Victorian Water Accounts

2020-2021

A statement of Victorian water resources

VICTORIA State Government
Environment, Land, Water and Planning

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Acknowledgment

We acknowledge and respect Victorian Traditional Owners as the original custodians of Victoria's land and waters, their unique ability to care for Country and deep spiritual connection to it. We honour Elders past and present whose knowledge and wisdom have ensured the continuation of culture and traditional practices.

We are committed to genuinely partner and meaningfully engage with Victoria's Traditional Owners and Aboriginal communities to support the protection of Country, the maintenance of spiritual and cultural practices and their broader aspirations in the 21st century and beyond.

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Victorian Water Accounts 2020–2021

A statement of Victorian water resources

Foreword

The *Victorian Water Accounts 2020–2021* are the eighteenth in a series of reports that communicates to the public how Victoria's water resources are sustainably managed and shared.

We know we cannot assume that our climate will remain the same. In light of the long-term challenges of a warming, drying climate and a growing population, Victorians need accurate information about water availability and use that highlights the many sources of, and demands for, water.

This year's accounts tell the story of more rainfall and higher levels of water availability than in the previous year. Victorians experienced a spring-summer La Niña that brought significant rainfall across most of the state. Below-average rainfall persisted, however, in the north-west of the state.

This higher water availability during the year led to Victorian storages holding about 1,400 GL more water at the end of the water year compared to the start. A large proportion of this was in the Murray system. Victorian towns did not experience any restrictions beyond permanent water-saving rules, while seasonal water determinations were higher and there were fewer restrictions on diversions from unregulated streams.

The *Victorian Water Accounts 2020–2021* show that the total volume of surface water, groundwater, recycled water and desalinated water available in 2020–21 was about 23,900 GL, which was 6,400 GL more than what was available in 2019–20. Of the water available, about 3,400 GL was taken for consumptive purposes, similar to volumes taken in the previous year. Another 657 GL of water held for the environment was delivered to support environmental outcomes in Victorian waterways.

The wealth of information presented in these accounts supports better informed water-related decision-making for governments, businesses and individuals. For example, the draft *Central and Gippsland Region Sustainable Water Strategy* uses up-to-date information about water availability and use to plan the long-term water future of this region. Robust, timely water resource management information is essential to effectively operate the water entitlement and water resource planning frameworks.

On top of this comprehensive account of Victoria's water availability and use, I invite you to explore the two Victorian Water Accounts online products: statewide highlights (at https://howmuch.water.vic.gov.au) and more detailed water accounts (at https://accounts.water.vic.gov.au/) for surface water basins, groundwater catchments and distribution systems.

These digital resources complement these accounts, providing a range of options for Victorians to explore and engage with water data. They demonstrate the Victorian Government's commitment to providing clear information about water resources to the community.

THE HON LISA NEVILLE MP

Minister for Water

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Executive summary

Victorian Water Accounts 2020–2021 at a glance

- The *Victorian Water Accounts 2020–2021* provide statewide and system pictures of water availability and use for each of Victoria's 29 river basins and 20 groundwater catchments.
- The total available volume of surface water, groundwater, recycled water and desalinated water was higher than in 2019–20.
- Victorian consumptive water use was almost the same as in 2019–20.
- More surface water was used than in 2019–20.
- Less groundwater was used than in 2019–20.
- More recycled water was used than in 2019–20.
- Desalinated water use was the same as in the previous year.
- Conditions in 2020–21 were wetter than in the previous year. Rainfall across Victoria was generally above average, with the highest amounts received in East Gippsland and in the Victorian Alps. Most of the rest of the state received between 80% and 125% of the average rainfall.
- September 2020 was Victoria's sixth warmest on record, and November was Victoria's second warmest on record, both contributing to the state's third-warmest spring on record. 2020–21 brought us the wettest January since 2011, the wettest March since 2012 and the wettest June since 2014.
- Seasonal determinations to high-reliability entitlements in all northern declared water systems in 2020–21 reached 100%. Southern systems also had 100% high-reliability determinations made in the Thomson and Werribee systems.
- There were no towns with urban restrictions in place in 2020–21 compared to 32 towns the previous year. All towns were on permanent water-saving rules throughout 2020–21.
- There were more restrictions on groundwater use than in the previous year but fewer restrictions on urban use and unregulated streams.
- Victoria's total storage levels were higher at the end of the water year than at the start. On 1 July 2020, total storage levels were at 50% of total capacity compared to 61% on 30 June 2021. Levels reached a peak capacity of 65% in October compared to 53% the previous year.
- The Victorian Environmental Water Holder reported that in 2020–21, 92% of required water for the environment actions were either fully or partially achieved.

About the *Victorian Water Accounts 2020–2021*

The *Victorian Water Accounts 2020–2021* is the eighteenth report in a series that presents annual information about the state's water resources. It covers different sources of water including surface water, groundwater, recycled water and desalinated water. The purpose of the Victorian Water Accounts is to report on water availability and use and to demonstrate Victoria's compliance with its water entitlement framework.

The publication of the *Victorian Water Accounts 2020–2021* is part of the government's commitment to transparency and accountability in the management of Victoria's water resources. These accounts also show that Victoria is meeting its obligations under state and federal legislation to collect and publish information about the state's water resources.

Ultimately, the accounts are a valuable resource for the water sector, water users, other interested parties and the broader community: they help make water-related decisions better informed.

The accounts consolidate information from rural and urban water corporations, the Department of Environment, Land, Water and Planning (DELWP), the Australian Bureau of Meteorology, the Victorian Environmental Water Holder, the Essential Services Commission, the Murray–Darling Basin Authority, the Victorian Alpine Resorts Commission, power generators and other major users of water. The information is recorded in the Victorian Water Register.

