



Water Quality Annual Report

2021-22

Melbourne Water

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Melbourne Water is owned by the Victorian Government. We manage Melbourne's water supply catchments, remove and treat most of Melbourne's sewage, and manage rivers and creeks and major drainage systems throughout the Port Phillip and Westernport region.





Table of Contents

- Water Supply System 4**
- Source Water..... 4**
- Drinking Water Treatment Processes 7**
- Improvement Initiatives 13**
 - Implementing Upgrades and Renewals13
 - Strategic Planning13
- Issues 14**
 - Widespread Customer Complaints.....14
 - Fluoride Notifications14
- Emergency, Incident and Event Management..... 15**
 - Issues with Known or Suspected Water Contamination.....15
 - Issues with Potential to Impact Water Supply16
- Risk Management Plan Audit Results..... 17**
- Exemptions under Section 8 of the Act 21**
- Undertakings under Section 30 of the Act 21**
- Further information 21**
- Appendix 22**
- Glossary 24**

This report is provided to the Secretary of the Department of Health (DH) in accordance with Section 26 of the *Safe Drinking Water Act 2003* (Vic) for the 2021-22 financial year.

Melbourne Water (MW) makes a vital contribution to the renowned Melbourne lifestyle by underpinning human health, enhancing community well-being, supporting economic growth and balancing the natural and man-made environment.

The organisation is responsible for the supply of affordable, high-quality water, reliable sewerage, healthy waterways, integrated drainage and flood management services and cooler greener spaces, helping make greater Melbourne a fantastic place to live.

Today, the organisation employs a passionate, truly diverse, future-focused team of experts, who collaborate with a wide range of partners to skilfully balance the social, economic and liveability needs of the community with the long-term benefit of the environment.

Melbourne Water has a solid history of foresight, ingenuity and best practice. Today, with a strong commitment to understanding and delivering to the needs of customers and the community, we are a leader in the delivery of an outstanding integrated system that is secure, efficient, affordable and sustainable.

Our key stakeholders are customers, government, regulators, other water businesses, land developers, the community and suppliers. These stakeholders and our other strategic partners, including our construction and maintenance partners and research organisations, help us achieve our objectives. We consider social, environmental and financial effects and short-term and long-term implications in all our business decisions.

We are owned by the Victorian Government, with an independent Board of Directors responsible for governance. The responsible Minister is the Minister for Water.

The Environment Protection Authority Victoria (EPA) and the Department of Health (DH) Victoria regulate the environmental and public health aspects of our business. The Essential Services Commission (ESC) regulates prices and monitors service performance. We work across several arms of the Victorian Government, including the Department of Environment, Land, Water and Planning (DELWP) and the Department of Treasury and Finance.

Our customers include Melbourne's retail water companies (Greater Western Water, GWW; South East Water, SEW; and Yarra Valley Water, YVW), regional water authorities (South Gippsland Water, SGW; Gippsland Water, GW; Westernport Water, WPW and Barwon Water, BW), local councils, land developers, and businesses that divert river water.

Melbourne Water and the retail water companies have developed risk management systems for drinking water quality using the principles of HACCP (Hazard Analysis Critical Control Point) and the quality management system standard ISO 9001. The HACCP process systematically analyses hazards and establishes measures for their control in order to ensure product quality and safety. Our commitment to delivering safe and secure high quality drinking water that meets or exceeds regulatory and customer service standards is set out in our board approved [Public Health Policy](#).

Water Supply System

We manage the harvesting of water from catchments, storage of harvest, bulk water transfer, the treatment of water, and the delivery of treated water to numerous interface points with Greater Western Water, South East Water, Yarra Valley Water, Barwon Water, South Gippsland Water and Westernport Water (SGW and WPW receive water via the Victorian Desalination Pipeline). Gippsland Water receives untreated water. In total, we supplied 447 billion litres of water in 2021-22, which is 2% more than last year. This volume included a small volume of untreated water directly from our aqueducts to connected customers supplied by Melbourne's retail water companies.

Source Water

The drinking water we supply is sourced from a combination of protected surface water catchments, unprotected surface water catchments, and seawater. Each of these source waters requires a different type of treatment to ensure that the treated water is appropriate for human consumption.

Approximately half of Melbourne's water is sourced from forested, protected catchments. The catchment system consists of 11 water supply catchments and five water holding storages. The catchments located within National Parks are co-managed with Parks Victoria, with management arrangements outlined in a National Parks Agreement. The catchments located within State Forest are co-managed with DELWP, a Memorandum of Understanding details the arrangements to effectively manage human activity and land use for the purposes of protecting water resources in State Forest. The five water holding storages are solely managed by Melbourne Water. Most of Melbourne's water is supplied via Silvan Reservoir which receives inflows from Thomson Reservoir, Upper Yarra Reservoir, O'Shannassy Reservoir and other small tributaries to the Yarra River. Historically Cardinia Reservoir has been supplied by the Silvan system however in recent years it has received a significant share of its water from the Victorian Desalination Plant (VDP), some of this water can then be used to supplement Silvan demand. Greenvale Reservoir continues to be supplied by the Silvan system. These sources are supplied to Melbourne's retail water companies unfiltered because of the high quality of water drawn from the protected catchments and large storages. As is reflected in our board approved Public Health Policy Melbourne Water is committed to "Protect Melbourne's existing drinking water sources through sustainable catchment management practices".

On average over the last 10 years approximately 25 per cent of Melbourne's drinking water has been sourced from open catchments that have mixed land uses including farming, rural properties and state forests that are open to activities such as camping and four-wheel driving. Water sourced from these catchments undergoes additional treatment to that sourced from protected catchments in order to ensure the safety of the drinking water supply.

The Tarago water supply catchment contains land that is privately owned, with a variety of agricultural uses. We have an interest in the protection and improvement of water quality on this private land and have worked with stakeholders, including the Baw Baw Shire Council and the Neerim District Landcare Group, to develop a Tarago Catchment Management Plan.

