ANNUAL DRINKING WATER QUALITY REPORT 2021-2022

LOWER MURRAY WATER

VICTORIA State Government

ACKNOWLEDGEMENT OF COUNTRY

Lower Murray Water acknowledges the Traditional Owners of the land on which we work and reside. We recognise their continuing connection to land, waterways, and community. We pay our respects to Elders past, present and future.

The Traditional Owner groups within Lower Murray Water's service region lie within the traditional lands of First Nations Peoples, from upstream at Koondrook moving downstream along the Murray River (Mil) through to the western edge of our region at the South Australian border. They are the Barapa Barapa Peoples, Wamba Wemba Peoples, Wadi Wadi Peoples, Tatti Tatti Peoples, Latji Latji Peoples, Nyeri Nyeri Peoples, Ngintait Peoples and the Wergaia Peoples.

The First Nation Peoples' connection to land and water is the living cultural knowledge that is passed down from generation to generation. The stories that connected the ancestors to their culture still live through the First Nations Peoples of today.

- Acknowledgement of Country written by Stephanie Sloane.

Stephanie works at Lower Murray Water as a People and Safety Trainee. She is a proud Ngiyampaa woman and has a strong connection to her culture, history, and the land. Stephanie has brought not only her experience and passion for people to this role but also a commitment to inspire and mentor others wishing to pursue a career at LMW.

This artwork has been provided by local artist Bella Sloane from the Ngiyampaa tribe.
Her painting represents family and is titled 'The Connection to Family'.

CONTENTS

GLOSSARY

The Act	Safe Water Drinking Act 2003 (Vic)
The Regulations	Victorian Safe Drinking Water Regulations 2015
ADWG	Australian Drinking Water Guidelines 6, 2011. Published by the National Health and Medical Research Council of Australia, version 3.6, Updated March 2021.
DH	Victorian Department of Health
EPA	Environment Protection Authority
ESC	Essential Services Commission
RMP	Risk Management Plan
DWQMP	Drinking Water Quality Management Plan
DWQMT	Drinking Water Quality Management Team
HACCP	Hazard Analysis and Critical Control Points
NATA	National Association of Testing Authorities
BGA	Blue Green Algae are Cyanobacteria that can range in colour from yellow to purple. Some types can be highly toxic to humans, livestock, and birds.
Coliforms Bacteria	Widely distributed throughout the environment, which provide a sensitive measure of microbiological quality
E. coli	Escherichia coli, a type of pathogenic bacteria that normally lives in human intestines, which indicate the presence of faecal contamination and therefore, is a health risk
THMs	Trihalomethanes
NTU	Nephelometric turbidity units
orgs/100mL	Organisms per 100 millilitres
CFU/mL	Colony Forming Units per milliliters
mg/L	Milligrams per litre
Water Sampling Locality	An area that has common water quality characteristics because the supply is provided through specific pipes, tanks, or pumps. It is more likely to follow geographic features than suburb boundaries
Water Hardness	Refers to the concentration of calcium and magnesium salts in water, which can attach to surfaces and cause a hard, flaky scale. These salts can also make it difficult to achieve lather when using soap.
UV Disinfection	Ultraviolet disinfection

FROM OUR MANAGING DIRECTOR

I am pleased to present Lower Murray Urban and Rural Water Authority's (LMW) 2021-2022 Annual Drinking Water Quality Report (ADWQ). It provides comprehensive information on the quality of drinking water we have provided to our customers and community throughout LMW's service area, which extends from Kerang to the South Australian border, in the municipalities of Gannawarra, Swan Hill and Mildura. The report highlights all the test results from our water quality monitoring program and outlines the processes we have in place to continue delivering safe, clean drinking water to all.

This report is provided to the Secretary to the Department of Health (DH) in accordance with section 26 of the Safe Drinking Water Act 2003 (the Act), and Regulations 16 and 17 of the Safe Drinking Water Regulations 2015 (the Regulations). This report includes a summary of the chemical, physical and bacteriological test results of drinking water supplied to our customers, as part of our water quality monitoring program for each water sampling locality.

The information presented in this report explains the sources of our drinking water and how it is treated to ensure it consistently meets regulatory requirement. It further demonstrates our commitment to delivering water of high-quality standards, and highlights water quality challenges experienced as well as our improvements in 2021-2022.

In addition to the above, the report includes the following information:

- an overview of our water supply systems and sources of our water supply
- a summary of water treatment and disinfection processes
- an outline of how we arrange collection and testing of water samples
- details of customer feedback regarding water quality and safety
- a summary of the independent auditing processes used to verify our management of drinking water quality.

LMW is a statutory water corporation created under the Water Act 1989 and governed by a board of non-executive directors appointed by the Minister for Water. We work closely with the Environment Protection Authority Victoria (EPA), the DH and the Essential Services Commission (ESC), as they regulate and monitor the service performance of our environmental, public health, and water pricing obligations.

In accordance with the Act, we have adopted a multiple-barrier, catchment-to-tap approach to ensure safe, high-quality, drinking water is supplied to our customers. We are also required to prepare and implement a Drinking Water Quality Management Plan (DWQMP) to ensure the safety of our drinking water supply systems. Our DWQMP is based on Hazard Analysis and Critical Control Point (HACCP) principles and the Australian Drinking Water Guidelines 2011 (the Guidelines).

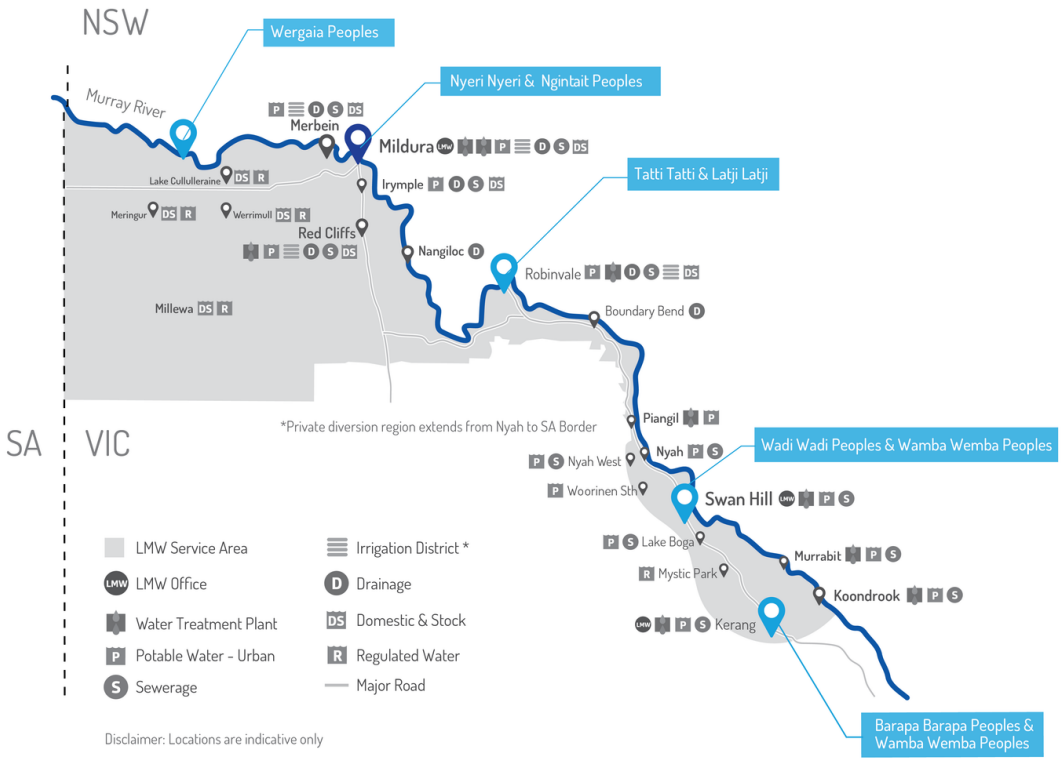
We verify the quality of the drinking water through a comprehensive monitoring program that also allows us to identify potential improvements to benefit our customers and the community. We also rely upon feedback from customers to advise of local issues that may arise, which are treated as water quality complaints.

LMW is committed to continuing its record of reliably providing high quality, safe drinking water to our customers. I'm pleased to advise that we achieved full compliance with the water quality standards and requirements of the Act and Regulations.

Anthony Couroupis
Managing Director

ABOUT US

Our service region



LMW operates in a remote and arid area of Australia extending from Kerang to the South Australian border, spanning the municipalities of Mildura, Swan Hill and Gannawarra.

We provide this extensive region with urban water and sewerage treatment, supply, and disposal; river quality water for stock and irrigation; and collection and disposal of subsurface irrigation drainage. We contribute to the economic, social, and cultural development of our region and its many communities with environmentally responsible and sustainable water management.

Nature and range of services

LMW provides services to both rural and urban customers including:

- Urban water services to 14 townships via 9 treatment plants to 35,171 households and businesses (approx. 75,000 customers) along the Murray River from Koondrook to Merbein.
- Wastewater collection, treatment and effluent re-use and disposal services to 11 towns via 10 treatment plants.
- Raw (river quality water) services to 2,655 irrigation and 2,253 stock and domestic customers in the four pumped irrigation districts of Mildura, Merbein, Red Cliffs and Robinvale, and to 300 Millewa waterworks district customers and 12 Yelta waterworks district customers.
- Management of the region's urban and rural bulk water entitlements.
- The collection and disposal of subsurface drainage water from the four pumped irrigation districts, as well as from private diverters in Nangiloc, Robinvale and Boundary Bend.
- Oversight of irrigation and drainage design in new agricultural developments ensuring conformity with salinity management plan development guidelines.
- Management of the private diversion licences of 1,317 water users along the Murray River in Victoria between Nyah and the South Australian border.
- The assessment and approval of licensing, water share and allocation trade applications.
- Reclaimed water for third party use.
- Water supply delivery to important environmental and recreational sites.
- Lead agency in a partnership model for the Victorian Murray Floodplain Restoration Project (VMFRP) which includes Goulburn-Murray Water (GMW), Mallee Catchment Management Authority (Mallee CMA), North Central Catchment Management Authority, Parks Victoria and the Department of Environment, Land, Water and Planning (DELWP).

WATER SUPPLY SYSTEMS

LMW manages eight drinking water supply systems, which provide drinking water to a population of approximately 75,000 customers along the Murray River in Victoria from Koondrook to Merbein. LMW also has two regulated water supplies, including a water quality improvement plant at Millewa intended to improve water quality for domestic and stock uses, but not for drinking.

Regulated water is not drinking water but could be mistaken for drinking water and is discussed in more detail in the Regulated Water section of this report.

Details of our drinking water and regulated water supply systems, including water sampling localities, population supplied, source water and Water Treatment Plants (WTP) are provided in Table 1. We do not manage water storages for drinking water supplies as we draw directly from the Murray River or other smaller waterbodies.

The population figures have been calculated based on the number of water connections as at 30 June 2022 (35,171) multiplied by the 2021 Census average household population for each region. Non-residential connections are not included. Locations of drinking water supply systems are shown on the map of our service region.

This report, in accordance with the Act, provides an overview of our drinking water supply systems, the quality systems in place for provision of safe drinking water and the drinking water test results for 2021-2022.

Table 1 - LMW water supply systems

Water sampling locality	Source water	Population	Treatment plant/s
Irymple	Murray River	8,388	Mildura 7th Street, Mildura West
Kerang	Murray River, Loddon River, 14/2 Irrigation Channel	4,081	Kerang
Koondrook	Murray River	1,056	Koondrook
Lake Boga	Murray River	1,143	Swan Hill
Merbein	Murray River	3,590	Mildura 7th Street, Mildura West
Mildura	Murray River	36,859	Mildura 7th Street, Mildura West
Murrabit	Murray River, Storage Dam	101	Murrabit
Nyah	Murray River	647	Swan Hill
Nyah West	Murray River	607	Swan Hill
Piangil	Murray River	265	Piangil
Red Cliffs	Murray River	4,103	Red Cliffs
Robinvale	Murray River	2,390	Robinvale
Swan Hill	Murray River	12,175	Swan Hill
Woorinen South	Murray River	424	Swan Hill
Millewa*	Lake Cullulleraine	97	Millewa Water Quality Improvement Plant
Mystic Park*	Kangaroo Lake	29	N/A
* Regulated supplies	**Total**	**75,955**	

SOURCE WATER

The source of water for the majority of drinking water supplies in our service region is the Murray River. Two exceptions to this are the Kerang and Murrabit drinking water supplies. The Kerang supply system sources its water from the 14/2 Irrigation Channel in addition to the Murray River. The Murrabit drinking water supply source its water either from the Murray River or from a storage dam at the plant, which is supplied from the nearby GMW channel, during times of BGA blooms along the Murray River.

LMW's regulated water supplies source water from Kangaroo Lake and Lake Cullulleraine (although this is directly connected to the Murray River) for the Mystic Park and Millewa areas respectively.

The Murray River catchment (part of the Murray-Darling Basin) covers a large area that spans Victoria, New South Wales and Queensland. Water from Queensland catchments enters the Murray River downstream of Mildura so does not impact on our WTPs' raw water offtakes. Several other water agencies located upstream of our offtakes also utilise the Murray River to provide drinking water to major towns along the Murray River including Albury, Wodonga, Cobram, Echuca and other smaller localities.

In 2015, we carried out a sanitary survey to identify the intensity and sources of contamination of water sources within the catchment area of our service region. The results indicated that the Murray River catchment is subject to various activities, which impact on water quality. A revision was carried out in 2022, which showed no changes to impact on water quality.

The Murray River lies within an open and unprotected catchment, where various activities such as stock grazing, human habitation, agriculture, and industry, take place. Dominant agricultural activities include extensive horticultural areas, the production of rice, dairy, wool, wheat, beef, lamb, and forestry. An abundance of recreational activities is undertaken along the Murray River and its tributaries including camping, swimming, fishing, water skiing, canoeing, sightseeing, and picnicking.