The *Victorian Water Accounts 2020–2021* has two parts.

- Part 1 provides a statewide overview of water resources during the year. It provides context on the legal access to water and how resources are managed. There is information about rainfall, streamflows and storage levels, water taken for consumptive purposes, water trading and the management of water for the environment.
- Part 2 contains water accounts for each of Victoria's 29 river basins and 20 groundwater catchments. The water accounts track changes in each system's inflows, outflows and storage volumes for the year.

This year’s accounts tell a general story of more rainfall and higher levels of water availability than in the previous year, with Victorian storages holding more water at the end of the water year than at the start.

Variable conditions across Victoria

Winter 2020 was drier than average in most of the state. It was wetter than average over Baw Baw National Park and in east Gippsland. Rainfall in spring was generally close to average across most of Victoria. It was drier than average in some areas scattered across the east and wetter than average in parts of the south-west. September 2020 was Victoria's sixth warmest on record, and November 2020 was Victoria's second warmest on record, both contributing to the state's third-warmest spring on record. Rainfall totals during summer were above average in parts of central-west and south-west Victoria, as well as in the north-east. In autumn, rainfall totals were below average in most of western Victoria and in the north-east but wetter than average in Gippsland. Overall, conditions in 2020–21 were wetter than in the previous year.

In 2020–21, the evapotranspiration-to-rainfall ratio was generally less than the long-term average. This was consistent with above-average rainfall generally being observed, because the evapotranspiration-to-rainfall ratio generally decreases as rainfall increases. As a result, more rainfall became streamflow or groundwater recharge in 2020–21 than would be the case in the average year.

Fewer unregulated streams were subject to restrictions and bans on licensed diversions, with a peak of 115 streams with restrictions in place in February 2021 compared to a peak of 145 in January 2020. There were no towns with urban restrictions in place in 2020–21, 32 fewer than in the previous year. However, there were more groundwater restrictions in 2020–21 than in 2019–20, with restrictions in place in five groundwater systems compared to four in 2019–20. High-reliability entitlements received 100% allocation in nine regulated systems, which was five more than in 2019–20.

There were no qualifications of rights to water in 2020–21.

Groundwater level trends were more stable in 2020–21 than in 2019–20.

Increased water availability and fewer restrictions on use

A total of 23,942 GL of surface water, groundwater, recycled water and desalinated water was available in 2020–21. This was 6,355 GL more than the 17,587 GL that was available in 2019–20.

In 2020–21, the total annual streamflow volume for Victoria was 22,305 GL, about 6,347 GL more than in 2019–20. Surface water availability was just below the average: streamflow was 99% of the long-term average. In 2020–21,18 out of 29 river basins had higher annual streamflow volumes than those received in the previous year. A total of 11 basins had above-average streamflows for 2020–21 compared to the previous year when seven basins had above-average streamflows

For the second year in a row, Victoria’s total storage levels were higher at the end of the water year than at the start. On 1 July 2020, total storage levels were at 50% of total capacity, and they rose to 61% by 30 June 2021. Storage levels reached their peak of 65% in October 2020, exceeding the previous year’s peak level of 53%. At the beginning of the water year, regional storages were at 47%, peaking at 64% of total capacity in October 2020 compared to 51% the previous year. Over summer and autumn, regional storages levels declined, falling to 47% in April 2021. For the second year since 2016–17, Melbourne’s storage levels were higher at the end of the water year than at the start. On 30 June 2021, Melbourne storage levels ended the year at 75% of total capacity compared to 64% on 1 July 2020.

In declared water systems in 2020–21, seasonal determinations to high-reliability entitlements reached 100% in all systems (north and south). In northern Victoria, the Bullarook and Broken systems also reached 100% allocation for low-reliability entitlements. In southern Victoria, the Thomson Macalister, Werribee and Bacchus Marsh systems each received 100% allocation for low-reliability entitlements. Allocations for the Wimmera Mallee Pipeline Product began with initial allocations of 0% and ended with a final allocation of 57% of entitlement. In the Coliban Rural system, entitlement holders had access to 100% of their entitlement for the entire year.

Recycled water use increased from the previous year, with 87 GL recycled for use in 2020–21 compared to 79 GL in 2019–20.

Stable levels of water use

In Victoria, 3,395 GL of surface water, groundwater, desalinated water and recycled water was taken for consumptive use in 2020–21, 55 GL more than in the previous year. This volume represents about 14% of the total water available during the year, lower than the 19% of available water taken in 2019–20.

Surface water use was 2,806 GL in 2020–21, 102 GL more than the 2,704 GL used the previous year. Most of the increase was in the bulk entitlement volume taken in the Murray system.

Groundwater use decreased in 2020–21, with Victorian water users extracting 377 GL of groundwater compared to 439 GL in 2019–20. Less groundwater was used for irrigation, commercial purposes and salinity control, as well as urban and domestic and stock purposes: about 64 GL less than the 2019–20 volume. Slightly more groundwater was used for power generation: about 2 GL more than the 2019–20 volume.

In 2020–21, the Victorian Environmental Water Holder (VEWH) oversaw the delivery of 657 GL of water to 87 priority river reaches and 84 wetlands, and 92% of identified required watering actions were fully or partially achieved. The number of sites watered in 2020–21 increased since the previous year.

La Niña

On 28 September 2021, the Bureau of Meteorology's El Niño–Southern Oscillation (ENSO) outlook moved to LA NIÑA, indicating that La Niña had been established in the tropical Pacific. This continued until 30 March 2021, when most ENSO indicators returned to neutral levels. Neutral ENSO levels continued for the rest of 2020–21.