The open mid-Yarra River catchment feeds into Sugarloaf Reservoir, where it mixes with water from the protected Maroondah catchment before being treated at the Winneke Treatment Plant. The Yarra Glen supply is also fed from the Maroondah catchment; however, the transfer aqueduct is not protected, meaning that a greater degree of treatment is required prior to supply.

The Healesville supplies are from nominally protected catchments, however, water from these sources travels via open aqueducts prior to treatment at Frogley and Cresswell Treatment

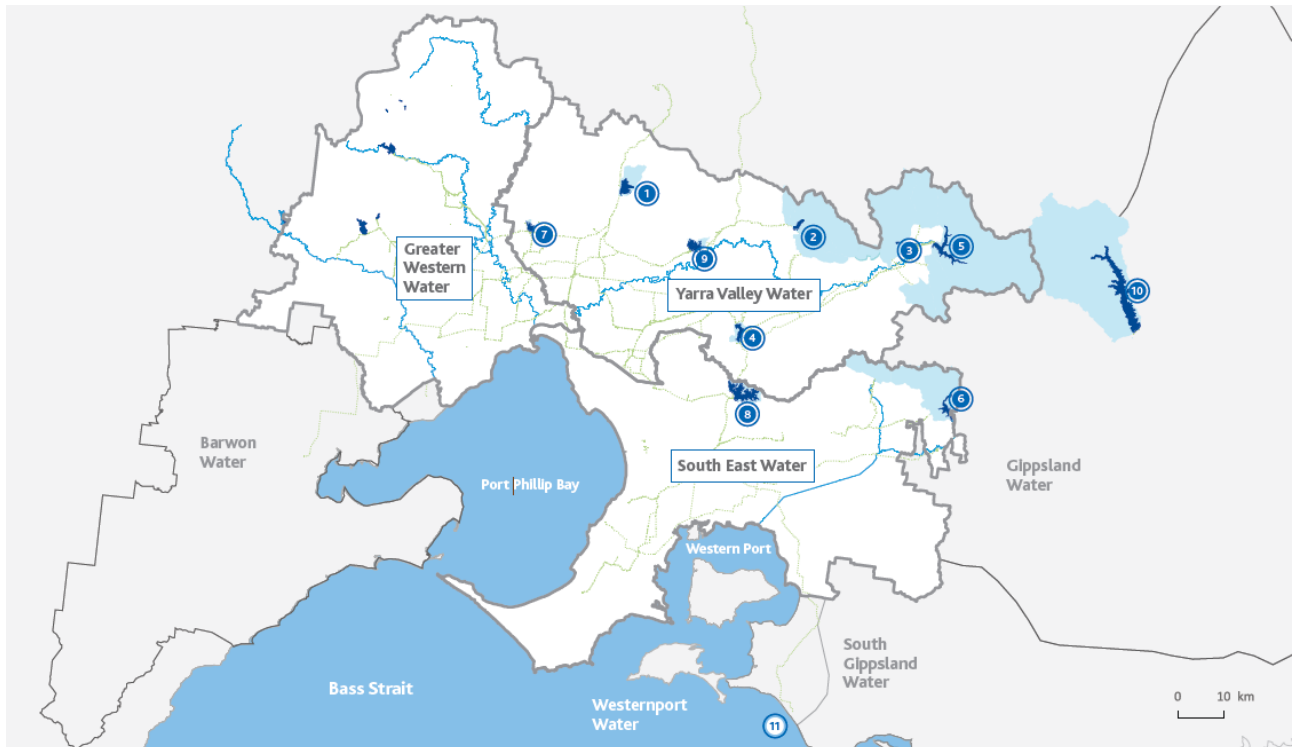
Plants. To mitigate the water quality risks posed by ingress during transit these sites also have additional treatment barriers, which remove colour and turbidity as well as potential pathogens.

Depending on the volume of water stored in Melbourne's reservoirs, Cardinia Reservoir can also receive desalinated water. The Victorian Desalination Project comprises a 150 gigalitre/year reverse osmosis plant at Wonthaggi, an 84-kilometre underground, two-way transfer pipeline to Berwick and an 87 kilometre underground dedicated power supply from Cranbourne. The plant extracts seawater from Bass Strait near Wonthaggi. Water is fully treated via a series of processes (refer to Table 1 and Table 2 on pages 9 – 12 for further details). Water enters an underground transfer pipeline which connects the plant to our existing water supply network, enabling supply to Cardinia Reservoir, directly into the water network at Berwick and to offtakes along the pipeline. The pipeline is two-way, so when the plant is not in use, the pipeline can transfer water from our distribution network to connected regional water businesses, thereby ensuring security of supply.

In the 2021-22 financial year, 125 billion litres of water was supplied by the Victorian Desalination Plant. There were no major changes in the arrangements for water supply compared to the previous financial year and the relative contribution from each source was similar to the previous year. We continued to optimise which sources we harvested from throughout the year to meet forecast demand and climate variability, as per regularly updated plans.

Figure 1 shows our supply area, supply systems and treatment processes are described in Table 1 and 2.

Figure 1 - Melbourne's water supply system



Melbourne water supply system

Water supply storage reservoirs:

- ① Yan Yean
- ② Maroondah
- ③ O'Shannassy
- ④ Silvan
- ⑤ Upper Yarra
- ⑥ Tarago
- ⑦ Greenvale
- ⑧ Cardinia
- ⑨ Sugarloaf
- ⑩ Thomson

Other sources of water:

- ⑪ Victorian Desalination Plant

- Rivers
- Water corporation boundaries
- Water supply pipelines and aqueducts

- Water supply catchment area

We manage the catchments and source water storages used for the supply of drinking water to the Melbourne metropolitan area. Untreated (supply by agreements) and treated drinking water is supplied to consumers by Melbourne’s retail water companies. The water is monitored from catchments, through major storages and treatment plants to the interface points with the retail water companies to ensure that it meets the requirements of relevant drinking water quality guidelines and agreements with these companies.