As a result, Murray River water is subject to a high microbial and chemical risk from humans, stock, and industry. To assess that LMW's water treatment processes can manage these risks, we have a source water quality monitoring program, which involves collecting and testing of source water samples for a range of parameters such as turbidity, colour, UV absorbance, pesticides, radioactivity, etc. to help assess risks from the catchment. In addition, the raw water turbidity is monitored online at all WTPs, which provides an initial alert to treatment plant operators of potential changes to the raw water quality. This enables operators to undertake control measures to ensure adequate treatment is applied to the raw water and potential for process deviation is reduced.

To quantify the microbial risks in the catchment and realising the similarities in each catchment and the microbial hazards, we conducted a detailed microbial hazard quantification assessment on our drinking water supply systems. The assessment used the methodology outlined in the Water Services Association Australia (WSAA) Manual for the Application of Health Based Targets for Drinking Water (2015).

LMW has been intermittently monitoring Cryptosporidium and Giardia in the source water since January 1998. The monitoring frequency has changed to fortnightly and includes E.coli, to enable ongoing quantification and assessment of the source water risks.

Seasonal BGA monitoring is undertaken by our water quality team and WTP operators, to identify potential BGA presence in the source water, implement appropriate control measures when blooms are detected and ensure that produced water is safe to drink. BGA monitoring is undertaken on a weekly basis and the frequency can increase subject to the volume of BGA detected in the source water.

Catchment management

LMW always endeavors to reduce potential risks to water quality in the Murray River being the main source of water supply for our water supply systems.

LMW is an active partner in the state-wide program that collects water and groundwater data, called the Regional Water Monitoring Partnership. LMW work closely with the Mallee CMA to assess the risks of chemical contaminants in irrigation drainage water. We are a participating member of the Mallee CMA's Mallee Floodplain Management Strategy Implementation Committee. This committee seeks to understand flooding risks for our region and coordinate a response to these risks with multiple agencies via development and implementation of mitigating actions.

Actions to date include mapping floodplains to help understand future flood risks and the building of strategically placed levees. LMW is a member of the Mallee CMA's Regional Catchment Steering Committee which is in the process of renewing the Regional Catchment Strategy, a document which underpins the sustainable management of land and water resources and contributes to biodiversity management.

LMW regularly partners with Mallee CMA to flush Psyche Bend Lagoon on a high river, to reduce the salt load in the lagoon using LMW infrastructure. While this sounds counterproductive to water quality, this activity prevents highly saline waters to enter the river when a rain event occurs during a low river, which can trigger an electroconductivity exceedance in Morgan, South Australia and compromises water quality for LMW offtakes downstream. By doing this on a high river, the salinity is effectively diluted and poses no problems for water quality downstream of the lagoon.

DRINKING WATER TREATMENT PROCESSES

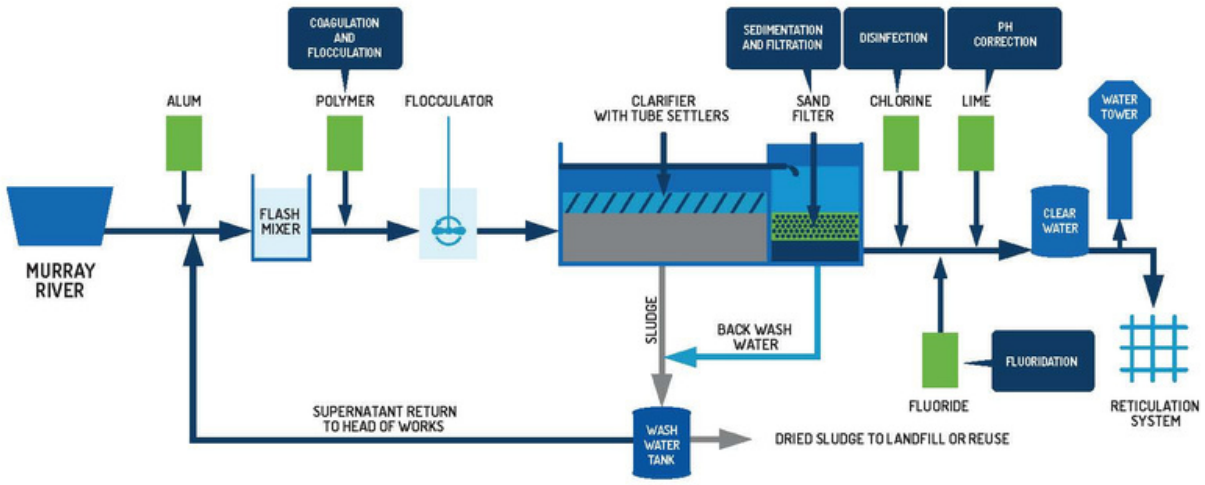
During 2021-2022, LMW treated more than 20,000 megalitres (ML) of drinking water across nine WTPs. All of these WTPs use conventional water treatment systems, with one WTP utilising dissolved air flotation as part of its treatment system. The water treatment systems involve the following process steps:

- coagulation
- flocculation
- clarification/sedimentation/Dissolved Air Flotation
- filtration
- chlorine disinfection
- fluoridation
- UV disinfection

Our drinking water is disinfected using chlorine, the most widely used drinking water disinfectant in the water industry. Chlorine dose rates are adjusted to provide adequate free chlorine residual throughout the distribution system. This helps provide some protection against potential contamination within the reticulation system and can limit biological regrowth. LMW have recently retrofitted Red Cliffs, Piangil, Koondrook, and Murrabit WTPs with UV disinfection systems, which provide additional barrier for Protozoa in line with the ADWG recommendations and industry best practice. The UV project is underway for Mildura 7th Street, Mildura West, Robinvale, Swan Hill, and Kerang WTPs.

Water treatment processes may slightly differ from one WTP to another due to plant capacity, technology type or raw water quality characteristics of source water. Steps in the drinking water treatment process are outlined in Figure 1.
Table 2 shows water sampling localities, WTPs that supply water to those localities, treatment processes used to treat the water per locality, and chemicals used for water treatment.

Figure 1 - Drinking water treatment processes



Coagulation and flocculation

The first step of the conventional treatment process involves dosing a chemical coagulant to help gather suspended solids and organic material in the raw water. We use aluminium sulphate or aluminium chlorohydrate to bring about the coagulation process, which helps form larger particles called 'flocs' that can be more readily removed by subsequent treatment steps. During flocculation, the floc particles develop and agglomerate into larger particles. The larger size and weight of the agglomerated particles assists in the sedimentation or clarification process. Flocculant aids including polyelectrolytes are also commonly used to enhance the flocculation phase, which further assists in the sedimentation and clarification processes.

Sedimentation

Sedimentation is a step in the treatment process intended to enhance the filtration process, where suspended particles are removed from the water by means of gravity or separation. In the sedimentation process, the water passes through a relatively quiet and still basin. In these conditions, the floc particles settle to the bottom of the basin while 'clear' water passes out of the basin over an effluent baffle or weir. The solids collected on the bottom of the basin are removed through sludge bleeding pipework at the smaller "package" WTPs, or by a mechanical 'sludge collection' device at the larger plants, which scrapes the solids (sludge) to a collection point within the basin from which it is pumped to a storage for further treatment and disposal.

Solid contact clarification

The purpose of the solid contact clarification is the same as the sedimentation process, i.e. to enhance the filtration process by removing particles. It involves mixing the influent flow with previously settled solids within a cylinder located in the centre of the clarifier. Gentle mixing within the reaction well promotes agglomeration of floc particles and/or chemical precipitates. The aggregated solids settle out more rapidly in the clarification area. Even better clarity is achieved when particles become enmeshed in a sludge blanket layer. Rotating sludge scrapers transport settled solids to the centre of the basin for removal. Clarified overflow is removed through a circular launder system that draws water from the entire surface area to prevent solids carryover caused by uneven velocity currents.

Dissolved Air Flotation (DAF)

The process of floatation consists of three steps:

1. bubble formation
2. attachment of bubbles to the solids
3. solids separation from the fluid

In DAF systems, air is pressurised under several atmospheres and then introduced into water, where it is mixed with pre-coagulated water just before it enters the floatation tank.

Upon attachment of air bubbles to the solid particles, the density of the solid becomes less than that of the surrounding fluid. In the process, the buoyant force lifts the solids to the surface to form a scum blanket, which is continuously swept to the periphery, automatically discharged into a scum trough by the skimming device.

Filtration

Filtration occurs as the water passes through filters that help remove particles that have not settled in the sedimentation process. Sand filters are commonly used in the water treatment process and may contain layers of gravels, sands and filter coal. The sand filtration process removes fine suspended solid matter as well as some other particles including larger micro-organisms, resulting in clear water passing through.

Disinfection using chlorine gas

Water is disinfected to kill any pathogens (disease-causing organisms) that remain in the treated water after filtration and provide protection within the distribution system. Without disinfection, the risk from waterborne disease is greatly increased. Disinfection is carried out by chlorination at all our WTPs in the form of chlorine gas.

Ultraviolet (UV) disinfection

UV disinfection is widely used in water treatment due to its ability to permanently de-activate bacteria, spores, moulds and viruses. It provides a secondary barrier to the conventional water treatment process, where filtration is the only barrier against protozoan pathogen, such as Cryptosporidium. UV disinfection is highly effective against the Cryptosporidium oocysts that are resistant to the routinely applied doses of chlorine.

pH correction

Due to the addition of coagulants and chlorine, the pH (acidity) of the water being treated is lowered, becoming more acidic. To inhibit corrosion and make the water safe to use, the pH is adjusted to a neutral pH, about pH 7.0, by adding lime or other alkaline chemicals such as soda ash or sodium hydroxide.

Fluoridation

Water fluoridation is the adjustment of fluoride in drinking water to a level that helps protect teeth against dental decay.We fluoridate five water supply systems that deliver fluoridated water to 12 localities within our service region. Fluoridation of the drinking water supplies is undertaken as per the requirements of the Health (Fluoridation) Act 1973.

Powdered Activated Carbon (PAC)

PAC is derived from a variety of sources such as coal, wood, and coconut. Due to its high adsorption capacity, i.e., ability to attract contaminants and bind them to its surface, PAC is used to assist in removing taste, odour compounds, blue-green algae toxins, and other impurities from water.

Taste and odour treatment

Intermittent PAC dosing takes place at some WTPs during times where elevated blue-green algae counts are detected, or biovolume is above the trigger for PAC dosing for the control of potential algal toxins that may be present in water. PAC is also dosed occasionally to remove taste and odour compounds.

Manganese treatment

Historically, seasonal moderate manganese levels have been detected in the source water at Red Cliffs Water Treatment Plant. Over time, these have become more concentrated due to sludge handling and water recycling processes, where potassium permanganate was occasionally used as an oxidizing agent to remove soluble manganese from drinking water and maintain its levels below the limits stipulated in the Guidelines.

We have also used Calgon-T for manganese treatment, which is a sequestering agent that prevents the oxidation of manganese in the treated water and eliminates the water discolouration. Due to the recurrent nature of this problem, LMW liaised with the Environment Protection Authority and obtained a permanent approval to discharge the recycled water with elevated manganese levels back into the Murray River.

Table 2 - LMW drinking water treatment processes

Water treatment plant	Water supply locality	Treatment process	Added substances
Kerang	Kerang	• Coagulation • Flocculation • Sedimentation • Granular Media Filtration • Chlorine Disinfection • Fluoridation	• Aluminium Sulphate • Hydrated Lime • Sodium Hydroxide • Chlorine Gas • Powdered Activated Carbon • Fluorosilicic Acid
Koondrook	Koondrook	• Coagulation • Flocculation • Sedimentation • Granular Media Filtration • Chlorination • UV Disinfection	• Aluminium Sulphate • Sodium Hydroxide • Chlorine Gas • Powdered Activated Carbon
Mildura 7th Street Mildura West	Mildura Merbein Irymple	• Coagulation • Flocculation • Sedimentation • Clarification* • Slow Sand Filtration • Chlorination • Fluoridation	• Aluminium Sulphate* • Aluminium Chlorohydrate** • Hydrated Lime* • Polymer • Chlorine Gas • Powdered Activated Carbon • Fluorosilicic Acid • Sodium Metabisulfite** • Sodium Hydroxide**
Murrabit	Murrabit	• Coagulation • Flocculation • Sedimentation • Granular Media Filtration • Chlorination • UV Disinfection	• Aluminium Chlorohydrate • Sodium Hydroxide • Chlorine Gas • Powdered Activated Carbon
Piangil	Piangil	• Coagulation • Flocculation • Sedimentation • Granular Media Filtration • Chlorination • UV Disinfection	• Aluminium Sulphate • Sodium Hydroxide • Chlorine Gas • Powdered Activated Carbon
Red Cliffs	Red Cliffs	• Coagulation • Flocculation • Pre-sedimentation • Dissolved Air Floatation • Granular Media Filtration • Chlorination • Fluoridation • UV Disinfection	• Aluminium Chlorohydrate • Sodium Hydroxide • Chlorine Gas • Powdered Activated Carbon • Fluorosilicic Acid
Robinvale	Robinvale	• Coagulation • Flocculation • Clarification • Granular Media Filtration • Chlorination • Fluoridation	• Aluminium Sulphate • Soda Ash • Chlorine Gas • Powdered Activated Carbon • Sodium Fluoride
Swan Hill	Swan Hill	• Coagulation • Flocculation • Clarification • Slow Sand Filtration • Chlorination • Fluoridation	• Aluminium Chlorohydrate • Sodium Hydroxide • Chlorine Gas • Powdered Activated Carbon • Fluorosilicic Acid

*Applies to Mildura 7th Street WTP **Applies to Mildura West WTP

DRINKING WATER QUALITY MANAGEMENT

Quality management systems

LMW's Drinking Water Quality Management Plan has been developed based on the 12 elements of the 'Framework for Management of Drinking Water Quality', described in the Guidelines and the requirements set out in the Act. The plan identifies key water quality risks in the water supply system using a catchment to tap approach. Each key risk is assessed, and processes put in place to manage those risks to provide safe drinking water to our customers.

