Sulfate

Table A34: Sulfate (as SO4) results

Water sampling locality	Sampling frequency	No. of samples[1]	Max. (mg/L)	Min. (mg/L)	Ave. (mg/L)	Complying[2] (Yes/No)
Bulla	Annually	1	1	1	1	Yes
Darley	Annually	1	20	20	20	Yes
Diggers Rest	Annually	1	1	1	1	Yes
Eynesbury	Annually	1	1	1	1	Yes
Gisborne	Annually	3	64	53	57	Yes
Lancefield	Annually	3	11	4	6	Yes
Lerderderg	Annually	1	20	20	20	Yes
Macedon	Annually	1	56	56	56	Yes
Maddingley	Annually	1	19	19	19	Yes
Melton South	Annually	1	1	1	1	Yes
Merrimu	Annually	1	1	1	1	Yes
Mount Macedon	Annually	1	56	56	56	Yes
Myrniong	Annually	1	42	42	42	Yes
Riddells Creek	Annually	1	53	53	53	Yes
Rockbank	Annually	1	1	1	1	Yes
Romsey	Annually	1	6	6	6	Yes
Sunbury	Annually	1	3	3	3	Yes
Toolern Vale	Annually	1	20	20	20	Yes
Woodend	Annually	5	41	13	28	Yes

[1] *No. of samples includes routine program sampling at network taps, tank and pump station taps for that specific water sampling locality.*

[2] *Compliance as measured against the aesthetic (taste) guideline value set out in ADWG for the mean concentration of sulfate in drinking water should not exceed 250 mg/L.*

Appendix 5 – Source water monitoring

Western Water uses the principles of the 12 elements of the ADWG framework for the management of its drinking water quality. This framework is incorporated within Western Water's Drinking Water Risk Management Plan (DWRMP), and is part of the business' strategic approach to providing quality drinking water to customers and protecting public health.

One of the key components of Western Water's DWRMP is the extensive source water monitoring program aimed at increasing the understanding of source water quality in the reservoirs, bores and basins. It involves the monitoring and identification of hazards, sources and events which could compromise drinking water quality in a catchment-to-consumer multiple barrier approach.

The source water monitoring program for 2017/18 allows for the assessment of source water quality at water storages for key chemicals with health-related guidelines, physical features such as turbidity and colour, impacts of rainfall events, organic matter and common waterborne disease pathogens.

This continual monitoring of sources water quality enables Western Water to conduct historical trending analysis, review individual system risk assessment plans, identify new hazards and review risk at each source water. This information better positions Western Water to appropriately select the type of disinfectant to use for each water system and provide the most effective water treatment.

Through an independent NATA-accredited laboratory, a comprehensive source water monitoring program at reservoirs, bores and final source water entry points to water filtration plants was undertaken during 2017/18.

An overview of the parameters tested and the frequency of testing at each sampling location for pesticides, chemicals (organics and in-organics), metals, physical and radiological parameters and their results is contained in this appendix. Table A35 on the following page is a list of all parameters monitored during 2017/18.

In addition to the source water monitoring conducted by a contracted, independent NATA-accredited laboratory, source water samples at various sampling locations were taken routinely for physical microbiological analysis by qualified microbiologists. This involves the determination of any flagellates, diatoms, algae and cyanobacteria (blue green algae) present in the source water sources.

General observations provided by microbiologists in relation to any water discolouration, the levels of detritus and the presence of any odour in the source water provided valuable information in assessing the quality of the source water. This information allows Western Water to monitor changes in conditions of source water sources and their potential impacts on drinking water quality.

For Merrimu, Rosslynne and Pykes Creek Reservoirs, BGA monitoring was conducted by water storage manager, Southern Rural Water. Western Water received regular results on BGA numbers in the three reservoirs during the reporting period, which allowed for Western Water to assess the adverse impacts on its ability to treat and provide safe drinking water to customers.

Water sourced from Melbourne Water prior to the off-take entry point to Western Water's region was monitored by Melbourne Water during 2017/18. Western Water receives monthly water quality reports from Melbourne Water for Greenvale and Silvan reservoirs, which include information on algal populations. Melbourne Water is required to notify Western Water of any major changes in treated water quality that could potentially impact the ability to supply safe drinking water to customers and to meeting the ADWG.

Appendix 5 – Source water monitoring (continued)

Table A35: List of all source water parameters monitored during 2017/18

Parameter	Type
1,1-Dichloroethane	Chemical organics
1,2-Dichloroethane	Chemical organics
2,4 D	Pesticides
4,4' – DDT	Pesticides
Aldrin	Pesticides
Alkalinity, total as CaCO3	Physical
Aluminium, filtered	Metals
Aluminium, total	Metals
Ammonia	Chemical inorganics
Amoebae (Naegleria SPP)	
Arsenic	Chemical inorganics
Atrazine	Pesticides
Benzene	Chemical organics
Benzo(a)pyrene	Chemical organics
Calcium	Chemical inorganics
Carbon Tetrachloride	Chemical organics
Chlordane, total	Pesticides
Chloride	Chemical inorganics
Chromium	Metals
Coliforms, total	Microbiological
Colour, true	Physical
Copper	Metals
Cryptosporidium spp.	Microbiological
Cyanide	Chemical inorganics
Dieldrin	Pesticides
Dissolved organic carbon	Chemical organics
Dissolved oxygen	Physical
Electrical conductivity @ 25ºC	Physical
Parameter	Type
E.coli	Microbiological
Faecal streptococci	Microbiological
Fluoride[1]	Chemical inorganics
FRNA Coliphage	Microbiological
Giardia spp.	Microbiological
Gross alpha activity	Radiological