We prioritise our actions to protect source water from contamination using our drinking water quality risk assessment. The risk assessment covers catchments, storage and service reservoirs, treatment and bulk water transfer to the interface with the retail water companies. Operational monitoring is used to provide early warning of issues which could affect drinking water quality, before critical limits are reached. Examples of this monitoring include catchment inspections, manual water quality sampling and online monitoring.

We routinely monitor the water quality within the catchments and distribution system through regular sampling and analysis according to a risk-based water sampling program consistent with the requirements of regulation 8(1)(d) of the Safe Drinking Water Regulations 2015. The sampling and analysis is contracted out to external National Association of Testing Authorities (NATA) accredited Laboratories. The level of monitoring is designed to complement risk management and HACCP systems, meet the requirements of the Bulk Water Supply Agreements (BWSAs), monitor treatment processes and assist Melbourne’s retail water

companies and regional water authorities' needs in meeting the Safe Drinking Water Regulations 2015.

We maintain a certified management system, Hazards Analysis Critical Control Points (HACCP), for operation of the water treatment plants and supply system to ensure the delivery of safe drinking water. This risk-based management system verifies that treatment processes are operating in accordance with design intent and are achieving the required level of pathogen reduction.

The supply areas of Melbourne's retail water companies are divided into water sampling localities and these localities can have one or more water sources during the day or year due to the demand, seasonal variation and complexity of our water supply system. The retail water companies must comply with the Safe Drinking Water Regulations in these localities as part of their licence agreement with the Essential Services Commission.

Melbourne Water supports a balanced approach to recreation in our catchments where community benefits outweigh costs, and where any risks can be appropriately managed. During the 2021-22 financial year Melbourne Water continued to investigate options for community recreation at Yan Yean reservoir as part of the Revitalising Yan Yean Reservoir project. In April to May 2022, 936 community members contributed to the recent community engagement program. Participants highlighted the value the reservoir provides to the community, particularly noting opportunities to enjoy the scenery, peacefulness and exercise. Melbourne Water also engaged with traditional owners of the land occupied by the reservoir to understand the cultural value of the site. Should recreation go ahead any additional water quality risk will be managed through a range of holistic measures.

Drinking Water Treatment Processes

The water we supply to retail water companies is drinking water, with the exception of:

- Gippsland Water - Untreated water from our Tarago Reservoir is fed into Gippsland Water's treatment plants and then into supply for consumption by the customers.
- South Gippsland Water – Water from the VDP is supplied to South Gippsland Water via the Victorian Desalination Pipeline. This water is retreated in South Gippsland Water's treatment plants prior to being supplied to customers to ensure it meets water quality standards.
- Supply by Agreement Customers – some customers directly connect to our untreated water assets. The retail water companies have processes to ensure these customers are informed that their water is not suitable for drinking.

Water treatment plants are located where water from open storages first enters the distribution system. Whilst long retention times in storage reservoirs and primary disinfection plants help inactivate microorganisms such as pathogenic bacteria, protozoa and viruses in the untreated water, additional treatment barriers are required depending on the risk level of the water.

Chlorination and ultraviolet (UV) irradiation are the methods we use to disinfect the water. Chlorination is the most common form of disinfection used to treat Melbourne's water supply, with chlorination plants located at all of the major water treatment plants. Chlorination is effective against viruses and bacteria, and also provides a residual to control biofilm growth in the downstream network. We also operate six UV irradiation disinfection plants, which provide effective initial disinfection, but do not provide a disinfection residual for protection against downstream biofilm growth. UV disinfection at Tarago is discussed below. At Warburton (Martyr Road), Woori Yallock and Launching Place (Lusatia Park), East Warburton (Brahams Road and Lyrebird Avenue) and Yarra Junction, UV disinfection at each site provides primary disinfection, and sodium hypochlorite addition provides secondary disinfection.

Water from unprotected catchments is treated by filtration in addition to chlorine disinfection, to ensure protozoa removal. We operate two large filtration plants. Winneke is a sand filtration plant that treats water at the outlet of Sugarloaf Reservoir. It incorporates processes including coagulation, clarification, filtration and chemical addition for fluoridation, chlorination and pH correction. The Tarago Water Treatment Plant at Drouin West is gravity fed and incorporates processes including permanganate pre-dosing, coagulation, Dissolved Air Flotation and Filtration (DAFF), UV irradiation and chemical addition for pH correction, fluoridation and chlorination. At the Tarago Water Treatment Plant, UV irradiation is used as an additional barrier downstream of filtration to ensure the inactivation of protozoa.

There are three membrane filtration plants; two that supply Healesville (Frogley and Cresswell Water Treatment Plants) and one that supplies Yarra Glen. These plants remove particles in the untreated water from their respective aqueduct sources to ensure that parameters such as turbidity and colour are reduced to acceptable levels, particularly during storm events. In addition, pathogens attached to the filtered particles are removed. Reducing the turbidity to below 1 nephelometric turbidity unit (NTU) also ensures more effective chlorine disinfection of the filtered water.

Water from the Victorian Desalination Plant is treated via a series of processes which include filtration, reverse osmosis, disinfection and fluoridation.

The Yan Yean Water Treatment Plant was privately owned and operated and could supply treated water into the water supply system under our direction. Since July 2019 Melbourne Water has been responsible for its operation. The plant is not currently in operation while a capital project to upgrade the plant and reintroduce treated Yan Yean water into supply during the second quarter of 2023 continues to progress.

Eleven fluoridation plants are operated at the direction of the Department of Health to promote improved dental health outcomes in the community. The operation of the fluoridation plants is a statutory requirement under the *Health (Fluoridation) Act 1973* (Vic). These 11 plants are:

- Seven fluorosilicic acid plants operating at: Silvan (three plants), Cardinia (two plants), Winneke (one plant) and Tarago (one plant)
- Two sodium fluoride solution plants operating at Monbulk and Kallista
- The Yan Yean fluorosilicic acid plant (not currently in operation).
- The Victorian Desalination Plant which uses fluorosilicic acid. AquaSure operates the Victorian Desalination Plant under a public private partnership project managed by DELWP.