Verification of water quality monitoring

Water quality monitoring constitutes a significant part of our water supply activities. We have a water quality monitoring program that was designed based on the requirements of the Regulations, and the Guidelines, including consideration of locality population numbers for bacterial monitoring.

Using the outcomes of the sanitary survey to assist in identifying the source water quality hazards and risks, we reviewed the irrigation practices within our catchment area to identify raw water quality parameters that potentially constitute health risks, and therefore, require ongoing monitoring.

The Guidelines provide a basis for assessing the quality of drinking water. The microbiological assessment is based on Escherichia coli (E. coli), which is considered a definitive indicator for the presence of fecal contamination, and therefore, a health risk. In terms of the physical and chemical monitoring, it is based on a combination of parameters that indicate the physical and aesthetic characteristics of water such as pH, colour and turbidity, as well as the chemical quality of the water, which include but not limited to free chlorine levels, iron and manganese, fluoride, dissolved salts, aluminium, copper, lead, chromium, nickel, and other parameters.

To comply with the water quality monitoring requirements set out in the Act and Regulations, we use an external National Association of Testing Authorities (NATA) registered laboratory to perform all regulatory drinking water testing, which was developed based on a rigorous risk assessment process. All drinking water quality test results for 2021-2022 are available in Appendix A.

In 2021-2022, we collected more than 1,700 samples from our 16 water supply localities and analysed these for more than 40 parameters to assess water quality and safety.

Sampling points

The water quality sampling points have been carefully chosen based on the DH 'Safe Drinking Water Regulations 2015 - Appendix 1:Water sampling program', and risk assessment approach with the objective of identifying effective strategies for prevention and control of hazards within the distribution system.

This involved understanding the characteristics of the drinking water system, what hazards may arise, how these hazards create risks, and the processes and practices that affect drinking water quality.

While the sampling points are representative of the water quality within their subsequent supply systems, a regular review of the sampling points is undertaken to verify the locations of the current sampling points, ensure that they reflect the associated water quality risks within their distribution systems, and assess the need to add in additional sampling points to reflect the expansion of the water supply localities that results from population growth, i.e., new subdivisions.

Tank cleaning

A scheduled inspection and maintenance program is in place for cleaning clear water storage tanks and service reservoirs, which was followed in 2021-2022. This involved general inspections of the interior and exterior of the storages for sediment build-up, asset condition, and the roof area to ensure that access hatches are properly sealed and prevent contamination that could result from rainwater ingress, and desludging of water storages as required.

In addition to physical inspections of clear water storages and service reservoirs, we recently undertook an extensive drone inspection for water tank condition inspections for all LMW storages. This project uncovered many missed areas of risk where assets have not been appropriately maintained, enabling LMW to make repairs a targeted priority.

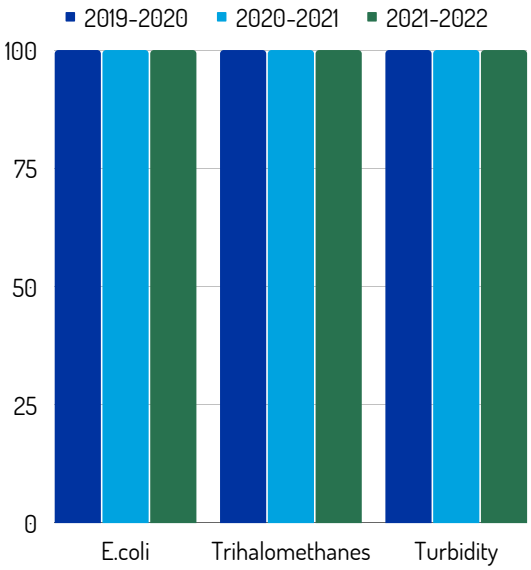
Three-year percentage compliance

A comparison of test results of water samples collected in accordance with the sampling program set out in our DWQMP, and percentage of complying samples over the last three financial years, based on the regulated parameters stipulated in the Regulations, was undertaken.

The high quality of the drinking water we supplied continued for 2021-2022, complying fully with all water quality standards. Figure 4 demonstrates the continued outstanding performance and achievement of full compliance with the water quality standards detailed in Schedule 2 of the Regulations.

Further detailed comparisons of water quality parameters with the previous two financial years are provided in the drinking water quality test results in Appendix A.

Figure 4 - Compliance with Water Quality Standards



Fluoride treatment

Levels of fluoride have remained consistently below the maximums specified in the Australian Drinking Water Guidelines 2011 over the three-year period.

During the reporting period, the average optimal fluoride concentration of 0.7 to 0.9mg/l, as recommended by DH to provide a dental health benefit, was achieved within all water supply systems.

Fluoride levels sourced from the ClearSCADA systems at the WTPs.

LMW reviewed the design of all fluoride dosing systems, investigated, and identified upgrade requirements to increase reliability of the dosing systems. The upgrade works are underway and currently in being rolled out across all sites. Other changes included reviewing plant attendance procedures, training of staff and keeping stock of critical spares.

Fluoride outage notifications

LMW's water quality sampling program indicates that all localities that receive fluoridated water supply were compliant for fluoride for the reporting period. Comprehensive data is provided in Table 3 of Appendix A.

LMW notified the DH of a total of 2 temporary fluoride interruptions, where fluoride concentration in drinking water supplied was less than 0.7 mg/L for longer than 72 hours, as required under the Code of Practice for Fluoridation of Drinking Water Supplies.

These occasions occurred when fluoridation was taken offline as a precautionary measure while LMW confirmed potential irregularities with plant processes or undertook urgent maintenance. A summary of interruptions is provided in Table 3.

Aesthetic characteristics

LMW's water quality sampling program included aesthetic drinking water parameters turbidity, salinity, hardness, pH and colour. These results are reported in detail in Appendix A.

Table 3 - Summary of fluoride interruption

Fluoridation plant	Interruption date	Resumption date	Summary	Number of days fluoride was offline
Mildura West	26 Nov 2021	13 Dec 2021	A leak in the fluoride dosing pump	17
Red Cliffs	1 Feb 2022	2 Mar 2022	Replacement of the fluoride dosing pump	29

Water quality and safety improvement initiatives

During the 2021-2022 financial year, LMW completed or continued a number of projects that contribute to maintaining and improving the robustness of the water treatment process and ensuring that water quality and safety is not compromised.

After a successful installation and commissioning of UV disinfection systems at Red Cliffs, Piangil, Koondrook and Murrabit WTPs in 2019-2020, LMW continues its endeavour to improve the robustness of the water supply systems. This includes continuing our project to retrofit the Mildura 7th Street, Mildura West, Robinvale, Swan Hill, and Kerang WTPs with UV disinfection systems.

UV disinfection systems provide a secondary barrier for pathogenic bacteria such as Cryptosporidium and Giardia, reduce risks to water safety especially during poor raw water quality events such as blackwater and blue-green algae blooms, and ensure the continuity of water supply during such events.

Table 4 (on the next page) lists the water quality and safety improvement projects that were initiated or completed in 2021-2022.

Table 4 - Water quality and safety improvement projects

Water treatment plant	Project	Project status (complete, in progress, planning)	Expenditure, $ Actual FY2022
All sites	Instrument replacement	In progress	55,192
Mildura West	Upgrade to ClearSCADA	In progress	503,669.03
Kerang	UV treatment upgrade	In progress	1,784,082.01
Swan Hill	UV treatment upgrade	In progress	686,281.58
Robinvale	UV treatment upgrade	In progress	817,202.49
Mildura West	RPZ works	Complete	6,084.73
Swan Hill	Fluoride upgrade - Fluoride dosing board replacement	In progress	FY23
Kerang	Fluoride upgrade - Fluoride dosing board replacement	In progress	FY23
Mildura West	UV treatment upgrade	In progress	382,619.36
Mildura 7th Street	UV treatment upgrade	In progress	622,014.35
Red Cliffs - Cliffside PS	Relocate chlorine cylinders, dosing board & analysers	In progress	35,900.38
Red Cliffs	Replace PAC mixing tank with 5,000 poly tank	In progress	26,131.12
Kerang	Replace fluoride flow meter Kerang	Complete	7,416.47
Merbein GLS	Upgrade chlorine analyser and scales to SCADA	In progress	3,101.01
Mildura 14th Street GLS	Upgrade chlorine analyser and scales to SCADA	In progress	5,201.53
Red Cliffs	Install pressure pump system	Complete	26,107.61
Robinvale	Refurbish Filter No 1 (nozzles and media)	Complete	19,057.20
Mildura 7th Street	Lime dosing hopper filter	Complete	1,928.03
Mildura 7th Street	Installation of raw water pH meter and DO sensor	Complete	15,889.47
Red Cliffs	Fluoride upgrade	In progress	678.86
Kerang	Fluoride upgrade	Complete	16,104.27
Swan Hill	Fluoride upgrade	In progress	7,366.86
Robinvale	Fluoride upgrade	In progress	634.36
Mildura 7th Street	Fluoride upgrade	In progress	5,750.60

EMERGENCY INCIDENT AND EVENT MANAGEMENT

Section 18 and 22 notifications

Section 18 and 22 notifications Section 22 of the Act requires an officer of a water supplier to notify the DH where it's suspected that the drinking water supplied, or to be supplied to customers, may pose a risk to human health, or cause widespread public complaint. Section 18 of the Act require water suppliers to notify the Secretary of DH if it becomes aware that the drinking water supplied, or to be supplied, to another person does not comply, or is not likely to comply, with any relevant water quality standard and must do so within 10 days after it becomes aware of that fact.

Reportable incidents 2021-2022

The following incident occurred during the reporting period:
An E. coli was detected in a sample collected on 19 April 2022, from the locality of Nyah, which was reported under s22 of the Act to the DH. In response to this incident, we immediately resampled the site including randomly selected points within the distribution system. An investigation into the source of the E. coli was immediately undertaken. The investigation covered the water supply system and included the performance of the treatment plants and the chemical dosing systems two weeks before the event, free chlorine residual in the distribution system, the integrity of the water storages and service reservoirs, main breaks or repairs within the Nyah distribution system, the sampling point, samples collection procedure, the sample processing at the NATA accredited lab. The investigation concluded that the sample collected from the locality of Nyah was a false positive and not representative of the water being supplied at the time the sample was collected and met the E. coli water quality standard.

Staff training

LMW always endeavour to ensure that treatment plants' operators have achieved Certificate III qualifications in water industry operations. Whilst some operators have already completed this training, other team members are progressing towards achieving certificate III, and new members who have recently joined the operational team have been enrolled in this training program.

In addition, LMW's treatment plant operators attend the Water Industry Operators Association conference in Bendigo on annual basis, and visit other water authorities WTPs when the opportunity arises. We also engage instruments suppliers to conduct training on the operation and maintenance of the analyzers.

Issues

Under the Regulations, LMW is required to provide a summary of any issues arising out of the application of the treatment processes that may have affected water quality and safety.

Weir pool height affecting Red Cliffs WTP

During the reporting period, GMW lowered the height in the Mildura weir pool to undertake routine maintenance on the Mildura weir, which affects the operation of the offtake at Red Cliffs WTP by reducing suction and allowing riverbed sludge to enter the treatment plant process. In previous years during times of low river, LMW have used a diesel pump lifted via crane onto a barge which was costly and a logistic burden. Therefore in May, prior to a planned weir removal, a submersible pump was permanently installed to replace the barge and diesel pump.

Aquatic weed blockages at Mildura West WTP

Towards the end of the reporting period, the Operations teams experienced a sudden 40% decrease in suction rates through Mildura West WTP raw offtake. The blockage was found to be caused by a common aquarium plant which had been growing rampant in the river. A flushing point has been installed on the suction to push water back through, and clear the weed from the suction screen, effectively returning flows back to normal. Aquatic weed continues to be problematic for operations teams in the Mildura region and we are considering solutions for long term management.

Robinvale WTP water quality event

Raw water changes on 13 August 2021 at Robinvale WTP caused ineffective coagulation, flocculation, and sedimentation processes leading to elevated turbidity levels. During the filter to waste period, when non-compliant water was discarded, the prolonged high turbidity exacerbated an underlying nozzle issue in Filter number 1, resulting in catastrophic failure of the filter (see Figure 3 missing nozzle). The treatment plant was forced to operate with only the three remaining filters while the affected filter was taken offline. Effective coagulation was restored shortly after and there was no impact to customers. Following this, refurbishment of the filter included removal of sand media, (see Figure 2), full replacement of nozzles and filter media with works extending over a 10-month period, with the treatment plant resuming operation of all filters in June 2022.

Figure 2 - Removal of filter media from Robinvale WTP Filter #1

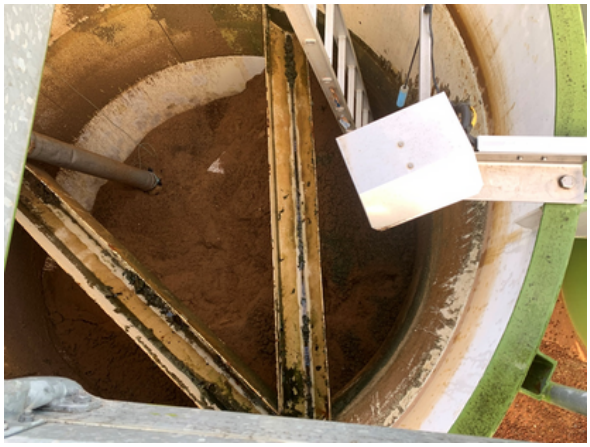


Figure 3 - Missing nozzle from Robinvale WTP Filter #1

Koondrook WTP water quality event

Raw water changes on 4 April 2021 at Koondrook WTP caused ineffective coagulation, flocculation, and sedimentation processes leading to elevated turbidity levels. The operations team managed to bring the process back under control whilst filter to waste ensured non-compliant water was discarded.