La Niña is typically associated with above-average rainfall across much of Australia during spring. Above-average summer rainfall across eastern Australia is also typical during La Niña. The Bureau of Meteorology reported that the 2020–21 La Niña event was a major influence on the Victorian climate in the 2020–21 summer season. Victoria experienced the wettest January since 2011, contributing to above-average statewide rainfall for the 2020–21 summer. Despite an overall wet summer, December and February received below-average rainfall.

Want to know more?

Useful information can be found online:

- 'Managing Victoria's water resources' at howmuch.water.vic.gov.au provides a statewide overview of the *Victorian Water Accounts 2020–2021*, as well as useful general information about how Victoria manages water
- surface water and distribution systems accounts from the *Victorian Water Accounts 2020–2021* are online at accounts.water.vic.gov.au, where you can delve into the detail of each surface water basin and distribution system
- DELWP's online water-quality visualisation at http://quality.water.vic.gov.au/ helps understand water quality issues
- www.vewh.vic.gov.au has information about environmental water
- www.bom.gov.au has information about weather and climate across Australia.

More information about water supply and use is available from water corporations:

- Barwon Water – https://www.barwonwater.vic.gov.au/
- Central Highlands Water – www.chw.net.au
- City West Water[1] – www.citywestwater.com.au
- Coliban Water – www.coliban.com.au
- East Gippsland Water – www.egwater.vic.gov.au
- Gippsland Water – www.gippswater.com.au
- Goulburn-Murray Water – www.g-mwater.com.au
- Goulburn Valley Water – www.gvwater.vic.gov.au
- GWMWater – www.gwmwater.org.au
- Lower Murray Water – www.lmw.vic.gov.au
- Melbourne Water – www.melbournewater.com.au
- North East Water – https://www.newater.com.au/
- South East Water – https://southeastwater.com.au/
- South Gippsland Water – https://www.sgwater.com.au/
- Southern Rural Water – www.srw.com.au
- Wannon Water – www.wannonwater.com.au
- Western Water[1] – www.westernwater.com.au
- Westernport Water – www.westernportwater.com.au
- Yarra Valley Water – www.yvw.com.au.

[1] After the 2020–21 water year, City West Water and Western Water were brought together to form Greater Western Water (GWW). Both previous water corporations' websites now redirect to the GWW website.

Part 1: Overview of Victoria's water resources 2020–21

Part 1 of the *Victorian Water Accounts 2020–2021* summarises Victoria’s water entitlement and planning framework and the way it shares available water resources.

Part 1 also provides a statewide overview of Victorian water resources during the year, reporting on:

- the quantity of water available in terms of rainfall, streamflows, water storages, aquifers and desalinated water
- the quantity of water allocated for consumptive use from reservoirs, streams and aquifers under entitlements issued by government, as well as quantities used, recycled and desalinated
- water available to the environment
- Victoria’s water trade activity.

1. Management of Victoria’s water resources

The *Water Act 1989* is the primary legislation guiding the management of Victoria’s water resources. Under the Act, the Crown retains the overall right to the use, flow and control of all surface water and groundwater on behalf of all Victorians.

The Act establishes a water entitlement framework, and the government has established a water resource planning framework to provide for the efficient and equitable sharing of Victoria’s water resources. The entitlement framework clearly specifies the legal rights and obligations of entitlement holders and the state in overseeing the management of Victoria’s water resources. The framework gives entitlement holders flexibility and certainty about how they manage their water, enabling them to make decisions and manage their own risks. This flexibility and certainty underpin investment decisions by irrigators, urban water authorities and industry. The water entitlement and water resource planning frameworks are explained in chapter 1.3. Good-quality, timely water resource management information is essential for the frameworks to operate effectively.

This chapter:

- provides an overview of the types of water resources governed under Victoria’s water entitlement and water resource planning frameworks
- describes the water sector’s institutional arrangements for managing Victoria’s water resources
- explains the features of the water entitlement and water resource planning frameworks and how they provide flexibility to respond to seasonal variability in water availability
- describes how we monitor and report on water resources.

1.1 Types of water resources

This report covers all types of water resources that are managed under Victoria’s water entitlement and water resource planning framework. These are:

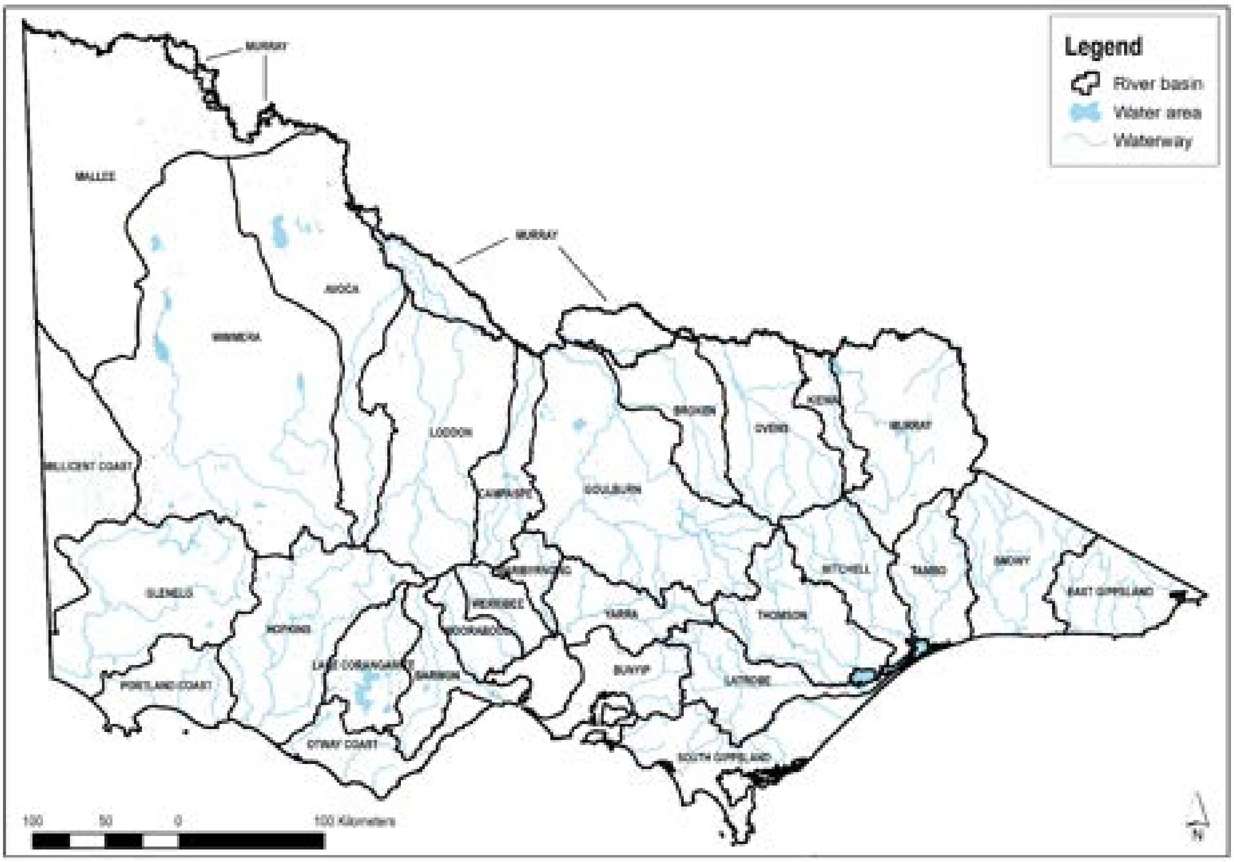
- **surface water**, which is water that occurs or flows on land. This includes water in waterways and in lakes, reservoirs, dams, wetlands and other water bodies. The term ‘waterway’ means a river, creek, stream, watercourse or a natural channel where water regularly flows, whether or not the flow is continuous
- **groundwater**, which is any water occurring in an aquifer: any geological formation that contains water either permanently or intermittently or allows water to pass through it
- **recycled water**, which is water derived from sewerage systems or industrial processes that is then treated to a standard appropriate for its intended use
- **desalination water**, which is seawater treated to a standard appropriate for its intended use.

1.1.1 Surface water

For surface water accounts, river basins are the primary reporting unit for surface water information. A river basin is the area of land drained by a river and its tributaries. Victoria is made up of 29 major river basins[2]. The river basins in the south and east of the state drain to the sea, and those in the north drain to the Murray–Darling Basin. The boundary for each of Victoria’s river basins is shown in Figure 1-1.

[2] The river basins defined by the former Australian Water Resource Council (AWRC) are used, except for the Murray basin. For the purposes of the water accounts, the Murray basin includes the Upper Murray basin as defined by the AWRC and the areas in Victoria that are supplied from the Murray River downstream of Lake Hume.

Figure 1-1 River basins, Victoria



Victoria's rivers and waterways can be categorised as either regulated or unregulated systems.

In **regulated systems**, the flow of water in the waterway is regulated and captured through the operation of large dams or weirs. In these systems, large volumes of water can be harvested and stored in dams, weirs and other flow-regulating structures, and this provides for a more reliable supply of water. Examples of regulated systems with large storages include the Goulburn system, which includes Lake Eildon as the large storage. For the Murray systems, it includes Dartmouth and Hume dams. The allocation of water in regulated systems is managed through seasonal determinations and the Minister's carryover and trading rules.

Unregulated systems are waterways that do not have large dams or weirs controlling the streamflow. Water is taken directly from these systems by pumps or diverted to off-stream storages. The volume of water available is based purely on rainfall and run-off, not on storage. Therefore, water supplies are more susceptible to variation in streamflow, and less water is available in the drier months and in drought periods. These resources are managed through rosters and restrictions.

Surface water also includes the water captured and held in small catchment dams. In other jurisdictions, these are sometimes referred to as farm dams, hillside dams or run-off dams. These dams are not located on or fed by a waterway, and they are filled by rainfall and run-off. They intercept flows that may have otherwise flowed into waterways.

Chapter 6 provides the water accounts for each of Victoria's 29 river basins, tracking surface water from the time it appears as inflows to a waterway to the time it is diverted from the surface streams of the basin or flows from the basin to another basin or to the sea.