Parameter	Type
Gross beta activity	Radiological
Hardness, as CaCO3	Physical
Hardness, as MgCO3	Physical
HCHC (gamma) (Lindane)	Pesticides
Helminth (Ascaris ova)	Microbiological
Helminth (Taenia ova)	Microbiological
Heptachlor	Chemical organics
Heptachlor epoxide	Chemical organics
Hexachlorobenzene	Chemical organics
Iron, filtered	Metals
Iron, total as Fe	Metals
Magnesium, as Mg	Metals
Manganese, filtered	Metals
Manganese, total as Mn	Metals
Mercury, as Hg	Metals
Methoxychor	Chemical organics
Nitrate	Chemical inorganics
Nitrite	Chemical inorganics
Pentachlorophenol	Chemical organics
pH	Physical
Phosphorus, reactive as P	Chemical inorganics
Potassium	Metals
Parameter	Type
Selenium	Chemical inorganics
Silica, total as SiO2	Chemical inorganics
Silicon	Chemical inorganics
Sodium	Chemical organics
Sulphate	Chemical organics
Tetrachloride	Chemical organics
Tetrachloroethene	Chemical organics
Total dissolved solids	Physical
Trichloroethene	Chemical organics
Turbidity	Physical
UVT 254	Physical

[1] *Fluoride is measured where potable transfers into an untreated reservoir are performed or if the natural level of fluoride present in the untreated water source that is significant enough to require monitoring.*

Glossary

Algae	Simple types of plant with no root, stems of leaves. They occur mostly in freshwater and marine environments.
Algal bloom	A rapid growth of algae in aquatic environments often triggered by an input of high levels of nutrients and an increase in temperature. Blue-green algae (or cyanobacteria) are of most concern.
Alum	An aluminium sulphate based chemical used as a coagulant in the water treatment process.
Aluminium (Al)	A naturally occurring element in soils which can enter water from catchments.
Ammonia (NH3)	A highly soluble compound resulting from the decomposition of organic matter containing nitrogen. Usually only found in small concentrations in surface waters.
Aquifer	A layer or section of earth or rock that contains freshwater (known as groundwater), any water that is stored naturally underground or that flows through rock or soil, supplying springs and wells.
ADWG	National Health and Medical Research Council's Australian Drinking Water Guidelines 2004
AWA	Australian Water Association
Blue-green algae (cyanobacteria) (BGA)	Single celled, filamentous or colony-forming organisms which are widely distributed in the freshwater and marine environments. Under favourable conditions of light, temperature and nutrient supply, extensive growth of blue green algae may occur, leading to blooms. These can result in environmental problems and can create challenges for water treatment.
Bulk entitlement (BE)	An agreement that outlines the conditions for supply of bulk drinking water from reservoirs managed by Southern Rural Water and drinking water supplied by the Melbourne Water Corporation to Western Water.
Calcium (Ca)	A naturally occurring element which can enter water from catchments. It may also be added to water in the treatment process to reduce the acidity levels or increase the capacity of water to buffer pH changes.
Catchment	An area of land surrounding a water storage. The runoff water from rain falling over the catchment drains into the storage and may collect nutrients, minerals and other contaminants including microorganisms from the surface of the land.
Chlorination	The disinfection of water, wastewater and industrial waste through the application of chlorine (Cl) as part of the water treatment process. Chlorination kills microorganisms and oxidises undesirable compounds.
Chloramination	The application of the chlorine followed by ammonia to create monochloramine (NH2Cl), a stable disinfectant that is added to drinking water to kill bacteria or to oxidise undesirable compounds. Chloramines persist for a longer time than chlorine and as a result are used in longer water distribution systems.
Coliforms	Coliform bacteria are used as one of the indicators of the quality of drinking water and the possible presence of disease-causing microorganisms. These bacteria are killed by chlorine.
Cryptosporidium	A parasitic protozoan (microorganism) which causes gastroenteritis in humans. These organisms occur in the gut of infected warm-blooded animals and can be introduced into source water through faecal contamination.
DHHS	Department of Health and Human Services
Disinfection	Inactivation (killing) of pathogens or organisms capable of causing infectious disease by chemical or physical processes, including chlorination.
Drinking Water Quality Management System (DWQMS)	Western Water's DWQMS is used to ensure our drinking water supplies are managed effectively to provide high quality drinking water and to ensure the protection of public health.
EPA	Environment Protection Authority
ESC	Essential Services Commission
Escherichia coli (*E.coli*)	The most common heat tolerant coliform present in faeces, which is regarded as the most specific indicator of recent faecal contamination. *E.coli* can be killed by standard disinfection practices.
Filtration	A process for removing particles from water by passing through a porous barrier, such as a screen, membrane, sand or gravel. Often used in conjunction with a coagulant to settle contaminants.
Fluoride (F)	Fluoride is regarded as a useful constituent of drinking water, particularly for the prevention of tooth decay. Fluoride is added to the water supply at Merrimu WFP, Rosslynne WFP and all water supplied from the Melbourne system.
Groundwater	Water beneath the earth's surface (often between saturated soil and rock) that supplies bores, wells and springs.
HACCP	Hazard Analysis and Critical Control Point. A system that identifies, evaluates and controls hazards that are significant for food safety (Codex 1997).
Incident	Any event or circumstance that causes or is likely to cause: a) threat to community health or safety; or b) creation of the need for urgent action under statute or legislation.
Inflows	Water flowing from the catchment to the reservoirs through streams, rivers and creeks.
Iron (Fe)	An element which when found in water leads to brownish discolouration. Limits on the amount of iron in water are usually due to taste and appearance factors rather than any detrimental health effects.
IWA	Institute of Water Administration