Murrabit WTP algae build-up

Mid-April this year, an unusually large number of algae entered the Murrabit WTP, causing ineffective coagulation, flocculation, and sedimentation processes leading to higher settled water turbidity and filter blinding. The flocculator was manually cleaned and sludge was wasted until the system was running normally again.

DRINKING WATER QUALITY STANDARDS

During 2021-2022 financial year, LMW remained 100% compliant with the water quality standards specified for drinking water in Schedule 2 of the Regulations. These are outlined in Table 5. All drinking water quality results can be found in Appendix A of this report.

Table 5 - Schedule 2 Safe Drinking Water Regulations 2015 Drinking Water Quality Standards

Parameter	Sampling frequency	Quality standards
Escherichia coli	One sample per week	No E. coli per 100 milliliters of drinking water, with the exception of any false positive sample.
Total Trihalomethanes	One sample per month	Less than or equal to 0.25 mg/l of drinking water.
Turbidity	One sample per week	The 95th percentile of results for samples in any 12-month period must be ≤ to 5.0 NTU.

Other water quality standards

In addition to the water quality parameters stipulated in the Regulations, we also monitored a range of other parameters, such as substances that may pose a risk to human health, to compare against the Guidelines' health-related guideline values and ensure the safety and quality of the drinking water.

Table 6 lists other parameters included in the water quality parameters list that are regularly monitored in drinking water samples collected from the reticulation system and water storages.

LMW has assessed the test results of these parameters against the Guidelines' health-related guideline values and found all results were fully compliant.

Blue-green algae

Blue-green algae (Cyanobacteria) are microscopic organisms that may thrive in warm, nutrient rich waters. They may impact water quality by releasing taste and odour compounds. In some extreme circumstances, these organisms may release concentrations of toxins.

As part of our water quality monitoring program, raw water samples are collected on a weekly basis from source water during the BGA season (November to May inclusive) and tested in-house for BGA cell count.

The BGA monitoring frequency increases to twice weekly if:

- 2,000 ≤ Cell Numbers < 6,500 Cells/ml Microcystis Aeruginosa, or
- 0.2 ≤ Total Biovolume < 0.6 mm3/L

DH must be notified under Section 22 of the Act when treated water supplied for drinking may place public health at risk due to one or more of the following:

- total Microcystins are detected at ≥ 1.3 µg/l (Microcystin-LR toxicity equivalents)
- Microcystis aeruginosa is present at ≥ 6,500 cells/ml
- total combined biovolume of known toxic cyanobacterial species ≥ 0.6 mm3/L
- total combined biovolume of all cyanobacterial species ≥ 10 mm3/L

or

- BGA is present in drinking water at levels that may cause widespread public complaint, for example through taste and odour.

Table 6 - Other drinking water quality standards

Parameter	ADWG 2011 guideline, mg/L		Frequency of testing*	Met the guideline Yes/no
	Health	Aesthetic		
Arsenic	0.1		Quarterly	Yes
Cadmium	0.0002		Quarterly	Yes
Chlorine	5	0.6	Weekly	Yes
Chromium	0.05		Quarterly	Yes
Copper	2	1	Quarterly	Yes
Cyanide	0.08		Quarterly	Yes
Fluoride	1.5		Weekly	Yes
Lead	0.01		Quarterly	Yes
Manganese	0.5	0.1	Quarterly	Yes
Mercury	0.001		Quarterly	Yes
Nitrate	50		Quarterly	Yes
Iron	c	0.3	Quarterly	Yes
Zinc	c	3	Quarterly	Yes
Selenium	0.01		Quarterly	Yes
Nickel	0.02		Quarterly	Yes
Sulphate	c	250	Quarterly	Yes
Atrazine	0.02		Yearly	Yes
Chlorpyrifos	0.01		Yearly	Yes
Chlorothalonil	0.05		Yearly	Yes
Glyphosate	1		Yearly	Yes
Maldison (Malathion)	0.07		Yearly	Yes
Simazine	0.02		Yearly	Yes
Gross Alpha			Every 5 years	Yes
Gross Beta			Every 5 years	Yes

c ADWG 2011 note that there is insufficient data to set a guideline value based on health conditions

WATER QUALITY COMPLAINTS

LMW is committed to providing high quality, safe drinking water and continuously improving services and communications to all customers. To ensure water quality complaints are resolved in appropriate timeframes, complaints are captured in LMW's customer management system 'Merit', which provides workflow tracking of each complaint from registration to completion and produces reports as required. Merit directs the complaint to the relevant action officer to follow up with the customer. Complaints received after hours via our 1800 phone number are also directed to the relevant officer the next working day for follow up, if necessary.

If the issue cannot be resolved over the phone, an officer attends the property of concern to discuss the complaint with the customer, undertakes basic water quality testing such as pH, turbidity and colour, and takes water samples for taste tasting. Main's flushing will be undertaken, if necessary.

Monthly complaint summary reports for Board meetings, and quarterly reports for Essential Services Commission reporting are prepared from the Merit database.

2021-2022 complaint data

A total of 26 water quality complaints from a customer base of 35,171 was recorded in 2021-2022. This is a reduction from 2020-2021 where 28 water quality complaints were recorded, which equates to 0.035 water quality complaints per 100 customers.

Over the reporting period, the main water quality complaint was for taste and odour (14 complaints), which can be generated by one or more factors including but not limited to the presence of BGA, soluble organics, elevated Chlorine residual, etc. Algal blooms can result in the presence of taste and odour compounds such as Geosmin and 2-methylisoborneol (MIB). Reduced water consumption and extended retention times during low flows in the reticulation system 'long age' and dead ends may also contribute to imparting taste and odour to the water.

During the reporting period, increased chlorine dosing was required in all supply localities to meet chlorine demand in response to high organics consuming the free chlorine residual. The organics were a result of high flows within the Murray River that cause soluble organics to remain in the finished water. The taste and odour complaints account for 53% of the total number of complaints received throughout the reporting period.

LMW systematically undertake mains cleaning programs that assist in maintaining and improving water quality, consequently reducing the number of water quality complaints. Reactive mains flushing is conducted in response to customer requests to investigate water quality issues associated with colour, taste and/or odour complaints.

We monitor algae count/biovolume during the spring and summer season, where algae growth is accelerated due to optimal weather conditions. In general, we promote biological growth within the filter media, as it helps break down the taste and odour compounds, which then can be removed during the disinfection process, due to being oxidized by Chlorine. During algal blooms, we undertake additional treatment measures involving dosing of activated carbon at WTPs to help absorb the taste and odour compounds.

Discoloured water was the second highest category of water quality complaints for the reporting period (14 complaints). It can be attributed to one or a combination of several factors which could include a burst water main within the area, change in the direction of water flow that could result in disturbing the sediment in the interior of mains, oxidized manganese, iron sediment or potentially from a customer's internal plumbing or hot water service.

2021-2022 complaint data continued

LMW received two alleged illness complaints during the reporting period, one of which the cause was not found to be linked to water quality; and the other was caused by consumption of water connected via a temporary water supply during a main repair. One water quality complaint was also received under the 'other' category, which after investigation was found to be unrelated to water quality.

Tables 7A and 7B show a comparison between the number of water quality complaints received during 2021-2022, to those of the previous year, and the types of complaints received by each of LMW's water sampling locality respectively.

Table 7C shows the types of water quality complaints, total water quality complaints received during 2021-2022, and the number of complaints per 100 customers supplied.

Table 7A - Types of complaints compared to previous reporting periods

Type of complaint	Number of complaints			Comparison with previous reporting periods	Comments
	2021-2022	2020-2021	2019-2020		
Colour	14	11	12	An increase by three complaints	The increase may be attributed to higher manganese levels from catchment activities or issues with internal plumbing.
Taste and odour	9	13	15	A decrease by five complaints	The decrease may be attributed to a mild BGA season compared to other years. BGA is a source of the MIB & Geosmin that causes taste and odour problems.
Blue water	0	0	1	No change	No complaints received
Alleged sickness	2	3	5	A decrease by one complaint	The decrease may be attributed to customers confidence in the safety of LMW drinking water.
Air in water	0	0	0	No change	No complaints received
Other	1	1	2	No change	This category of complaints includes various types that upon investigation were found to be not related to water quality.
Total	**26**	**28**	**35**	**A decrease by 2 complaints**	**All categories**

Table 7B - Types of complaints by water sampling locality

Water sampling location	Type of complaints					
	Colour	Taste and odour	Blue water	Alleged sickness	Other	Total complaints
Mildura	6	5	0	1	1	13
Irymple	2	0	0	0	0	2
Merbein	0	0	0	0	0	0
Red Cliffs	1	1	0	0	0	2
Robinvale	0	1	0	0	0	1
Nyah	0	0	0	0	0	0
Nyah West	0	0	0	0	0	0
Woorinen	1	0	0	0	0	1
Piangil	1	0	0	0	0	1
Swan Hill	3	0	0	0	0	3
Lake Boga	0	0	0	0	0	0
Wakool	0	0	0	0	0	0
Koondrook	0	0	0	0	0	0
Murrabit	0	0	0	0	0	0
Kerang	0	2	0	1	0	3

Table 7C - Water quality complaints

Type of complaint	Number of complaints	Number of complaints per 100 customers supplied	LMW's corporate target
Colour	14	0.019	-
Taste and odour	9	0.012	-
Alleged sickness	2	0.003	-
Blue water	0	0.000	-
Air in water	0	0.000	-
Other	1	0.013	-
Total	**26**	**0.035**	**<25 complaints**

RISK MANAGEMENT PLAN AUDIT RESULTS

Audit process

For part of this reporting period, the 2021-2022 audit (1 January 2021 to 31 December 2022) will be held during 1 Jan 2023 to 30 April 2023. In response to the following 19 opportunities for improvements (OFIs) identified in the previous Safe Drinking Water Act audit conducted for the period 29 May 2018 to 13 March 2020 inclusive, LMW has undertaken all necessary actions to address the OFI as per below.

Status of opportunities for improvements (OFIs)

Since the March 2020 Safe Drinking Water Act audit, LMW has undertaken measures to bridge the gap and address all the OFIs identified during the audit. The status of addressing the 2019-2020 Risk Management Plan OFIs are shown in table 8 below.

Table 8 - Status of 2019-2020 Risk Management Plan OFIs

Opportunity for improvement	Lower Murray Water response	Status
Kerang Water Supply System		
1 - Black water events have been created by environmental flows flooding upstream forests and by releases of water from upstream lakes. LMW should lobby to have such activities undertaken in ways that don't adversely impact raw water quality. Those same source water protection lobbying efforts should consider factors such as pesticide application and council stormwater management.	Pesticides risks have been considered in LMW's DWQMP and were rated as a medium risk to water quality and safety. LMW has included Pesticides in its drinking water quality monitoring program and are being reviewed regularly to ensure changes to their use is reflected in the DWQMP. In addition, LMW has established communication protocols with the GMW as the Water Storage Manager, and Mallee Catchment Management Authority (Mallee CMA), and the Environment Protection Authority (EPA) to ensure timely notification of incidents, events and emergency situations that may adversely impact on the raw water quality. Also, the MWQ & E is on the water quality advisory panel, which is a network managed by the MDBA that is concerned with the source water quality, and keeps stakeholders informed of events or incidents that may have impact on WQ.	Complete
2 - It is worth considering locking chemical fill points at WTPs as an extra mitigation against accidental loading of the chemicals into the wrong place (this is based on observations at both Kerang and Swan Hill WTP so the OFI not repeated in the summary of Swan Hill WTP).	This OFI was immediately addressed after the audit.	Complete
3 - For the Kerang WTP wet rack and lab area consideration could be given to including a max-min thermometer to check and, if required, installing temperature control stabilise temperature.	The operations team discussed this OFI at the DWQM team meeting on 6 August 2020, and a decision was made to install a second air conditioner in the wet rack area.	Complete
4 - The Kerang WTP Control Limits Summary should have the use of the terms 'combined' and 'individual' checked and corrected.	The water quality team has reviewed and amended the summary sheet to reflect the OFI recommendations.	Complete

Table 8 - Status of 2019-2020 Risk Management Plan OFIs - continued

Opportunity for improvement	Lower Murray Water response	Status
Kerang Water Supply System		
5 - The Kerang treated water storage tank should be assessed to improve its security against vermin and runoff entry via holes in the roof from missing bolts and blocked backflowing gutters.	A physical inspection of the tank was undertaken by the maintenance team. The missing bolts were reinstated, vermin proofing was repaired, and the frequency of the roof inspection and cleaning was reviewed.	Complete
6 - At the Kerang WTP it was noted that some of the alert and critical limits in the SCADA system were tighter than those in RMP by a small margin, e.g., 0.1 mg/L more conservative, or with more conservative, shorter delay times. These changes had been made with the 'CCP Set Point Change Request' form having been used. It was accepted that operators should be able to tighten the limits, but not loosen them. However, this needs to be formalized in some way to ensure that operators understand that whilst tightening up alarms is acceptable, loosening them beyond the RMP limits is not.	The water quality and the WTPs' operation teams have jointly reviewed the CCP access levels, based on a risk assessment approach, and identified key officers that should be provided with the required access level to making changes to the limits. This is currently being finalised and will be implemented as part of ClearSCADA system upgrade projects. A more recent review of the CCP's resulted in converting the coagulated water pH to a process control point where operators have been provided access to make changes as required. This was supported by the fact that fluctuation in the raw water quality triggered the need for frequent adjustments to the treatment process, where access to the CCP limits was required. This change eliminates the above issue.	Complete
Swan Hill WTP and Supply System		
1 - The outdated sticker posted at the Swan Hill WTP showing outdated alert values needs to be removed and/or corrected and, if present, similar changes made at other sites.	This OFI has been taken on board, and the stickers were removed.	Complete
2 - The Swan Hill treated water storage tank should be assessed to ensure risks from backflowing gutters are mitigated.	The storage inspection frequency was reviewed to ensure that the gutters are cleaned on a regular basis.	Complete
3 - For the Swan Hill area, means of completing minor works rapidly, without going via Mildura-based contractors under the Rapid Global system, could be investigated, to help deliver works.	Contractors in Swan Hill/Kerang area are now on Rapid Global.	Complete