Secondary disinfection chlorination plants are also located at a number of points within the treated water network. The primary purpose of secondary disinfection is to provide an additional barrier to protect against minor ingress into the distribution network. Secondary benefits include increased chlorine residuals downstream of treated water storages, prevention of taste and odour problems and minimisation of biofilm growth within the closed distribution system where the water has already been treated by primary disinfection.

Tables 1 – 2 describe the water treatment sources, treatment processes and substances added at each treatment plant.

Table 1: Summary of water supply systems and areas serviced

Water Supply System	Source Water / Catchment	Storage	Treatment Plant	Treatment Storages	Area Supplied <i>(Retail water company supplied)</i>
Cardinia	Transfer from Silvan Reservoir without being treated at Silvan water treatment plant Treated water from Desalination plant	Cardinia Reservoir	Cardinia	N/A	Mornington Peninsula and south eastern suburbs. Note: pump station at Cardinia can also pump water back to Silvan Reservoir <i>(South East Water, Yarra Valley Water, South Gippsland Water and Westernport Water)</i>
Victorian Desalination Plant	Desalination plant offtake from Bass Strait	Direct to supply or Cardinia Reservoir	Wonthaggi Desalination Plant	Cardinia Reservoir / direct supply to townships	Capable of supplying primarily Mornington Peninsula, south eastern suburbs and South Gippsland area through direct delivery points and contributing to water businesses connected to the Melbourne Water supply through Cardinia Reservoir which is blended with catchment supplies. <i>(South East Water, Yarra Valley Water, South Gippsland Water and Westernport Water)</i>
Greenvale	Transfer from Silvan Reservoir (after treated at Silvan), or from Winneke water treatment plant. See Silvan and Winneke water supply systems	Greenvale Reservoir	Greenvale St Albans	N/A	Western suburbs and Sunbury/Melton <i>(Greater Western Water, Yarra Valley Water, Barwon Water)</i>
			Greenvale-Yuroke	N/A	
Lower Yarra Valley Townships	Maroondah Catchment	Maroondah Reservoir	Yarra Glen	Yarra Glen Service Reservoir	Yarra Glen <i>(Yarra Valley Water)</i>
Lower Yarra Valley Townships	Coranderrk and Graceburn Catchments	N/A	Cresswell	Cresswell Service Reservoir	Healesville <i>(Yarra Valley Water)</i>
			Frogley	Frogley Service Reservoir	

Water Supply System	Source Water / Catchment	Storage	Treatment Plant	Treatment Storages	Area Supplied <i>(Retail water company supplied)</i>
Silvan	Thomson Catchment Upper Yarra Catchment O'Shannassy Catchment Armstrong Catchment McMahons Catchment Starvation Catchment Coranderrk Catchment Treated water from Desalination plant via Cardinia	Silvan Reservoir	Silvan-Olinda Silvan-Preston Silvan-Waverley	N/A	Eastern, central, northern & western suburbs, including Seville and Wandin <i>(Greater Western Water, South East Water, Yarra Valley Water)</i>
			Monbulk	Monbulk Service Reservoir 1 & 2	Monbulk, Silvan, Sherbrooke, Sassafras, Ferny Creek, Olinda, Mount Dandenong <i>(Yarra Valley Water)</i>
			Kallista	Johns Hill Service Reservoir	Emerald, Kallista, Menzies Creek, Cockatoo <i>(Yarra Valley Water)</i>
Tarago	Tarago Catchment	Tarago Reservoir	Tarago	Tarago Clearwater Reservoir	Neerim South, Drouin/Warragul <i>(Gippsland Water)</i> Mornington Peninsula, West Gippsland townships, southern suburbs <i>(South East Water)</i>
Upper Yarra Valley Townships	Thomson Catchment Upper Yarra Catchment Silvan Reservoir via Monbulk pump station ¹	Thomson Reservoir Upper Yarra Reservoir	Brahams Rd Lusatia Park Lyrebird Martyr Rd Yarra Junction	N/A	Woori Yallock, Launching Place, Yarra Junction, Warburton, East Warburton <i>(Yarra Valley Water)</i> ¹
Winneke	Transfer from Maroondah Reservoir, Yarra River, Goulburn River ²	Sugarloaf Reservoir	Winneke	Winneke Clearwater Reservoir	Northern, eastern, central & western suburbs <i>(Greater Western Water, South East Water, Yarra Valley Water)</i>

¹ In response to elevated turbidity in the Upper Yarra Reservoir (UY) supply to the Upper Yarra Valley Townships was temporarily switched from UY to Silvan Reservoir via Monbulk pump station beginning 18 June 2021. Fluoride was first detected at Lusatia Park Treatment Plant indicating the arrival of Silvan water on 5 July 2021. This supply arrangement continued until water quality in the Upper Yarra Reservoir returned to normal, ending on 29 September 2021. Routine sampling taken on 6 October 2021 verified that no Silvan water remained.

² This source is only used when the relevant conditions specified in the Statement of Obligations (System Management) are met, and was not used this year.

Table 2: Water treatment processes and added substances at each drinking water treatment plant