Glossary (continued)

kL	kilolitres (thousand litres)
Manganese (Mn)	Manganese in a water supply may affect taste, cause staining of clothes, produce deposits in pipes and contribute to turbidity.
mg/L	milligrams per litre
ML	megalitres (million litres)
µg/L	micrograms per litre
National Association of Testing Authorities (NATA)	NATA is Australia's national laboratory accreditation authority. NATA accreditation recognises and promotes facilities competent in specific types of testing, measurement, inspection and calibration.
National Health and Medical Research Council (NHMRC)	NHMRC is Australia's peak body for supporting health and medical research for developing health advice for the Australian community, health professionals and governments.
Nitrogen (N)	Nitrogen is an essential nutrient for plant growth. It is used in fertilisers and is present in sewage effluent. High levels of nutrients can lead to excessive algal growth.
Nitrate (N03-)	The most stable form of combined nitrogen in water. Present in surface waters in small amounts, the major sources are from human and animal wastes.
Nephelometric turbidity unit (NTU)	A measure of the turbidity in water.
Nutrients	Compounds required for growth by plants and other organisms. Major nutrients for plant growth are phosphorous and nitrogen.
Pathogens	Disease causing organisms such as bacteria and viruses.
pH	The pH value indicates if a substance is acidic, neutral or alkaline. It is calculated from the number of hydrogen ions present and is measured on a scale of 0 to 14. A pH greater than 7 is alkaline, less than 7 is acidic and 7 is neutral.
Phosphorous (P)	Phosphorous is an essential nutrient for plant growth. High levels of phosphorous can lead to excessive algal growth and can be due to inputs from human activity such as fertiliser run-off and land clearing.
Potable water (drinking water)	Water that is intended for human consumption or for purposes connected with human consumption (e.g. food preparation, making of ice, preservation of unpackaged food).
QMS	Quality Management System
Reservoir	A natural or artificial body of water used as storage for water supply.
Risk assessment	A scientifically based process consisting of the following steps: i) hazard identification; ii) hazard characterisation; iii) exposure assessment; and, iv) risk characterisation.
Risk management	The process of weighing policy alternatives in the light of the results of risk assessment and, if required, selecting and implementing an appropriate control option, including regulatory measures.
Risk management plan	As set out in Section 9 of the *Safe Drinking Water Act 2003*.
SCADA	Supervisory Control and Data Acquisition system
Source water	Water that has not been treated in any way.
SRW	Southern Rural Water, bulk water supplier responsible for Merrimu, Rosslynne and Pyke Creek Reservoirs
Total dissolved solids	A measure of organic salts and small amounts of organic matter that are dissolved in water.
Total hardness	Total hardness is the sum of the concentrations of calcium and magnesium ions expressed as calcium carbonate equivalent. Waters with a total hardness in excess of 200mg/L are considered hard.
Treatment (water)	The filtration and disinfection processes employed to produce drinking water.
Trihalomethanes	Compounds that may occur in a chlorinated water supply as a by-product of organic materials present in the water reacting with chlorine.
True colour	True colour refers to the colour of water after particles of organic matter have been removed through filtration and is the measurement of the extent to which light is absorbed by the water. Measured in Hazen Units (HU).
Turbidity	Refers to the presence of suspended solids in water causing a muddy or discoloured appearance. Turbidity is measured in Nephelometric Turbidity Units (NTUs).
Water Filtration Plant	Drinking water treatment plant.
Water quality standard	A quality standard specified for drinking water by regulations made for the purposes of Section 17 of the *Safe Drinking Water Act 2003*.
Water supply system	The complete system that provides a water supply to customers. It includes all infrastructure from the water source to the customer including the catchment, water storage, treatment and delivery systems and networks.
WIOA	Water Industry Operators Association
WSAA	Water Services Association of Australia

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