Table 8 - Status of 2019-2020 Risk Management Plan OFIs - continued

Opportunity for improvement	Lower Murray Water response	Status
Swan Hill WTP and Supply System		
4 - Improved water quality management system support and resourcing based in the Swan Hill area would provide technical support for water quality management in general, including awareness, SCADA, monitoring, and reporting, to help compensate for the remoteness from Mildura. This would raise the standard of quality management since this is the area where compliance is least robust at present.	Two new operators have been appointed to provide additional resources to the Swan Hill and Kerang WTPs. In addition, LMW's Water Quality Technologist has increased visits to the Swan Hill and Kerang areas, including the number of days stayed there to provide guidance and technical support as required.	Complete
5 - Contamination risks at the Lake Boga treated water storages should be assessed and consideration given to improving security against vermin and runoff entry via holes in the roof from missing bolts and/or to having the residual chlorine be continually monitored to ensure control of potential bacterial ingress from the large bird population roosting on the tank roof.	The missing bolts were reinstated immediately after the audit. A bird scarer was also placed on top of the tank. In addition, training options are being considered (inhouse and external) to improve the knowledge of maintenance staff across asset condition assessment, awareness of risks to water quality, timely communication to supervisors/managers, and required actions are undertaken to mitigate risks and rectify any issues.	Complete
Piangil WTP and Supply System		
1 - The completion and logging of routine tasks at the Piangil WTP needs to be aligned better with the information given in the RMP. This may mean that more resources are required and/or the system needs to be adapted to match what is achievable at the site within constraints of resources.	The Swan Hill and Piangil WTP's are operated by one operator. An additional resource has been appointed to assist with the operation of both plants.	Complete
2 - The Piangil treated water storage tank should be assessed to improve its security against vermin and runoff entry via holes in the roof from missing bolts and loose vermin-mesh.	This OFI has been attended to and completed in timely manner.	Complete

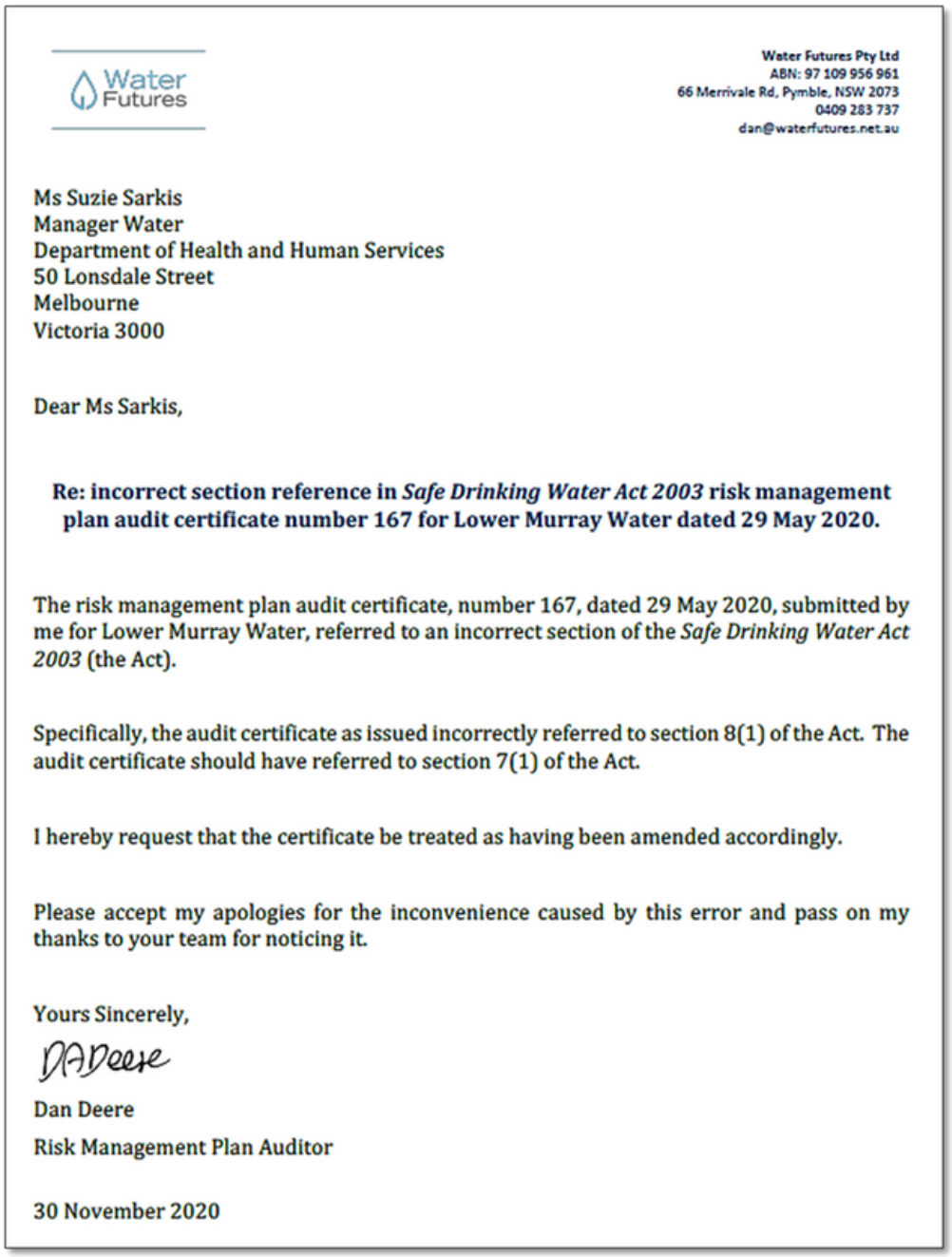
Table 8 - Status of 2019-2020 Risk Management Plan OFIs - continued

Opportunity for improvement	Lower Murray Water response	Status
OFIs relevant more broadly and/or for one system		
1- More operator and/or contractor training and awareness is worth considering to clarify what is expected in terms of treated water storage reservoir integrity, particularly in the southern area. There were a number of potential ingress points noted during the audit despite LMW having procedures and processes to help identify and capture those. The importance of reservoir integrity, and clarification and communication to operators and/or contractors of LMW's expectations in this regard, is worth emphasising.	This is being considered as per comments on Swan Hill OFI number five.	Complete
2 - LMW needs to continue to push ahead to improve backflow prevention compliance. Given that this is a regulatory compliance obligation it may be worth reporting this to the Board in a dashboard, traffic light, or similar report.	The land development department is following up with the customers who have not carried out device testing, they'll receive a follow up letter to advise that a backflow plumber will carry out the testing at the customers' expense. A Tender has gone out to engage a plumber to perform the testing and drive compliance for backflow prevention devices.	Complete
3 - It is recommended that the Water Quality and Environment team's log of monthly instrument checks be updated to include a section for recording checks on individual filter effluent turbidity since this is a most critical monitoring point.	All benchtop Calibrations are being added to our Infor work order system so they can be tracked, individual filter turbidimeter calibrations are included in the work order system.	In Progress (Due 30 December 2022)
4 - For some parameters it would be useful to have a setpoint ± a range rather than an upper and lower limit, to help avoid nuisance alarms at sites that have potentially variable setpoints, e.g., for chlorine residuals.	This OFI has been noted.	Complete
5 - At some sites (e.g., Kerang) alum was still being dosed whereas some operators advised that in many cases ACH is preferred for River Murray water, and this could be reviewed where it may simplify coagulation and improve performance.	ACH has been successfully trialed and is being used at Red Cliffs, and Piangil WTPs. A trial for ACH use at Koondrook WTP is planned for this winter. ACH has also been unsuccessfully trialed at Kerang in the past.	Complete
6 - Changes to CCP limits should be limited to a supervisor or a team leader level and higher to help reduce the risk of them being changed without due process.	This OFI has been discussed with the operational team, where the risks associated with uncontrolled access to CCP changes was explained, and a decision was made to limit the access to the Manager Water Quality and Environment, Water Quality Technologist, Manager Plant Operations and Maintenance, Team Leaders Operations, two Engineering Officers, and Electrical/Instrumentation Technician.	Complete

Audit certificate

The audit certificate for the period 29 May 2018 to 13 March 2020 issued by the auditor, Dan Deere, contained an error, in that it says LMW was compliant under section 8(1), however, this section refers to water storage manager conditions, not water suppliers, and therefore, a letter was sent to LMW to clarify and correct this error.

A copy of the letter is provided below.



Water Futures

Water Futures Pty Ltd
ABN: 97 109 956 961
66 Merrivale Rd, Pymble, NSW 2073
0409 283 737
dan@waterfutures.net.au

Ms Suzie Sarkis
Manager Water
Department of Health and Human Services
50 Lonsdale Street
Melbourne
Victoria 3000

Dear Ms Sarkis,

Re: incorrect section reference in *Safe Drinking Water Act 2003* risk management plan audit certificate number 167 for Lower Murray Water dated 29 May 2020.

The risk management plan audit certificate, number 167, dated 29 May 2020, submitted by me for Lower Murray Water, referred to an incorrect section of the *Safe Drinking Water Act 2003* (the Act).

Specifically, the audit certificate as issued incorrectly referred to section 8(1) of the Act. The audit certificate should have referred to section 7(1) of the Act.

I hereby request that the certificate be treated as having been amended accordingly.

Please accept my apologies for the inconvenience caused by this error and pass on my thanks to your team for noticing it.

Yours Sincerely,

DA Deere

Dan Deere
Risk Management Plan Auditor

30 November 2020

REGULATED WATER

What is regulated water?

Section 6 of the Act allows the Minister for Health to declare any water that is not drinking water, but that may be supplied to the public in circumstances in which it may be mistaken as being drinking water, to be 'regulated water' for the purposes of the Act.

Following consultation between the DH and LMW, the Minister for Health declared the water supplied by LMW to the Millewa area and Mystic Park water supply systems as regulated water as per Section 6 of the Act.
The declaration for the Millewa system was gazetted in the Victoria Government Gazette Special Edition No. S28 on 15 February 2007 and the Mystic Park system was gazetted in the Victoria Government Gazette Special Edition No. S135 on 19 May 2009.

Declaration as regulated water meant that LMW had to prepare and implement risk management plans for the Millewa and Mystic Park water supply systems. This was to minimise the risk that the water as supplied could be mistaken for drinking water.

LMW take all reasonable steps to ensure that residents and visitors to Meringur, Werrimull, Cullulleraine in the Millewa Waterworks District and Mystic Park are aware that the mains water supply to these towns is untreated and not suitable for consumption. The following actions are undertaken:

- provide the 'Living with an Untreated Water Supply' brochure and reminder notices to LMW customers who are connected to an untreated water supply including private diverters, advising that untreated water is not suitable for drinking, teeth brushing or food preparation, and that due care should be taken when bathing and showering to avoid swallowing of untreated water
- supply the 'Living with an Untreated Water Supply' brochure to accommodation facilities as requested to assist in informing guests that their supply is untreated and is not suitable for drinking, teeth brushing, or food preparation and that due care should be taken when bathing and showering to avoid swallowing of untreated water bathing
- provide 'Do Not Drink' signs free of charge to the responsible managers of all publicly accessible taps connected to untreated water (e.g., parks, public toilets, schools, halls, caravan parks)
- provide notification via Information Statements of the property's untreated water supply to intending property purchasers
- provide new irrigation or domestic and stock customers with an information kit including the 'Living with an Untreated Water Supply' brochure
- make a copy of our customer charter available which details the respective rights and obligations of customers supplied with untreated water
- make this information available on our website.

LMW's regulated water supplies

Milliewa Water Supply System

A non-potable water system supplies an area which includes the towns of Meringur, Werrimull and Cullulleraine and also the surrounding rural properties in the Millewa district. The water is sourced from Lake Cullulleraine which is filled directly from the Murray River via an earthen channel. The population served by this supply is estimated to be less than 250.
The water supply system is primarily a domestic and stock water supply to dryland farmers in the Millewa area located to the west of Mildura. Previously, the water from Lake Cullulleraine had been chlorinated as it was pumped into the system to control the nuisance growth of the Plumatella species, which if allowed to become established within a pipeline system can cause severe ongoing operational challenges.

In 2013, LMW commissioned a Water Quality Plant at Lake Cullulleraine. The plant has improved water quality; providing clearer water for domestic uses such as washing, and farmers can benefit as the impact on their spraying equipment is reduced.

The treatment plant comprises two large lagoons that alternate as storages for removing turbidity. Aluminium sulphate is used to aid in the precipitation of the suspended matter. Clarified water is chlorinated whilst gravitating into a clear water storage tank from which it is pumped into the Bambill water storage dam or into the Cullulleraine reticulation system.
The 182ml storage dam at Bambill is an earthen water storage within the Millewa system, located at Bambill South which supplies operating head for the system when the treated water pumps are not operating.

The dryland area serviced by the Millewa regulated water supply covers an area of approximately 243,500 hectares. The total number of connections for the supply to the dryland farming properties is 252.

Mystic Park Water Supply System

A non-potable water system supplies the small township of Mystic Park which is located to the south of Swan Hill. In May 2008, LMW assumed responsibility for the Mystic Park untreated water supply, previously the responsibility of the Gannawarra Shire Council.

The water is sourced from nearby Kangaroo Lake before being screened and pumped to an earthen dam located within the township. A small amount of coagulant is added as the water enters the dam. This dam provides some detention time assisting in the reduction of turbidity in the water, however no disinfection is provided.

The town population is currently 29 with 12 serviced properties, including a hotel, recreation reserve and cenotaph.

APPENDIX A – WATER QUALITY TABLES

All samples were taken in reticulations unless otherwise noted.

Tables 1 to 3 contain results reporting against the standards listed in Schedule 2 of the Safe Drinking Water Regulations 2015.