Water Supply System	Treatment Plant	Treatment Process	Added Substances	Role of Each Process
Cardinia	Cardinia 1400 Cardinia 1700	Chlorination	Chlorine gas / Sodium hypochlorite ³	Disinfection
		Fluoridation	Fluorosilicic acid	Provide dental health benefit
		pH Correction	Hydrated Lime	pH correction
Victorian Desalination Plant	Wonthaggi Desalination Plant	Coagulation /Flocculation	Ferric sulphate / Sulphuric acid / Polydadmac	Improve performance of filtration
		Filtration (Drum screens, dual media pressure filters, cartridge filters)	-	Protect RO membranes
		Reverse Osmosis	Antiscalant / Sodium hydroxide/ Sodium bisulfite	Removal of salts from the water
		Reverse Osmosis Cleaning	Membrane cleaning chemicals (caustic, detergent, acid)	Maximise performance of RO
		Chlorination	Chlorine gas	Disinfection
		Fluoridation	Fluorosilicic acid	Provide dental health benefit
		Remineralisation	Hydrated lime / Carbon dioxide	Stabilise water and pH correction
		Membrane preservation	Sodium bisulfite	Protect membranes when not in use
		Sludge thickening/dewatering	Polymer	Washwater recovery
Greenvale	Greenvale St Albans Greenvale Yuroke	Chlorination	Sodium hypochlorite	Disinfection
Lower Yarra Valley Townships	Cresswell Frogley Yarra Glen	Coagulation / flocculation	Aluminium chlorohydrate	Colour & organics removal
		Membrane ultrafiltration	-	Remove pathogens/turbidity
		Membrane cleaning	Citric acid / Sodium hypochlorite	Optimise membrane performance
		Chlorination	Sodium hypochlorite	Disinfection
		pH correction	Sodium carbonate	pH correction
Silvan	Silvan-Olinda Silvan-Preston Silvan-Waverley	Chlorination	Chlorine gas / Sodium hypochlorite ⁴	Disinfection
		Fluoridation	Fluorosilicic acid	Provide dental health benefit
		pH correction	Hydrated Lime	pH correction
	Monbulk	Chlorination	Sodium hypochlorite	Disinfection

³ Occasional use of Sodium hypochlorite when required as additional residual or when Chlorine gas dosing is offline.

Water Supply System	Treatment Plant	Treatment Process	Added Substances	Role of Each Process
	Kallista	Fluoridation	Sodium fluoride	Provide dental health benefit
Tarago	Tarago	Pre-treatment chemical dosing	Powdered activated carbon / hydrated lime / carbon dioxide	Optimise treatment plant performance
		Coagulation/flocculation	Aluminium chlorohydrate / PolyDADMAC / Polyacrylamide	Improve filter performance
		Dissolved air flotation filtration (DAFF)	-	Removal of pathogens/turbidity
		Chlorination	Chlorine gas	Disinfection
		Ultraviolet (UV) irradiation	-	Disinfection
		Fluoridation	Fluorosilic acid	Provide dental health benefit
		pH correction	Hydrated Lime / Carbon dioxide	pH correction
		Sludge thickening / dewatering	Polyacrylamide	Washwater recovery
		Iron / manganese removal	Potassium permanganate	Removal of iron and manganese
Upper Yarra Valley Townships	Brahams Rd Lusatia Park Lyrebird Ave Martyr Rd Yarra Junction	Ultraviolet (UV) irradiation	-	Disinfection
		Chlorination	Sodium hypochlorite	Secondary disinfection to provide a chlorine residual to customer tap
Winneke	Winneke Treatment Plant	Coagulation / flocculation	Aluminium sulphate / Polymer	Colour & organics removal
		Clarification	-	Remove pathogens / turbidity
		Rapid media filtration	-	Remove pathogens / turbidity
		Chlorination	Sodium Hypochlorite	Disinfection
		Fluoridation	Fluorosilic acid	Provide dental health benefit
		pH correction	Hydrated Lime	Optimise disinfection, and pH correction
		Sludge thickening / dewatering	Polyacrylamide	Washwater recovery
Distribution network	Various secondary treatment plants	Secondary disinfection	Sodium hypochlorite	Secondary disinfection
		Alkalinity adjustment	Sodium Hydroxide/Hydrated lime/Carbon Dioxide	Optimise alkalinity, pH correction

Improvement Initiatives

Melbourne Water aims to continually improve our drinking water quality. To that end a number of improvement initiatives significant to water quality were approved, planned or delivered over the 2021-22 period.

Implementing Upgrades and Renewals

Significant plant upgrades and renewal works have been initiated, progressed or delivered across 2021-22 included:

- An options assessment was completed investigating filter refurbishment options for the Winneke water treatment plant rapid gravity filters. Melbourne Water are considering upgrades to improve backwash effectiveness as well as alternate media options that will improve resilience to raw water quality changes and ensure reliable throughput under a broader envelope of operating conditions. Pilot plant trials have been underway since early 2022, to assist in confirming the scope of the upgrade.
- Likewise work on the Winneke UV treatment plant remains on track. This new UV treatment plant will ensure achievement of the internationally-accepted microbial health based target, one microDALY per person per year, adopted in Melbourne Water's 2017 Drinking Water Quality Strategy. Funding was allocated in the 2021 pricing submission and we anticipate completion of construction and commissioning in 2024.
- A number of safety and resilience upgrades of critical disinfection systems at Silvan treatment plant were delivered in 2021/22. These included renewal of chlorine gas handling and control systems, installation of an additional interim back-up generator and renewal of the primary emergency generator and, improved short term back up disinfection capability with an independent power supply and disinfectant source.
- An interim sodium hypochlorite emergency dosing unit that will provide disinfection contingency to the Cardinia supply begun its construction in 2022 and we anticipate completion of construction and commissioning in 2023.
- Work on the Mt Evelyn Water Treatment Plant, which will provide additional disinfection resilience to the Silvan supply, continues to progress. Construction of this plant is scheduled to begin in 2023 and plant completion and commissioning is scheduled for early 2024.
- In July 2019, Melbourne Water took over the Yan Yean treatment plant, previously owned by Trility Pty Ltd. The plant is not currently in operation while a capital project to upgrade the plant and reintroduce treated Yan Yean water into supply during 2023 continues to progress.

Strategic Planning

Drinking Water Quality Improvement Program

Though Melbourne Water continues to provide world class drinking water there are always opportunities for improvement. A number of strategic reviews were completed in 2021 that systematically evaluated the performance of Melbourne Water's Drinking Water Quality Management System. These reviews identified key opportunities for improvement, which have been translated into work packages and assigned to project managers across the organisation, for delivery.

In order to ensure a coordinated and risk driven response, these improvement opportunities have been drawn into a single Drinking Water Quality Improvement Program (DWQIP) spanning Melbourne Water's planning, service delivery and safety groups. Thematic areas of

focus include improvements in foundational activities, core business processes, short and long term risk interventions, and emergency response.