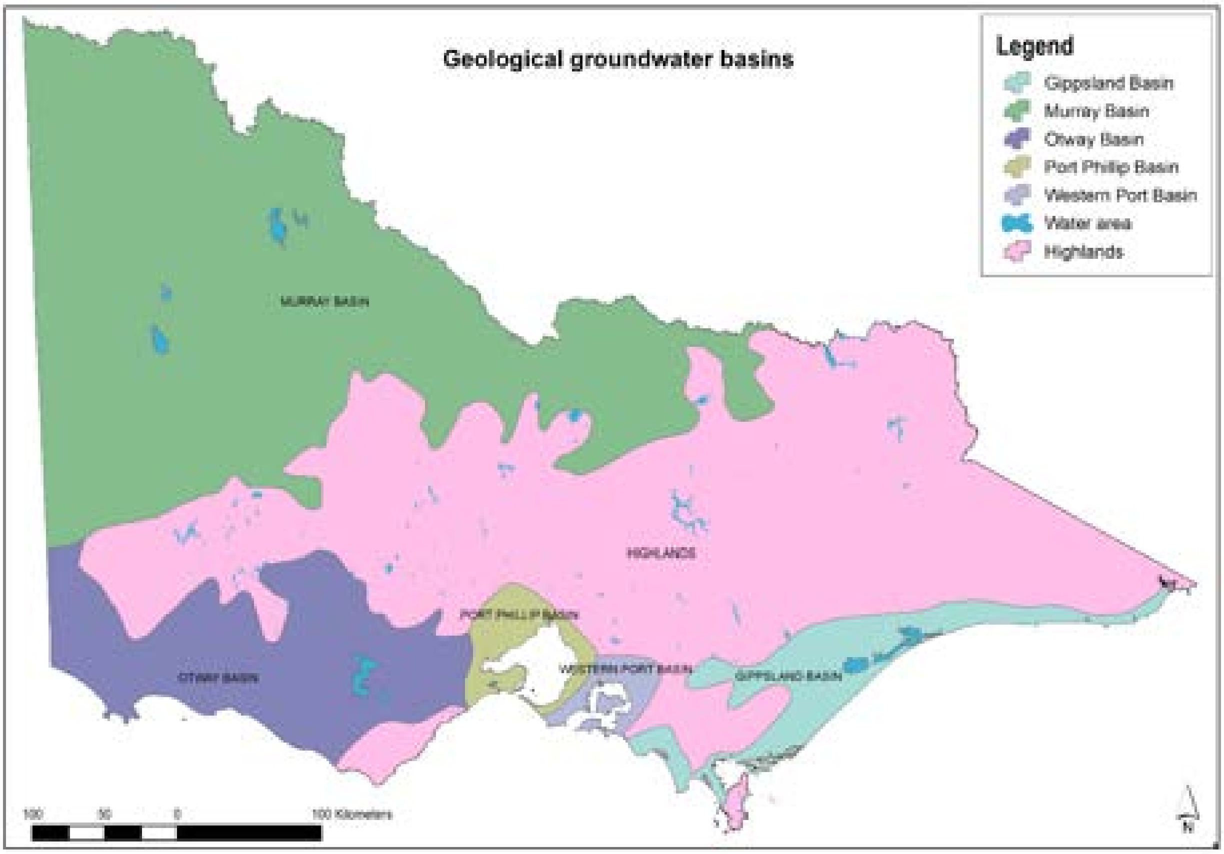
1.1.2 Groundwater

Groundwater is found in the spaces and fractures in rock and sediment beneath the ground's surface. Groundwater forms part of Earth's water cycle. Rainfall, surface water and snowmelt seeps from the surface and reaches the water table to form groundwater. Groundwater flows may eventually return to the surface as springs; baseflow into rivers, streams, lakes, wetlands and the ocean; or the flows may evaporate. Groundwater can be used for human consumption and agricultural, commercial and industrial purposes. The salinity of the groundwater often determines whether it is suitable for consumptive use. Groundwater supports groundwater-dependent ecosystems and contributes to base flows in streams, which provide environmental value.

Where groundwater is held within a geological formation that allows water to flow through — called an aquifer — it can be pumped to the surface for use. The flow of groundwater can vary. Some users pump groundwater from a bore and store it for use. Elsewhere, groundwater is artesian, flowing naturally due to pressure in a deep aquifer.

The majority of Victoria's groundwater is contained in geological basins, which are shown in Figure 1-2. Each basin contains layers of sediment, which form Victoria's aquifers.