Table 1 – E.coli

Water Quality Standard: All samples of drinking water collected are found to contain no Escherichia coli per 100 millilitres of drinking water, with the exception of any false positive sample.

E. coli is a microorganism that may cause illness in susceptible individuals. E. coli is associated with contamination of water supplies with faecal material and is therefore considered to be an important indicator of the safety of the water supply. Samples are taken at least weekly in each of the water sampling localities.

Water sampling locality	Frequency of sampling	Number of samples	Maximum detected (orgs/100mL)	Number of detections and investigations conducted (s.22)	Number of samples where standard was not met (s.18)
Irymple	Weekly	52	0	0	0
Kerang	Weekly	52	0	0	0
Koondrook	Weekly	52	0	0	0
Lake Boga	Weekly	52	0	0	0
Merbein	Weekly	52	0	0	0
Mildura	Weekly	116	0	0	0
Murrabit	Weekly	52	0	0	0
Nyah*	Weekly	52	0	1	0
Nyah West	Weekly	52	0	0	0
Piangil	Weekly	52	0	0	0
Red Cliffs	Weekly	52	0	0	0
Robinvale	Weekly	52	0	0	0
Swan Hill	Weekly	77	0	0	0
Woorinen South	Weekly	52	0	0	0

**Additional number of samples were taken for Mildura & Swan Hill due to the larger populations serviced by these supplies.

*A false positive was detected at Nyah standpipe of 6 orgs/100mL (Entry Point samples not shown)

Table 2 - Trihalomethanes

Water Quality Standard: Total Trihalomethanes less than or equal to 0.25 milligrams per litre of drinking water.

Trihalomethanes are compounds that may be produced when chlorine disinfectant reacts with organic material present in the water. These compounds may impact public health if they are present in drinking water in high concentrations over a long period of time. Samples are taken monthly in each of the water sampling localities.

Water sampling locality	Frequency of sampling	Number of samples	Drinking water quality standard (mg/L)	Maximum (mg/L)	Average (mg/L)	Number of samples where standard was not met (s.18)
Irymple	Monthly	12	0.25	0.07	0.045	0
Kerang	Monthly	12	0.25	0.05	0.034	0
Koondrook	Weekly	12	0.25	0.09	0.057	0
Lake Boga	Weekly	12	0.25	0.07	0.046	0
Merbein	Weekly	12	0.25	0.09	0.056	0
Mildura	Weekly	12	0.25	0.11	0.041	0
Murrabit	Weekly	12	0.25	0.06	0.037	0
Nyah	Weekly	12	0.25	0.08	0.057	0
Nyah West	Weekly	12	0.25	0.07	0.051	0
Piangil	Weekly	12	0.25	0.25	0.063	0
Red Cliffs	Weekly	12	0.25	0.10	0.057	0
Robinvale	Weekly	12	0.25	0.10	0.054	0
Swan Hill	Weekly	12	0.25	0.05	0.029	0
Woorinen South	Weekly	12	0.25	0.07	0.048	0

Table 3 - Turbidity

Water Quality Standard: The 95th percentile of results for samples in any 12-month period must be less than or equal to 5.0 Nephelometric Turbidity Units (NTU).

Turbidity measures the presence of fine suspended material present in the water and at elevated levels may result in a 'cloudy' appearance of water. Turbidity is an indirect indicator for the general quality of water and may represent fine particles such as clays, minerals or microscopic organisms. Samples are taken weekly in each of the water sampling localities.

Water sampling locality	Frequency of sampling	Number of samples	Maximum turbidity in a sample (NTU)	Maximum 95th percentile of turbidity results in any 12 months (NTU)	Number of 95th percentile of results in of results in any 12 months above standard (s.18)
Irymple	Weekly	52	0.6	0.2	0
Kerang	Weekly	52	0.3	0.1	0
Koondrook	Weekly	52	0.1	0.1	0
Lake Boga	Weekly	52	0.1	0.1	0
Merbein	Weekly	52	0.8	0.2	0
Mildura	Weekly	52	1.2	0.2	0
Murrabit	Weekly	52	0.4	0.1	0
Nyah	Weekly	52	<0.1	0.1	0
Nyah West	Weekly	52	0.2	0.1	0
Piangil	Weekly	52	0.2	0.1	0
Red Cliffs	Weekly	52	2.2	0.3	0
Robinvale	Weekly	52	0.2	0.1	0
Swan Hill	Weekly	52	0.2	0.1	0
Woorinen South	Weekly	52	<0.1	0.1	0

Tables 4 to 38 inclusive, are results reporting against the Australian Drinking Water Guidelines 2011 (ADWG), health & aesthetic guidelines.

Tables 9 to 20 & 34 to 39, inclusive, are parameters from samples taken from LMW's 9 treatment plants entering the reticulation system, 8 localities in total (Mildura & Mildura West have a combined locality, Mildura). This differs from other parameters, which show 14 localities that are supplied from a total of 9 treatment plants.

Tables 17 to 20 & 37 to 41 inclusive, which have 3 monthly scheduling, have 8 samples reported for Mildura supply as both the Mildura & Mildura West WTP's were operating simultaneously.

Tables 5, 9 to 16, 18, 19, 23, 24, & 27 to 29 inclusive, do not have averages as the average cannot be calculated from 'less than' data.

Table 4 - Fluoride

Water Quality Standard: The total concentration of fluoride in drinking water should not exceed 1.5 mg/L. Fluoride is added to the water sampling localities listed below to promote oral health under direction of DH. Fluoride samples are taken monthly in each of the fluoridated water sampling localities.

Compliance is measured as: annual average fluoride level must not exceed 1 milligram per litre and all individual samples must be less than 1.5 milligrams per litre under s.5 (3) of the Health (Fluoridation) Act 1973.

Meeting Obligation is measured as: annual average fluoride level between 0.7 – 1.0 [JK1] milligrams per litre in fluoridated systems.

Water sampling locality	Frequency of sampling	Number of samples	Drinking water quality standard (mg/L)	Target optimum operating fluoride concentration (mg/L)	Maximum (mg/L)	Average *(mg/L)	Number of samples where standard was not met (s.18)
Irymple	Weekly	52	1.5	0.8	1.00	0.73	0
Kerang	Weekly	52	1.5	0.8	0.99	0.77	0
Lake Boga	Weekly	52	1.5	0.8	0.87	0.77	0
Merbein	Weekly	52	1.5	0.8	0.87	0.70	0
Mildura	Weekly	52	1.5	0.8	0.90	0.73	0
Nyah	Weekly	52	1.5	0.8	0.88	0.77	0
Nyah West	Weekly	52	1.5	0.8	0.93	0.77	0
Red Cliffs	Weekly	52	1.5	0.8	0.91	0.70	0
Robinvale	Weekly	52	1.5	0.8	0.95	0.74	0
Swan Hill	Weekly	52	1.5	0.8	0.90	0.77	0
Woorinen South	Weekly	52	1.5	0.8	0.87	0.77	0

*No data for Koondrook, Murrabit and Piangil systems as these systems do not have fluoridation.

Table 5 - Chloroacetic Acid

Health Guideline Value (ADWG) 0.15 mg/L

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Met ADWG guideline value (Yes/no)
Irymple	Monthly	12	<0.005	Yes
Kerang	Monthly	12	<0.005	Yes
Koondrook	Monthly	12	<0.005	Yes
Lake Boga	Monthly	12	<0.005	Yes
Merbein	Monthly	12	<0.005	Yes
Mildura	Monthly	12	<0.005	Yes
Murrabit	Monthly	12	<0.005	Yes
Nyah	Monthly	12	<0.005	Yes
Nyah West	Monthly	12	<0.005	Yes
Piangil	Monthly	12	<0.005	Yes
Red Cliffs	Monthly	12	<0.005	Yes
Robinvale	Monthly	12	<0.005	Yes
Swan Hill	Monthly	12	<0.005	Yes
Woorinen South	Monthly	12	<0.005	Yes

*Note: The min/max values of this parameter have remained the same in comparison to the previous two reporting periods.

Table 6 - Dichloroacetic Acid

Health Guideline Value (ADWG) 0.1 mg/L

Water sampling locality	Frequency of sampling	Number of samples	Maximum (mg/L)	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/no)
Irymple	Monthly	12	0.022	0.013	No change	Yes
Kerang	Monthly	12	0.015	0.012	No change	Yes
Koondrook	Monthly	12	0.044	0.021	Increased	Yes
Lake Boga	Monthly	12	0.030	0.019	Increased	Yes
Merbein	Monthly	12	0.023	0.013	Increased	Yes
Mildura	Monthly	12	0.018	0.014	No change	Yes
Murrabit	Monthly	12	0.029	0.018	No change	Yes
Nyah	Monthly	12	0.012	0.070	No change	Yes
Nyah West	Monthly	12	0.007	0.006	No change	Yes
Piangil	Monthly	12	0.032	0.019	Increased	Yes
Red Cliffs	Monthly	12	0.037	0.015	No change	Yes
Robinvale	Monthly	12	0.036	0.018	No change	Yes
Swan Hill	Monthly	12	0.019	0.012	No change	Yes
Woorinen South	Monthly	12	0.016	0.012	No change	Yes

Table 7 - Trichloroacetic Acid

Health Guideline Value (ADWG) 0.1 mg/L

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/no)
Irymple	Monthly	12	0.022	0.018	No change	Yes
Kerang	Monthly	12	0.015	0.011	No change	Yes
Koondrook	Monthly	12	0.044	0.025	Increased	Yes
Lake Boga	Monthly	12	0.030	0.010	Increased	Yes
Merbein	Monthly	12	0.023	0.018	Increased	Yes
Mildura	Monthly	12	0.018	0.015	No change	Yes
Murrabit	Monthly	12	0.029	0.021	No change	Yes
Nyah	Monthly	12	0.012	0.022	No change	Yes
Nyah West	Monthly	12	0.007	0.019	No change	Yes
Piangil	Monthly	12	0.032	0.021	Increased	Yes
Red Cliffs	Monthly	12	0.037	0.020	No change	Yes
Robinvale	Monthly	12	0.036	0.020	No change	Yes
Swan Hill	Monthly	12	0.019	0.013	No change	Yes
Woorinen South	Monthly	12	0.016	0.018	No change	Yes

Table 8 - Aluminium

Aesthetic Guideline Value (ADWG) 0.2 mg/L (acid soluble)

LMW uses Aluminium Chlorohydrate or Aluminium Sulphate at our water treatment plants as a coagulant. This can result in the presence of acid soluble aluminium within drinking water. Should acid soluble aluminium exceed a concentration of 0.2 mg/L, a white gelatinous precipitate can form within the distribution network causing "milky coloured" water (depending on the pH of the water).

Water sampling locality	Frequency of sampling	Number of Samples	Maximum (mg/L)	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/no)
Irymple	Monthly	12	0.04	0.03	Decreased	Yes
Kerang	Monthly	12	0.03	0.02	No change	Yes
Koondrook	Monthly	12	0.04	0.02	Decreased	Yes
Lake Boga	Monthly	12	0.03	0.02	No change	Yes
Merbein	Monthly	12	0.06	0.02	Decreased	Yes
Mildura	Monthly	12	0.14	0.04	Decreased	Yes
Murrabit	Monthly	12	0.05	0.02	No change	Yes
Nyah	Monthly	12	0.03	0.02	No change	Yes
Nyah West	Monthly	12	0.02	0.02	No change	Yes
Piangil	Monthly	12	0.11	0.06	Increased	Yes
Red Cliffs	Monthly	12	0.04	0.02	No change	Yes
Robinvale	Monthly	12	0.15	0.04	Decreased	Yes
Swan Hill	Monthly	12	0.04	0.02	No change	Yes
Woorinen South	Monthly	12	0.04	0.02	No change	Yes

Table 9 - 2,4 Dichlorophenoxy acetic acid

Health Guideline Value (ADWG) 0.03 mg/L

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Met ADWG guideline value (Yes/no)
Kerang	6 monthly	2	<0.01	Yes
Koondrook	6 monthly	2	<0.01	Yes
Mildura	6 monthly	4	<0.01	Yes
Murrabit	6 monthly	2	<0.01	Yes
Piangil	6 monthly	2	<0.01	Yes
Red Cliffs	6 monthly	2	<0.01	Yes
Robinvale	6 monthly	2	<0.01	Yes
Swan Hill	6 monthly	2	<0.01	Yes

*Note: The min/max values of this parameter have remained the same in comparison to the previous two reporting periods.

Table 10 - Benzene

Health Guideline Value (ADWG) 0.001 mg/L

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Met ADWG guideline value (Yes/no)
Kerang	6 monthly	2	<0.001	Yes
Koondrook	6 monthly	2	<0.001	Yes
Mildura	6 monthly	4	<0.001	Yes
Murrabit	6 monthly	2	<0.001	Yes
Piangil	6 monthly	2	<0.001	Yes
Red Cliffs	6 monthly	2	<0.001	Yes
Robinvale	6 monthly	2	<0.001	Yes
Swan Hill	6 monthly	2	<0.001	Yes

*Note: The min/max values of this parameter have remained the same in comparison to the previous two reporting periods.

Table 11 - Carbon Tetrachloride

Health Guideline Value (ADWG) 0.003 mg/L

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Met ADWG guideline value (Yes/no)
Kerang	6 Monthly	2	<0.001	Yes
Koondrook	6 Monthly	2	<0.001	Yes
Mildura	6 Monthly	4	<0.001	Yes
Murrabit	6 Monthly	2	<0.001	Yes
Piangil	6 Monthly	2	<0.001	Yes
Red Cliffs	6 Monthly	2	<0.001	Yes
Robinvale	6 Monthly	2	<0.001	Yes
Swan Hill	6 Monthly	2	<0.001	Yes

*Note: The min/max values of this parameter have remained the same in comparison to the previous two reporting periods.