Additionally, a Joint Action Plan is being drafted with the water retailers, DH and DELWP to track completion of improvement actions identified from the Silvan disinfection failure investigation. Though this plan remains in draft Melbourne Water has begun to progress or complete some of the key OFIs identified including upgrades to system resilience and, incident and emergency planning, preparedness and response.

Drinking Water Quality Strategy Refresh

Melbourne Water's current Drinking Water Quality Strategy was finalised in 2017 and sets out a framework and methodology to meet tolerable risk targets, service levels and legislative obligations.

We are currently updating the 2017 strategy to reflect insights gleaned since its inception and to align with government policy directions. The refreshed Drinking Water Quality Strategy will retain and build on the objectives of the current strategy to drive continuity of supply, source management actions, and to continue innovating and building trust with our customers, regulators and stakeholders. A new objective is also proposed to highlight the importance of monitoring and enhancing the resilience of the water supply system to bushfires, storms, and other extreme events. Stakeholder consultation is underway and will continue into 2022-23 when the updated Drinking Water Quality Strategy will be finalised.

Issues

Widespread Customer Complaints

There were no events causing or with the potential to cause widespread customer complaint reportable under section 22 of the *Safe Drinking Water Act 2003* in 2021-22

Fluoride Notifications

Melbourne Water made two notifications to DH and the retail water companies during the reporting period as required by the *Code of Practice for Fluoridation of Drinking Water Supplies* (Vic). A notification made in the 2020-21 reporting period also carried over to this year.

- The fluoride concentration at the Kallista fluoride plant dropped below the 12 month rolling average fluoride concentration target operating range of 0.8-1.0 mg/L between 5 July and 25 July 2021. This was caused by an extreme weather event interrupting power supply and fluoride dosing for over two days with further subsequent short term dosing interruptions caused by variation in the background fluoride concentration related to the Cardinia-Silvan pump station works. As the interruption was brief and caused by a severe weather event no further corrective action was required.
- As notified to DH in June 2021, the Monbulk fluoride plant 12 month rolling average fluoride concentration was impacted by the contingency plan requirements during both Upper Yarra Turbidity events in August 2020 and June 2021 during which fluoride dosing was ceased. The Monbulk fluoride plant and contingency supply arrangements were reverted back to normal operation in October 2021.

As the Monbulk supply is a pumped system the stop start nature means a greater duration of operation is required to see the average fluoride concentration return into the target operating range of 0.8 mg/L to 1.0 mg/L. This in turn caused the 12 month rolling average fluoride concentration to remain below the target operating range throughout the 2021-22

reporting period. It is anticipated that the 12 month rolling average will return to the target range by September 2022.

- The Winneke fluoride plant automatically shut down following an increase in measured fluoride concentration above the critical limit of 1.5mg/L on 17 January 2022. The excursion began shortly after plant start up and lasted approximately 6 minutes with a peak measured fluoride concentration of 1.9 mg/L. The outlet concentration of the Winneke Clearwater storage reservoir was monitored throughout and remained within the target operating range and therefore there was no impact to customers supplied by this treatment plant.

Root cause investigation found that the reading was a false high caused by excess lime water left in the dosing line following a brief treatment plant shut down. When the treatment plant started back up this dose water was injected into a relatively low outlet flow volume causing a pH spike which in turn impacted the fluoride probe pH buffering leading to a false high reading. This was verified by dose calculations. To prevent recurrence of this issue the fluoride plant start up time delay has been extended to allow the pH line to completely flush before fluoride is dosed ensuring an accurate fluoride concentration reading.

Emergency, Incident and Event Management

Issues with Known or Suspected Water Contamination

Melbourne Water reported two instances of known or suspected contamination as required by Section 22 of the *Safe Drinking Water Act 2003*:

Tyabb Service Reservoir Cover Tear

A Section 22 report was submitted to DH on 1 November 2021 to report the potential for contamination of the drinking water supply due to a tear in the floating cover on the west basin of the Tyabb Reservoir.

Upon completing a regular weekly drinking water quality and security inspection of the Tyabb Reservoir secondary dosing plant on Monday 1 November 2021 the operator conducting the inspection noticed a 20 cm tear in the floating cover of the West basin. Investigation revealed that the most likely cause of the tear was high winds dislodging some equipment including the dewatering pump basket and foot valve assembly from the cover in the early morning of Friday 29 October 2021. It was assumed that any surface water that had pooled on the cover in the area of the tear could have entered the basin.

Corrective actions included isolating the west basin of the reservoir from supply, notifying South East Water (SEW) of the issue, taking water samples for analysis and inspection of basin internals using a remotely operated vehicle (ROV).

As the secondary disinfection plant was operating normally during the period of interest (inlet free chlorine set point of 1.20 mg/l and outlet readings of between 0.85 – 1.1 mg/L), the reservoir fence was secure with no signs of animal ingress and the ROV inspection found no evidence of contamination, it was concluded that physical and chemical hazards to water quality were unlikely to be present and the only likely causes of biological contamination was bacteria from birds. Calculations based on the minimum measured outlet free chlorine residual and minimum basin residence time found a minimum Ct of 98.1 mg.min/L which is more than sufficient to kill the bacterial pathogens of concern, as such a boil water notice was not required.

Subsequent analysis of the water samples taken from the basin supported this assessment, finding residual chlorine concentrations between 0.9 and 1.0 mg/L, physical and chemical characteristics within the normal range and no positive detections of *E.coli* or coliforms for all samples. This was supported by downstream sampling undertaken by SEW which also found no *E.coli* or Coliforms, refer to the SEW annual report.

Following repair of the cover and subsequent physical, chemical and microbiological sampling, the West basin was returned to service on 17 December 2021 as supported by DH on the same day. The risk of this fault recurring at other basins with a similar design was assessed and where required modifications made to reduce the risk of recurrence. An additional protocol for Service Reservoir inspections following storm events has also been implemented.

Montrose Reservoir *E. coli* detection.

A Section 22 report was submitted to DH on 11 December 2021 to report potential contamination of the drinking water supply following detection of 1 org/100ml *E.coli* and 2 cfu/100ml Coliforms in a sample taken from the Montrose Reservoir on 10 December 2021. Chlorine residual was found to be normal at 0.94 mg/L.