Figure 1-2 Geological groundwater basins, Victoria

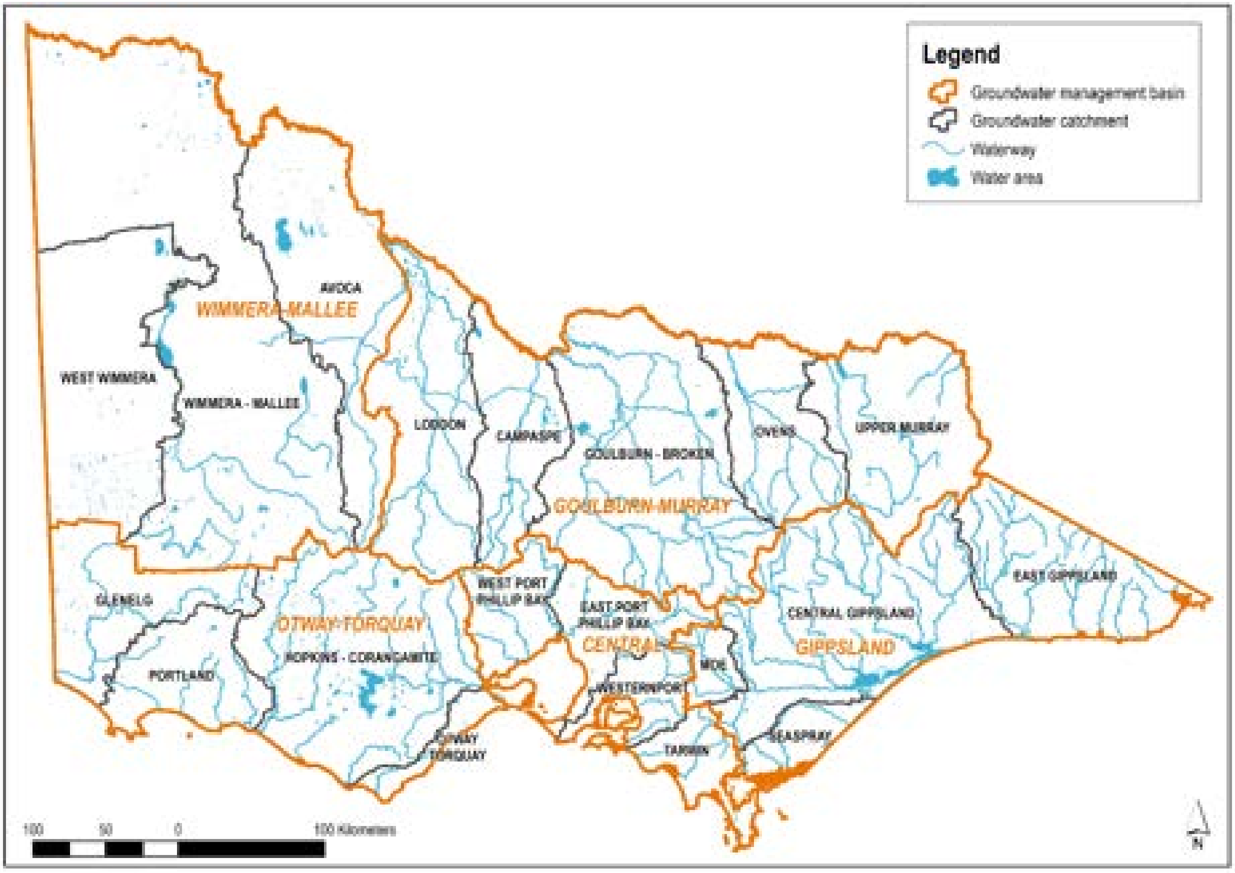


There is more information about Victoria's groundwater resources at [https://www.water.vic.gov.au/groundwater/victorias-groundwater-resources.](https://www.water.vic.gov.au/groundwater/victorias-groundwater-resources)

Planning for and reporting of groundwater in Victoria uses administrative boundaries known as groundwater management basins. These basins are areas of connected groundwater resources and are based on groundwater flow systems with water corporation administrative management boundaries.

Figure 1-3 shows Victoria's five groundwater management basins. Each contains several groundwater catchments, and they provide the basis for planning and reporting. Chapter 1.3.2 has more information about how groundwater is managed.

Figure 1-3 Groundwater management basins and catchments, Victoria



Chapter 7 provides the water accounts for each of Victoria's 20 groundwater catchments and further describes irrigation, urban and domestic and stock groundwater use in each catchment.

1.1.3 Recycled water

Highly treated wastewater can be recycled for a range of non-drinking uses.

Once treated, the recycled water is delivered by water corporations to their customers through a separate (purple) pipe system that has been installed in some new developments. Recycled water is suitable for a wide range of uses including irrigation and toilet flushing.

Recycled water produced in 2020–21 is described in chapter 3.3, and recycled water use in each river basin in chapter 6.

1.1.4 Desalinated water

Desalination is the process of removing salinity (dissolved salts) from salt water. The Victorian Desalination Project (VDP) at Wonthaggi uses reverse-osmosis technology to remove salt from seawater and so create high-quality drinking water.

The rainfall-independent VDP can supply up to 150 GL of high-quality drinking water a year, or about one-third of Melbourne's annual water consumption. The project includes a two-way underground transfer pipeline, which connects the VDP to Melbourne's water network through a delivery point at Berwick and transfer main to Cardinia Reservoir. Offtakes are included along the pipeline so that areas in south Gippsland and Western Port can access the water from the plant or Cardinia Reservoir if required. The benefits of the VDP are shared beyond Melbourne via the Victorian water grid, and it underpins security for Geelong and regional areas including South Gippsland.

The first order from the VDP was made in March 2016 by the Minister for Water. Chapters 2.3, 3.4 and 6.17 report on water produced in 2020–21.

1.2 Water sector institutional arrangements

Victoria's state-owned water sector is made up of 19 water corporations constituted under the Act. The water corporations provide a range of water services to customers within their service areas.

In 2020–21, 16 **water corporations** provided urban water supply (including recycled water) and sewage and trade waste disposal services to urban customers throughout Victoria. In regional Victoria, they were:

- Barwon Water
- Central Highlands Water

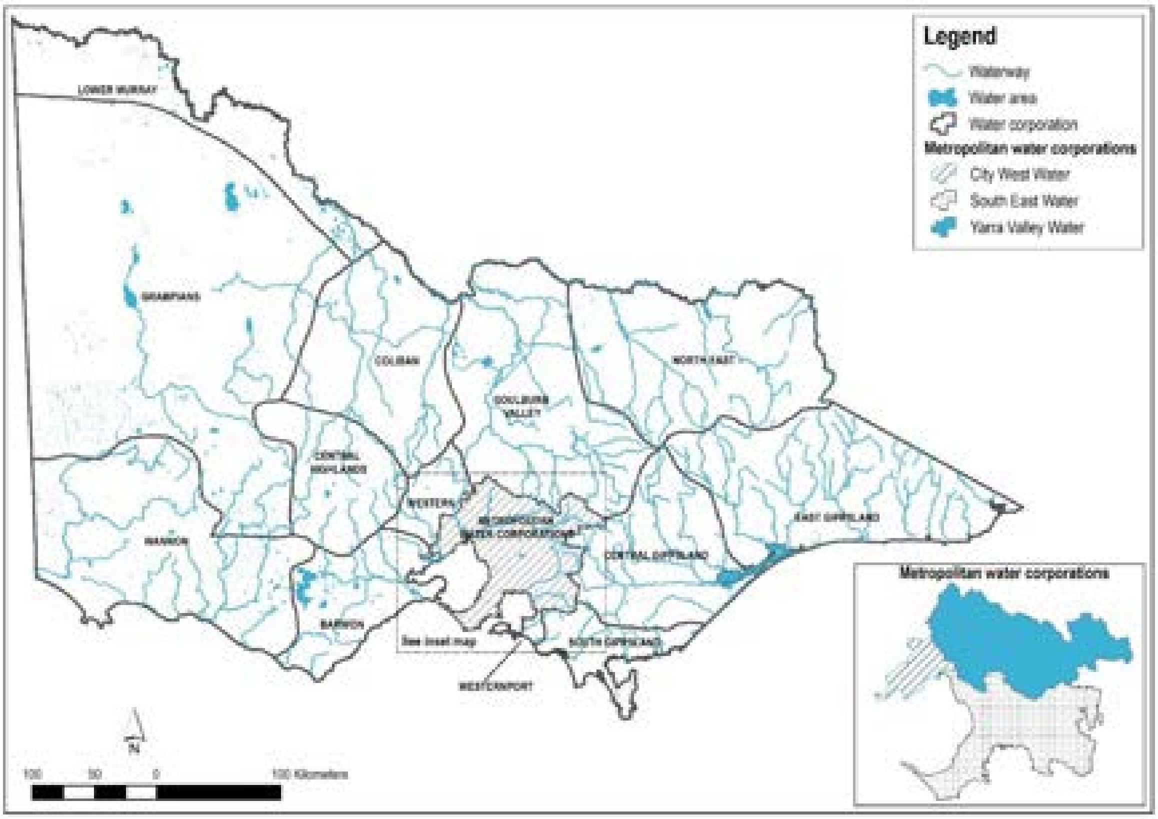
- Coliban Water
- East Gippsland Water
- Gippsland Water
- Goulburn Valley Water
- GWMWater
- Lower Murray Water
- North East Water
- South Gippsland Water
- Wannon Water
- Westernport Water
- Western Water[3].