Table 12 - 1,2 Dichloroethane

Health Guideline Value (ADWG) 0.003 mg/L

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Met ADWG guideline value (Yes/no)
Kerang	6 monthly	2	<0.001	Yes
Koondrook	6 monthly	2	<0.001	Yes
Mildura	6 monthly	4	<0.001	Yes
Murrabit	6 monthly	2	<0.001	Yes
Piangil	6 monthly	2	<0.001	Yes
Red Cliffs	6 monthly	2	<0.001	Yes
Robinvale	6 monthly	2	<0.001	Yes
Swan Hill	6 monthly	2	<0.001	Yes

*Note: The min/max values of this parameter have remained the same in comparison to the previous two reporting periods.

Table 13 - 1,1 Dichloroethene

Health Guideline Value (ADWG) 0.03 mg/L

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Met ADWG guideline value (Yes/no)
Kerang	6 monthly	2	<0.0001	Yes
Koondrook	6 monthly	2	<0.0001	Yes
Mildura	6 monthly	4	<0.0001	Yes
Murrabit	6 monthly	2	<0.0001	Yes
Piangil	6 monthly	2	<0.0001	Yes
Red Cliffs	6 monthly	2	<0.0001	Yes
Robinvale	6 monthly	2	<0.0001	Yes
Swan Hill	6 monthly	2	<0.0001	Yes

*Note: The min/max values of this parameter have remained the same in comparison to the previous two reporting periods.

Table 14 - Pentachlorophenol

Health Guideline Value (ADWG) 0.01 mg/L

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Met ADWG guideline value (Yes/no)
Kerang	6 monthly	2	<0.001	Yes
Koondrook	6 monthly	2	<0.001	Yes
Mildura	6 monthly	4	<0.001	Yes
Murrabit	6 monthly	2	<0.001	Yes
Piangil	6 monthly	2	<0.001	Yes
Red Cliffs	6 monthly	2	<0.001	Yes
Robinvale	6 monthly	2	<0.001	Yes
Swan Hill	6 monthly	2	<0.001	Yes

*Note: The min/max values of this parameter have remained the same in comparison to the previous two reporting periods.

Table 15 - Tetrachloroethene

Health Guideline Value (ADWG) 0.05 mg/L

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Met ADWG guideline value (Yes/no)
Kerang	6 monthly	2	<0.001	Yes
Koondrook	6 monthly	2	<0.001	Yes
Mildura	6 monthly	4	<0.001	Yes
Murrabit	6 monthly	2	<0.001	Yes
Piangil	6 monthly	2	<0.001	Yes
Red Cliffs	6 monthly	2	<0.001	Yes
Robinvale	6 monthly	2	<0.001	Yes
Swan Hill	6 monthly	2	<0.001	Yes

*Note: The min/max values of this parameter have remained the same in comparison to the previous two reporting periods.

Table 16 – 2,4,6 Trichlorophenol

Health Guideline Value (ADWG) 0.02 mg/L

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Met ADWG guideline value (Yes/no)
Kerang	6 monthly	2	<0.001	Yes
Koondrook	6 monthly	2	<0.001	Yes
Mildura	6 monthly	4	<0.001	Yes
Murrabit	6 monthly	2	<0.001	Yes
Piangil	6 monthly	2	<0.001	Yes
Red Cliffs	6 monthly	2	<0.001	Yes
Robinvale	6 monthly	2	<0.001	Yes
Swan Hill	6 monthly	2	<0.001	Yes

*Note: The min/max values of this parameter have remained the same in comparison to the previous two reporting periods.

Table 17 – Sulphate

Aesthetic Guideline Value (ADWG) 250 mg/L

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/no)
Kerang	3 monthly	4	44	37	No change	Yes
Koondrook	3 monthly	4	30	27	No change	Yes
Mildura	3 monthly	8	37	20	Increased	Yes
Murrabit	3 monthly	4	2	2	No change	Yes
Piangil	3 monthly	4	1	1	Decreased	Yes
Red Cliffs	3 monthly	4	3	2	Decreased	Yes
Robinvale	3 monthly	4	47	30	No change	Yes
Swan Hill	3 monthly	4	2	1	Decreased	Yes

*Note: The min/max values of this parameter have remained the same in comparison to the previous two reporting periods.

Table 18 – Arsenic

Aesthetic Guideline Value (ADWG) 250 mg/L

Arsenic is a naturally occurring element, which can be introduced into water in the catchment through the presence of naturally occurring minerals and ores. Short and long-term exposure to arsenic may result in potential health impacts.

Water sampling locality	Frequency of sampling	Number of Samples	Maximum mg/L	Met ADWG guideline value (Yes/no)
Kerang	3 monthly	4	<0.001	Yes
Koondrook	3 monthly	4	<0.001	Yes
Mildura	3 monthly	8	<0.001	Yes
Murrabit	3 monthly	4	<0.001	Yes
Piangil	3 monthly	4	<0.001	Yes
Red Cliffs	3 monthly	4	<0.001	Yes
Robinvale	3 monthly	4	<0.001	Yes
Swan Hill	3 monthly	4	<0.001	Yes

*Note: The min/max values of this parameter have remained the same in comparison to the past two years.

Table 19 - Selenium

Health Guideline Value (ADWG) 0.01 mg/L

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Met ADWG guideline value (Yes/no)
Kerang	3 monthly	4	<0.001	Yes
Koondrook	3 monthly	4	<0.001	Yes
Mildura	3 monthly	8	<0.001	Yes
Murrabit	3 monthly	4	<0.001	Yes
Piangil	3 monthly	4	<0.001	Yes
Red Cliffs	3 monthly	4	<0.001	Yes
Robinvale	3 monthly	4	<0.001	Yes
Swan Hill	3 monthly	4	<0.001	Yes

*Note: The min/max values of this parameter have remained the same in comparison to the past two years.

Table 20 - Mercury

Health Guideline Value (ADWG) 0.001 mg/L

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Met ADWG guideline value (Yes/no)
Kerang	3 monthly	4	<0.0001	Yes
Koondrook	3 monthly	4	<0.0001	Yes
Mildura	3 monthly	8	<0.0001	Yes
Murrabit	3 monthly	4	<0.0001	Yes
Piangil	3 monthly	4	<0.0001	Yes
Red Cliffs	3 monthly	4	<0.0001	Yes
Robinvale	3 monthly	4	<0.0001	Yes
Swan Hill	3 monthly	4	<0.0001	Yes

*Note: The min/max values of this parameter have remained the same in comparison to the previous 2 reporting periods.

Table 21 - Gross Alpha Activity

Health Guideline Value (ADWG) 0.5 Bq/L

Water sampling locality	Frequency of sampling	Number of samples	Maximum Bq/L	Met ADWG guideline value (Yes/no)
Kerang	5 yearly	1	<0.05	Yes
Koondrook	5 yearly	1	<0.05	Yes
Mildura	5 yearly	2	<0.05	Yes
Murrabit	5 yearly	1	<0.05	Yes
Piangil	5 yearly	1	<0.05	Yes
Red Cliffs	5 yearly	1	<0.05	Yes
Robinvale	5 yearly	1	<0.05	Yes
Swan Hill	5 yearly	1	<0.05	Yes

*Note: 2020 results shown, samples are taken every five years from source water.

Table 22 - Gross Beta Activity

Health Guideline Value (ADWG) 0.5 Bq/L

Water sampling locality	Frequency of sampling	Number of samples	Maximum Bq/L	Met ADWG guideline value (Yes/no)
Kerang	5 yearly	1	<0.1	Yes
Koondrook	5 yearly	1	<0.1	Yes
Mildura	5 yearly	2	<0.1	Yes
Murrabit	5 yearly	1	<0.1	Yes
Piangil	5 yearly	1	<0.1	Yes
Red Cliffs	5 yearly	1	<0.1	Yes
Robinvale	5 yearly	1	<0.1	Yes
Swan Hill	5 yearly	1	<0.1	Yes

*Note: 2020 results shown, samples are taken every five years from source water.

Table 23 - Lead

Health Guideline Value (ADWG) 0.01 mg/L

Lead may occur naturally in water or be introduced through contact with lead pipes and joint fittings. Human exposure to high levels of lead may result in toxic effects.

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Met ADWG guideline value (Yes/no)
Irymple	3 monthly	4	<0.001	Yes
Kerang	3 monthly	4	<0.001	Yes
Koondrook	3 monthly	4	<0.001	Yes
Lake Boga	3 monthly	4	<0.001	Yes
Merbein	3 monthly	4	<0.001	Yes
Mildura	3 monthly	4	<0.001	Yes
Murrabit	3 monthly	4	<0.001	Yes
Nyah	3 monthly	4	<0.001	Yes
Nyah West	3 monthly	4	0.003	Yes
Piangil	3 monthly	4	0.001	Yes
Red Cliffs	3 monthly	4	<0.001	Yes
Robinvale	3 monthly	4	<0.001	Yes
Swan Hill	3 monthly	4	<0.001	Yes
Woorinen South	3 monthly	4	<0.001	Yes

*Note: The max values of this parameter for Kerang have decreased and Nyah West had an increase, while other localities stayed the same in comparison to the previous two reporting periods.

Table 24 - Nickel

Health Guideline Value (ADWG) 0.02 mg/L

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Met ADWG guideline value (Yes/no)
Irymple	3 monthly	4	<0.001	Yes
Kerang	3 monthly	4	<0.001	Yes
Koondrook	3 monthly	4	<0.001	Yes
Lake Boga	3 monthly	4	<0.001	Yes
Merbein	3 monthly	4	<0.001	Yes
Mildura	3 monthly	4	<0.001	Yes
Murrabit	3 monthly	4	0.020	Yes
Nyah	3 monthly	4	<0.001	Yes
Nyah West	3 monthly	4	<0.001	Yes
Piangil	3 monthly	4	<0.001	Yes
Red Cliffs	3 monthly	4	<0.001	Yes
Robinvale	3 monthly	4	<0.001	Yes
Swan Hill	3 monthly	4	<0.001	Yes
Woorinen South	3 monthly	4	<0.001	Yes

*Note: The min/max values of this parameter have decreased or remained the same in comparison to the previous two reporting periods except Murrabit, which saw in increase.

Table 25 - Zinc

Aesthetic Guideline Value (ADWG) 3 mg/L

Zinc may occur naturally in the environment, or may be introduced through industrial activity, as well as through corrosion of customer service piping. High levels of zinc in the water can impart taste and appearance issues with drinking water.

Water sampling locality	Frequency of sampling	Number of samples	Maximum (mg/L)	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/no)
Irymple	3 monthly	4	0.012	0.006	Increased	Yes
Kerang	3 monthly	4	0.015	0.007	Decreased	Yes
Koondrook	3 monthly	4	0.008	0.005	Decreased	Yes
Lake Boga	3 monthly	4	0.005	0.004	Increased	Yes
Merbein	3 monthly	4	0.004	0.003	Decreased	Yes
Mildura	3 monthly	4	0.005	0.004	No change	Yes
Murrabit	3 monthly	4	0.017	0.007	Increased	Yes
Nyah	3 monthly	4	0.008	0.006	Increased	Yes
Nyah West	3 monthly	4	0.022	0.016	Increased	Yes
Piangil	3 monthly	4	0.006	0.004	Decreased	Yes
Red Cliffs	3 monthly	4	0.021	0.014	Increased	Yes
Robinvale	3 monthly	4	0.009	0.006	Increased	Yes
Swan Hill	3 monthly	4	0.005	0.003	No change	Yes
Woorinen South	3 monthly	4	0.013	0.009	Decreased	Yes

Table 26 - Nitrate Nitrogen

Health Guideline Value (ADWG) 50 mg/L (as Nitrate)

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L (as Nitrate)	Average (mg/L as Nitrate)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/no)
Irymple	3 monthly	4	0.08	0.033	No change	Yes
Kerang	3 monthly	4	0.32	0.158	Increased	Yes
Koondrook	3 monthly	4	0.19	0.083	Increased	Yes
Lake Boga	3 monthly	4	0.34	0.128	Increased	Yes
Merbein	3 monthly	4	0.08	0.043	Decreased	Yes
Mildura	3 monthly	4	0.11	0.053	Increased	Yes
Murrabit	3 monthly	4	0.30	0.13	Decreased	Yes
Nyah	3 monthly	4	0.03	0.025	Decreased	Yes
Nyah West	3 monthly	4	0.04	0.028	Decreased	Yes
Piangil	3 monthly	4	0.15	0.055	Decreased	Yes
Red Cliffs	3 monthly	4	0.20	0.078	Increased	Yes
Robinvale	3 monthly	4	0.12	0.05	Increased	Yes
Swan Hill	3 monthly	4	1.60	0.483	Increased	Yes
Woorinen South	3 monthly	4	0.59	0.178	Increased	Yes

Table 27 - Cyanide

Health Guideline Value (ADWG) 0.08 mg/L

Cyanide may occur naturally in the environment or be introduced through human activity.

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Met ADWG guideline value (Yes/no)
Irymple	3 monthly	4	<0.005	Yes
Kerang	3 monthly	4	<0.005	Yes
Koondrook	3 monthly	4	<0.005	Yes
Lake Boga	3 monthly	4	<0.005	Yes
Merbein	3 monthly	4	<0.005	Yes
Mildura	3 monthly	4	<0.005	Yes
Murrabit	3 monthly	4	<0.005	Yes
Nyah	3 monthly	4	<0.005	Yes
Nyah West	3 monthly	4	<0.005	Yes
Piangil	3 monthly	4	<0.005	Yes
Red Cliffs	3 monthly	4	<0.005	Yes
Robinvale	3 monthly	4	<0.005	Yes
Swan Hill	3 monthly	4	<0.005	Yes
Woorinen South	3 monthly	4	<0.005	Yes

*Note: The min/max values of this parameter have remained the same in comparison to the previous two reporting periods.

Table 28 - Chromium

Health Guideline Value (ADWG) 0.05 mg/L
Chromium may occur naturally in the environment or be introduced through human activity.