On the return of this positive result the reservoir was resampled and treatment plant performance, raw water quality, treated water quality and maintenance activities at Montrose Reservoir were reviewed and found to be normal. South East Water and Yarra Valley Water were also notified and performed their own sampling finding no *E.coli* or coliforms, refer to their respective 2021-22 annual reports for more information. Analysis of the repeat samples was negative for *E.coli* and had free chlorine residuals between 0.43 mg/L – 1.14 mg/L.

Further investigation found that the Montrose reservoir sample tap did not have a dust cap fitted and identified some trees overhanging the sample tap that may have contributed to environmental contamination. A dust cap has since been fitted and the trees trimmed so they no longer overhang the sampling location. Since these changes were made there have been no further *E. coli* detections at this location. Based on this assessment and lack of repeat results the most likely cause was considered to be a non-representative sample.

Issues with Potential to Impact Water Supply

COVID-19

As the pandemic continued into 2021-22, Melbourne Water adapted and managed our operations to ensure our essential services continued without interruption, and that our business remained resilient to COVID-19 infection waves.

We adapted workforce segregation to maintain operational resilience for our services and supply lines and accessed government permits to ensure Melbourne's critical infrastructure and services were maintained. Throughout this uncertain period, our workforce was also able to flex with changing Victorian Government policies, including vaccination mandates.

These strategies, along with the wider Victorian restrictions, have limited the risk of transmission to our essential workers and allowed us to fully satisfy the requirements of our Risk Management Plan while providing reliable, safe drinking water throughout the pandemic.

Upper Yarra Reservoir Turbidity Event

June 2021

As reported in the 2020-21 Annual Water Quality Report Melbourne Water's operational area was impacted by heavy rainfall and very strong winds over several consecutive days beginning 9 June 2021.

Strong winds disrupted mains power supply to 10 water treatment sites and three pump stations for periods of up to 14 days. Catchment runoff following heavy rain impacted on raw water quality, most significantly in the Upper Yarra Reservoir where high turbidity restricted its use for drinking water for a period of time due to the inability to guarantee treatment efficacy and aesthetic concerns. There was also significant storm damage in the Upper Yarra, Thomson and Silvan water supply catchments with 60ha of the Silvan catchment particularly heavily impacted.

In order to guarantee continuation of supply to the Yarra Valley townships water from the Silvan Reservoir was supplied via reverse flow pumping arrangements up the Yarra Valley Conduit, rather than the normal gravity fed supply from Upper Yarra Reservoir. Silvan reservoir levels were supplemented by pumping additional water to Silvan reservoir from Cardinia reservoir and changing some distribution network supplies from Silvan treatment plant water to Greenvale or Winneke treatment plant.

This reverse flow arrangement commenced on 18 June 2021 and first reached drinking water supply customers on 5 July 2021, as evidenced by fluoride monitoring at Lusatia Park treatment plant. Melbourne Water closely monitored water quality in the Upper Yarra Reservoir and restored normal supply arrangements to the Yarra Valley township sites on 29 September 2021 with subsequent water quality sampling on 6 October 2021 verifying that fluoride was no longer present after normal supply was restored.

Melbourne Water undertook a significant recovery effort to assess damage and prioritise repairs once the acute phase of the incident had completed. Key elements included restoring damaged security fences, unblocking and repairing roads, removal of fallen trees to prevent bushfire risk and removing high risk trees to make the area safe.

Risk Management Plan Audit Results

In 2020 Melbourne Water's drinking water risk management plan was audited against the requirements of the *Safe Drinking Water Act 2003* (the Act) and *Safe Drinking Water Regulations 2015* (the Regulations) for the period 31 May 2018 to 28 August 2020. The audit found Melbourne Water to be fully compliant with the requirements of the Act and the Regulations and noted ten Opportunities For Improvement (OFI). A copy of the audit certificate is provided in the appendix to this document.

Melbourne Water has committed to corrective actions to address each of the ten OFIs identified during the previous audit, the OFIs are summarised in Table 3 along with the associated corrective actions. Where a similar OFI carried over from the previous 2018 audit it has been identified via a foot note.

Table 3: 2020 RMP Audit Opportunities for Improvement

Opportunity for Improvement	Corrective Action	Completion Data
Develop improved condition monitoring, metrics and maintenance program for aqueduct catch drains.	Melbourne Water has an existing asset management inspection and maintenance regime in place for aqueducts which includes consideration of catch drain performance. An additional independent review of critical catch drain condition has also been completed along with an internal review and enhancement of existing programmed maintenance regimes.	Completed during 2021-22
Develop improved monitoring and metrics for activity in protected catchments and ensure activity is as low as reasonably practicable.	MW implemented an expanded security program beginning in November 2020 that includes enhanced security patrols, inspections and CCTV. MW has also hired a dedicated security professional in 2021 to deliver a number of longer term catchment security enhancements.	Completed during 2021-22
Implement a system to ensure outdated reagents and standards are not used.	Relevant SOPs require operators to check that reagents are in date before use. A review of reagents stored on site was completed and expired reagents safely disposed of following audit in August 2020. This activity continues to be reviewed as part of internal and external audits.	Completed during 2021-22
Consider covering or increasing launder cleaning of Winneke clarifiers.	A new launder cleaning methodology has been established and an appropriate cleaning frequency in line with other clarifier maintenance determined. Internal launder cleaning was completed for the first clarifier in July 2021 with the remainder to be completed during planned clarifier shutdowns over coming maintenance periods targeting completion of all clarifiers in 2023/24.	Completed during 2021-22