In Melbourne, they are:

- City West Water[3]
- South East Water
- Yarra Valley Water.

Figure 1-4 shows the urban supply areas.

Figure 1-4 Water corporations' urban supply areas



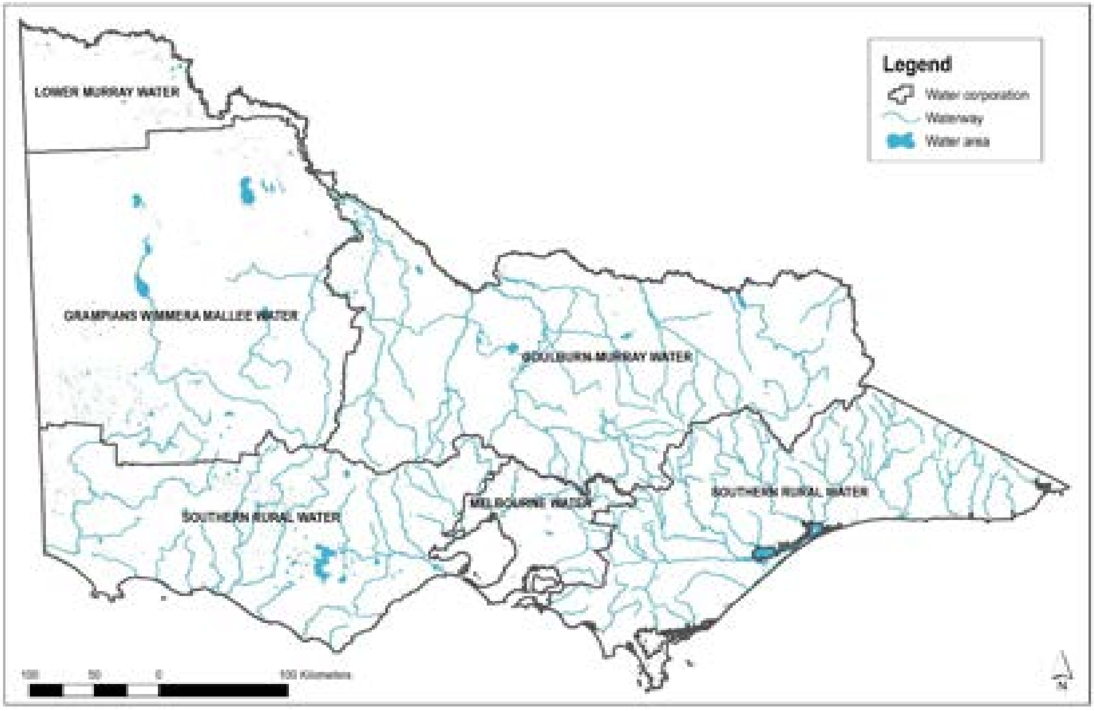
Six **rural water corporations** provide rural water services including water supply, drainage and salinity mitigation services for irrigation and domestic and stock purposes. They are:

- Southern Rural Water
- Goulburn-Murray Water
- Coliban Water
- GWMWater
- Lower Murray Water
- Melbourne Water.

[3] Western Water and City West Water were integrated on 1 July 2021 to form Greater Western Water. As this change took place after the end of the 2020–21 water year, it will be reported in the *Victorian Water Accounts 2021–22*.

Figure 1-5 shows the rural supply areas.

Figure 1-5 Water corporations' rural supply areas



Southern Rural Water, **Goulburn-Murray Water** and **GWMWater** are also responsible for:

- providing bulk water supply services to other water corporations in regulated water supply systems in regional Victoria
- managing regulated systems
- administering the diversion of water from waterways
- issuing and administering groundwater licences
- developing and implementing management plans on behalf of the Minister.

Lower Murray Water also administers the diversion of water from waterways and issues and administers groundwater licences.

Coliban Water's rural system is for stock and domestic use, and it distributes water across its region via a network of open channel and pipeline systems. Water is sourced for this rural supply from its bulk entitlement to the Campaspe system.