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Met ADWG guideline value (Yes/no)
Irymple	3 monthly	4	<0.001	Yes
Kerang	3 monthly	4	<0.001	Yes
Koondrook	3 monthly	4	<0.001	Yes
Lake Boga	3 monthly	4	<0.001	Yes
Merbein	3 monthly	4	<0.001	Yes
Mildura	3 monthly	4	<0.001	Yes
Murrabit	3 monthly	4	0.005	Yes
Nyah	3 monthly	4	<0.001	Yes
Nyah West	3 monthly	4	<0.001	Yes
Piangil	3 monthly	4	<0.001	Yes
Red Cliffs	3 monthly	4	<0.001	Yes
Robinvale	3 monthly	4	<0.001	Yes
Swan Hill	3 monthly	4	<0.001	Yes
Woorinen South	3 monthly	4	<0.001	Yes

*Note: The min/max values of this parameter have remained the same in comparison to the previous two reporting periods.

Table 29 - Cadmium

Health Guideline Value (ADWG) 0.002 mg/L
Cadmium may be introduced into drinking water supplies through corrosion of pipes and fittings. Exposure to high concentrations of cadmium may result in potential health implications.

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Met ADWG guideline value (Yes/no)
Irymple	3 monthly	4	<0.0002	Yes
Kerang	3 monthly	4	<0.0002	Yes
Koondrook	3 monthly	4	<0.0002	Yes
Lake Boga	3 monthly	4	<0.0002	Yes
Merbein	3 monthly	4	<0.0002	Yes
Mildura	3 monthly	4	<0.0002	Yes
Murrabit	3 monthly	4	<0.0002	Yes
Nyah	3 monthly	4	<0.0002	Yes
Nyah West	3 monthly	4	<0.0002	Yes
Piangil	3 monthly	4	<0.0002	Yes
Red Cliffs	3 monthly	4	<0.0002	Yes
Robinvale	3 monthly	4	<0.0002	Yes
Swan Hill	3 monthly	4	<0.0002	Yes
Woorinen South	3 monthly	4	<0.0002	Yes

*Note: The min/max values of this parameter have remained the same in comparison to the previous two reporting periods.

Table 30 - Copper

Water Quality Standard: The total concentration of copper in drinking water should not exceed 2 mg/L.

Copper may occur naturally in the environment or be introduced into water through contact with corroding copper pipes and fittings.

Water sampling locality	Frequency of sampling	Number of samples	Drinking water quality standard (mg/L)	Maximum mg/L	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Number of samples where standard was not met (s. 18)
Irymple	3 monthly	4	2	0.006	0.004	Increased	0
Kerang	3 monthly	4	2	0.018	0.009	Increased	0
Koondrook	3 monthly	4	2	0.054	0.022	No change	0
Lake Boga	3 monthly	4	2	0.033	0.021	Decreased	0
Merbein	3 monthly	4	2	0.013	0.006	Increased	0
Mildura	3 monthly	4	2	0.010	0.004	Increased	0
Murrabit	3 monthly	4	2	0.012	0.007	Decreased	0
Nyah	3 monthly	4	2	0.025	0.014	Increased	0
Nyah West	3 monthly	4	2	0.087	0.063	Increased	0
Piangil	3 monthly	4	2	0.007	0.005	Decreased	0
Red Cliffs	3 monthly	4	2	0.013	0.008	Increased	0
Robinvale	3 monthly	4	2	0.015	0.009	No change	0
Swan Hill	3 monthly	4	2	0.021	0.017	Increased	0
Woorinen South	3 monthly	4	2	0.012	0.006	Decreased	0

Table 31 - Manganese

Health Guideline Value (ADWG) 0.5 mg/L

Manganese may occur naturally in the environment or may be introduced through industrial activity. Manganese may cause aesthetic issues (such as taste or staining of laundry and appliances) as well as health issues at high concentrations.

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Met ADWG guideline value (Yes/no)
Irymple	3 monthly	4	0.003	Yes
Kerang	3 monthly	4	0.003	Yes
Koondrook	3 monthly	4	0.007	Yes
Lake Boga	3 monthly	4	<0.001	Yes
Merbein	3 monthly	4	<0.001	Yes
Mildura	3 monthly	4	0.025	Yes
Murrabit	3 monthly	4	<0.001	Yes
Nyah	3 monthly	4	<0.001	Yes
Nyah West	3 monthly	4	<0.001	Yes
Piangil	3 monthly	4	<0.001	Yes
Red Cliffs	3 monthly	4	<0.001	Yes
Robinvale	3 monthly	4	0.022	Yes
Swan Hill	3 monthly	4	<0.001	Yes
Woorinen South	3 monthly	4	<0.001	Yes

Table 32 - pH

Aesthetic Guideline Range (ADWG) 6.5-8.5 pH Units

pH is the measure of the acidity (pH <7.0) or alkalinity (pH >7.0) of the water. Extreme pH values may cause corrosion or scaling in certain circumstances. High pH may also reduce the effectiveness of chlorine disinfection.

Water sampling locality	Frequency of sampling	Number of samples	Minimum pH units	Maximum pH units	Average pH units	Average change *Comparison of past 2 reporting periods	Aesthetic operating range
Irymple	Weekly	52	7	7.8	7.3	Decreased	6.5-8.5
Kerang	Weekly	52	6.9	7.6	7.2	Decreased	6.5-8.5
Koondrook	Weekly	52	7	8.8*	7.5	Increased	6.5-8.5
Lake Boga	Weekly	52	7.3	8	7.6	Increased	6.5-8.5
Merbein	Weekly	52	7	7.6	7.3	Decreased	6.5-8.5
Mildura	Weekly	52	7	7.6	7.2	Increased	6.5-8.5
Murrabit	Weekly	52	6.8	7.5	7.2	No change	6.5-8.5
Nyah	Weekly	52	7	7.6	7.3	Increased	6.5-8.5
Nyah West	Weekly	52	7	7.6	7.3	Increased	6.5-8.5
Piangil	Weekly	52	7.2	7.7	7.4	Increased	6.5-8.5
Red Cliffs	Weekly	52	6.9	7.7	7.3	Decreased	6.5-8.5
Robinvale	Weekly	52	7.1	7.8	7.4	Decreased	6.5-8.5
Swan Hill	Weekly	52	7	7.7	7.4	Increased	6.5-8.5
Woorinen South	Weekly	52	7	7.7	7.4	Increased	6.5-8.5

*Note: pH exceedance in Koondrook on 4 May 2022 due to stagnation forming in dead end main. Flushing was carried out which significantly improved water quality in the affected location.

Table 33 - Colour

Aesthetic Guideline Value (ADWG) 15 HU*

Colour generally occurs in water as a result of dissolved organic material. Although not a health consideration, elevated colour can be an aesthetic issue.

Water sampling locality	Frequency of sampling	Number of samples	Maximum Pt/Co units*	Average Pt/Co units*	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/no)
Irymple	Monthly	12	<2	<2	No change	Yes
Kerang	Monthly	12	<2	<2	No change	Yes
Koondrook	Monthly	12	<2	<2	No change	Yes
Lake Boga	Monthly	12	<2	<2	No change	Yes
Merbein	Monthly	12	<2	<2	No change	Yes
Mildura	Monthly	12	<2	<2	No change	Yes
Murrabit	Monthly	12	<2	<2	No change	Yes
Nyah	Monthly	12	<2	<2	No change	Yes
Nyah West	Monthly	12	<2	<2	No change	Yes
Piangil	Monthly	12	<2	<2	No change	Yes
Red Cliffs	Monthly	12	<2	<2	No change	Yes
Robinvale	Monthly	12	2	<2	No change	Yes
Swan Hill	Monthly	12	<2	<2	No change	Yes
Woorinen South	Monthly	12	<2	<2	No change	Yes

*Pt-Co Units = Hazen Units (HU) = PCU = Platinum Cobalt Colour

Table 34 - Iron

Aesthetic Guideline Value (ADWG) 0.3 mg/L

Iron may occur naturally in the environment, or may be introduced through industrial activity, as well as through customer service piping. High levels of iron in the water can impart taste and may stain laundry or fittings. There is no health-based guideline for iron in drinking water.

Water sampling locality	Frequency of sampling	Number of samples	Maximum (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/no)
Irymple	3 monthly	4	0.02	No change	Yes
Kerang	3 monthly	4	<0.01	No change	Yes
Koondrook	3 monthly	4	0.01	No change	Yes
Lake Boga	3 monthly	4	0.03	Increased	Yes
Merbein	3 monthly	4	0.01	Increased	Yes
Mildura	3 monthly	4	0.19	No change	Yes
Murrabit	3 monthly	4	<0.01	No change	Yes
Nyah	3 monthly	4	0.02	No change	Yes
Nyah West	3 monthly	4	<0.01	No change	Yes
Piangil	3 monthly	4	<0.01	No change	Yes
Red Cliffs	3 monthly	4	<0.01	No change	Yes
Robinvale	3 monthly	4	0.29	No change	Yes
Swan Hill	3 monthly	4	<0.01	No change	Yes
Woorinen South	3 monthly	4	<0.01	No change	Yes

Table 35 - Hardness

Aesthetic Guideline Value (ADWG) 200 mg/L (as CaCO3)

Hardness is caused by the presence of dissolved calcium compounds in water. Hard water may result in scaling issues.

Water sampling locality	Frequency of sampling	Number of samples	Maximum (mg/L)	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/no)
Kerang	3 monthly	4	39	28	Increased	Yes
Koondrook	3 monthly	4	20	19	Increased	Yes
Mildura	3 monthly	8	75	51	Increased	Yes
Murrabit	3 monthly	4	23	19	Increased	Yes
Piangil	3 monthly	4	19	18	Decreased	Yes
Red Cliffs	3 monthly	4	42	36	Increased	Yes
Robinvale	3 monthly	4	40	34	Increased	Yes
Swan Hill	3 monthly	4	21	20	No change	Yes

Table 36 - Chloride

Aesthetic Guideline Value (ADWG) 250 mg/L

Water sampling locality	Frequency of sampling	Number of samples	Maximum (mg/L)	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/no)
Kerang	3 monthly	4	15	13	Decreased	Yes
Koondrook	3 monthly	4	14	11	Decreased	Yes
Mildura	3 monthly	8	24	18	Increased	Yes
Murrabit	3 monthly	4	17	13	Decreased	Yes
Piangil	3 monthly	4	16	14	Decreased	Yes
Red Cliffs	3 monthly	4	24	22	Increased	Yes
Robinvale	3 monthly	4	20	16	Decreased	Yes
Swan Hill	3 monthly	4	18	15	Decreased	Yes

Table 37 - Sodium

Aesthetic Guideline Value (ADWG) 180 mg/L

Water sampling locality	Frequency of sampling	Number of samples	Maximum (mg/L)	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/no)
Kerang	3 monthly	4	23	19	Increased	Yes
Koondrook	3 monthly	4	20	17	Decreased	Yes
Mildura	3 monthly	8	16	12	Increased	Yes
Murrabit	3 monthly	4	9.9	8	Increased	Yes
Piangil	3 monthly	4	10	8	Decreased	Yes
Red Cliffs	3 monthly	4	12	11	Decreased	Yes
Robinvale	3 monthly	4	32	25	Decreased	Yes
Swan Hill	3 monthly	4	14	11	Increased	Yes

Table 38 - Conductivity

Aesthetic Guideline Value (ADWG) <830 µS/cm*

Water sampling locality	Frequency of sampling	Number of samples	Maximum (mg/L)	Average (mg/L)	Average change *Comparison of past 2 reporting periods	Met ADWG guideline value (Yes/no)
Kerang	3 monthly	4	220	180	Increased	Yes
Koondrook	3 monthly	4	160	140	Decreased	Yes
Mildura	3 monthly	8	210	168	Increased	Yes
Murrabit	3 monthly	4	100	91	Increased	Yes
Piangil	3 monthly	4	100	93	Decreased	Yes
Red Cliffs	3 monthly	4	170	143	Decreased	Yes
Robinvale	3 monthly	4	280	203	Increased	Yes
Swan Hill	3 monthly	4	110	103	Decreased	Yes

*Total dissolved solids 600 mg/L

Table 39 - Calcium

No guideline value

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Average (mg/L)
Kerang	3 monthly	4	9.8	6.3
Koondrook	3 monthly	4	3.8	3.5
Mildura	3 monthly	8	21	12.7
Murrabit	3 monthly	4	4.2	3.5
Piangil	3 monthly	4	3.8	3.5
Red Cliffs	3 monthly	4	9.2	7.5
Robinvale	3 monthly	4	8.7	7.0
Swan Hill	3 monthly	4	3.8	3.6

Table 40 - Alkalinity (as CaCO3)

No guideline value

Water sampling locality	Frequency of sampling	Number of samples	Maximum (mg/L)	Average (mg/L)	Average change *Comparison of past 2 reporting periods
Kerang	3 monthly	4	33	24	Increased
Koondrook	3 monthly	4	24	19	Increased
Mildura	3 monthly	8	42	31	Increased
Murrabit	3 monthly	4	24	21	Increased
Piangil	3 monthly	4	24	21	Increased
Red Cliffs	3 monthly	4	42	32	Increased
Robinvale	3 monthly	4	60	44	Increased
Swan Hill	3 monthly	4	29	25	Increased

Table 41 - Magnesium

No guideline value

Water sampling locality	Frequency of sampling	Number of samples	Maximum mg/L	Average (mg/L)	Average change *Comparison of past 2 reporting periods
Kerang	3 monthly	4	2.3	3.0	Increased
Koondrook	3 monthly	4	2.2	2.5	Increased
Mildura	3 monthly	8	2.9	4.5	Increased
Murrabit	3 monthly	4	2.1	2.5	Increased
Piangil	3 monthly	4	2.1	2.3	No change
Red Cliffs	3 monthly	4	3.3	4.1	Increased
Robinvale	3 monthly	4	3.2	3.9	Increased
Swan Hill	3 monthly	4	2.5	2.6	No change

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