Opportunity for Improvement	Corrective Action	Completion Data
Develop a process for rapid alignment between SCADA set points and RMP documentation where either of them change.	<p>HACCP set points and targets were reviewed and updated at all treatment plants to standardise the controls and verify RMP documentation is accurate following the audit which was completed in December 2020.</p> <p>Three yearly preventative maintenance tasks to review set points have also been established for each primary treatment site to compare SCADA set points and documentation to prevent recurrence of this issue.</p>	Completed during 2020-21
Set clear and tangible metrics relating to Winneke clear water storage protection against ingress.	Melbourne Water has an existing condition assessment program in place for the Winneke clear water storage that sets inspection dates based on risk. The East tank was inspected in July 2022 and has been returned to service. The West tank is due for inspection in 2023.	Completed during 2021-22
Enhance SOP for reservoir and aqueduct inspections with respect to ingress protection ⁴	<p>The reservoir and aqueduct inspection SOP has been updated and split into two with a dedicated SOP for Service Reservoirs and a separate SOP for Aqueducts/Storage Reservoirs now published.</p> <p>An intensive service reservoir inspection program was also undertaken to proactively identify and address issues and completed in March 2022.</p>	Completed during 2021-22
Enhance SOP for reservoir and aqueduct inspections with respect to vegetation and debris management ⁴	As above the SOP has been updated and a dedicated SOP for Aqueducts and Storage reservoirs has been published.	Completed during 2021-22

⁴ Note there was a similar unclosed OFI from 2018 audit that has also been addressed by this corrective action.

Opportunity for Improvement	Corrective Action	Completion Data
Consider implementing system to improve logbook clarity.	Planned transition to digital forms is underway targeting completion in 2022-23	2022-23
Consider benchmarking chlorate and organic DBPs against global norms.	A project to review our dataset and benchmark it against both Australian and International guidelines has been completed. The review found no detections of disinfection by-products above relevant Australian guideline values in the Melbourne Water network.	Completed during 2021-22

Exemptions under Section 8 of the Act

No exemptions were in place during the year.

Undertakings under Section 30 of the Act

No undertakings were entered into or completed during the year and there were none in place from previous years.

Further information

This report and further information regarding drinking water quality is available on our website at www.melbournewater.com.au or by contacting the customer service team:

Telephone: 131 722
Translation Service: 131 450
Speak and Listen: 1300 555 727
Fax: (03) 9600 1192
Email: enquiry@melbournewater.com.au
Mail: Melbourne Water
PO Box 4342
Melbourne, Victoria 3001

Appendix

Risk management plan audit certificate

Safe Drinking Water Regulations 2015 - Regulation 10

Certificate Number: 168

Audit period: 31 May 2018 to 28 August 2020

To: Sylvia Campbell, Technical Management Systems Lead

Melbourne Water, 990 La Trobe Street, Docklands, Melbourne 3008

Australian Business Number (ABN): 81 945 386 953

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

Melbourne Water has complied with the obligations imposed by section 8(1) of the *Safe Drinking Water Act 2003* during the audit period.

Signature of approved auditor: D Deere Date: 28 Aug 2020



Certificate of Registration

CODEX HACCP: 2003

This is to certify that:

Melbourne Water Corporation
990 La Trobe Street
Docklands, Melbourne VIC 3008

Holds Certificate Number:

HACCP 694181

and have implemented a HACCP system according to the Codex Recommended International Code of Practice - General Principles of Food Hygiene - CAC/RCP 1-1969 (Rev. 4-2003) for the following scope:

Management of catchments, reservoirs, treatment facilities and transfer networks for the wholesale supply of drinking water and treatment facilities for the supply of Class A recycled water.

For and on behalf of BSI:



Marc Barnes, Managing Director, BSI Group ANZ

Original Registration Date: 2018-11-06

Latest Revision Date: 2021-07-30

Effective Date: 2021-03-03

Expiry Date: 2023-09-30

Page: 1 of 1

...making excellence a habit.™

This certificate was issued electronically and remains the property of BSI Group ANZ Pty Limited, ACN 078 659 211 and is bound by the conditions of contract. This certificate can be verified at www.bsi-global.com/clientdirectory. Printed copies can be validated at www.bsi-global.com/ClientDirectory. Further clarifications regarding the scope of this certificate and the applicability of CODEX HACCP: 2003 requirements may be obtained by consulting the organization. This certificate is valid only if provided original copies are in complete set.

Information and Contact: BSI Group ANZ Pty Limited, ACN 078 659 211: Suite 1, Level 1, 54 Waterloo Road, Macquarie Park, NSW 2113
A Member of the BSI Group of Companies.

Glossary

Term	Definition
Aqueduct	An open channel used for water transfer between harvesting reservoirs and storage reservoirs
Bulk Water Supply Agreement	Agreements between Melbourne Water and retail water companies which outline the drinking water quality specifications required for treated water at the interface points with retail water companies.
Bulk water transfer	Transfer of raw or treated water between storage reservoirs
COVID-19	A novel Coronavirus discovered in December 2019 which was implicated in a global pandemic in 2020
<i>E. coli</i>	<i>Escherichia coli</i> , a bacteria found in the intestines of humans and animals. <i>E. coli</i> is used as an indicator for the presence of other more harmful bacteria
HACCP	Hazard Analysis Critical Control Point – a set of principles to manage risk in product quality of food and water production
Holding storage	A reservoir that receives water from a harvesting reservoir, that is used to store water prior to treatment. Water level in holding storages is controlled by Melbourne Water to meet drinking water demands.
ISO 9001	An international standard for certification of a quality management system. The standard is used by organizations to demonstrate their ability to consistently provide products and services that meet customer and regulatory requirements and to demonstrate continuous improvement.
Microbial Health-Based Target	Health-based targets are measurable health, water quality or performance objectives that are established based on a judgement of safety and on risk assessments of waterborne hazards, in this case microbial hazards.
MicroDALY	DALY stands for Disability Adjusted Life Years. It is a metric used by the World Health Organisation to quantify the impact of a burden of disease on a population. A microDALY is one millionth of one DALY.
Pathogen	A microbe (bacteria, virus or protozoa) that can cause illness or disease
Raw Water	Water that has not yet been treated
Retail water company	Water Agencies that receive treated drinking water from Melbourne Water's transfer network and supply it to customers via distribution mains
Source water	Raw water that feeds into a treatment plant which may originate from different sources (eg protected or unprotected catchments)