Melbourne Water provides bulk water supply and sewerage services to water corporations in the Melbourne metropolitan area. Its other responsibilities include:

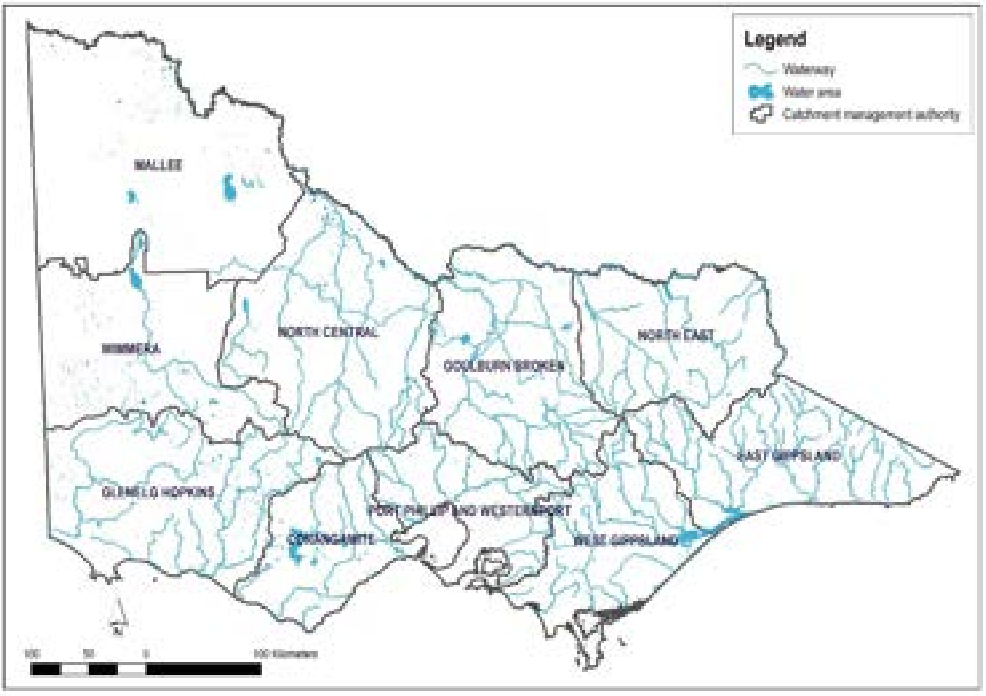
- managing rivers, creeks and major drainage systems in the Melbourne, Port Phillip and Western Port areas
- developing and implementing management plans on behalf of the Minister
- administering the diversion of water from waterways
- supplying recycled water, through a number of retail water corporations, for irrigation and other purposes.

The Victorian economic regulation framework for water, established under the *Essential Services Commission Act 2001* and the *Water Industry Act 1994*, guides water corporations' pricing and investment decisions. This framework is overseen by the **Essential Services Commission**. The quality of water supplied by water corporations is independently regulated by the **Department of Health** in accordance with the *Safe Drinking Water Act 2003*. The environmental performance of water corporations is independently regulated by the **Environment Protection Authority Victoria** (EPA) in accordance with the *Environment Protection Act 2017*. The EPA is responsible for controlling environmental standards for wastewater discharge and standards for recycled water use.

Victoria's framework for the integrated management of catchments is established under the *Catchment and Land Protection Act 1994* (the CaLP Act). Integrated catchment management is the coordinated management of land, water and biodiversity resources based on catchment areas. The framework incorporates environmental, economic and social considerations. Victorian is divided into ten catchment and land protection regions (shown in Figure 1-6), each reflecting the unique biophysical qualities of its area. In each region, a **catchment management authority** (CMA) is responsible for the integrated planning and coordination of land, water and biodiversity management in conjunction with local communities. Under the *Water Act 1989*, CMAs (except for the

Port Phillip and Westernport CMA) are also responsible for regional waterway, floodplain, drainage and environmental water reserve management.[4]

Figure 1-6 Catchment management authorities



The **Victorian Environmental Water Holder** (VEWH) is an independent authority established by the Victorian Government in 2011 that is responsible for managing Victoria's water for the environment. The VEWH works with local waterway managers — catchment management authorities and Melbourne Water — to ensure water for the environment achieves the best environmental outcomes with the available water. One of the VEWH's roles is to coordinate with other Murray–Darling Basin environmental water holders — the CEWH, the Murray–Darling Basin Authority and environmental water managers in New South Wales and South Australia — to optimise the benefits of delivery of all water for the environment in and from northern Victorian waterways. The VEWH holds environmental water entitlements in its own right, and it manages some entitlements on behalf of the Snowy Water Initiative and The Living Murray program.

From March 2020, the VEWH must meet new requirements under section 33DD of the *Water Act 1989* to consider Aboriginal cultural and social and recreational values and uses in its management of the Water Holdings, consistent with its objectives and other legislative requirements.

There is more information about the VEWH at https://vewh.vic.gov.au/.

The **Commonwealth Environmental Water Holder** (CEWH) manages the portfolio of water acquired by the Australian Government for the environment in the Murray–Darling Basin. The CEWH holds Victorian water shares that were acquired through the Australian Government's investment in water-saving infrastructure and purchases. The CEWH receives annual allocations against its water shares, and it partners with the VEWH, the MDBA and Victorian waterway managers to deliver this water for the environment in Victoria.

There is more information about the CEWH at https://www.environment.gov.au/water/cewo.

The **Murray–Darling Basin Authority** (MDBA) is responsible for overseeing implementation of the *Murray Darling Basin Plan*, including independent monitoring and evaluation and running the River Murray on behalf of Basin state governments. The MDBA provides technical advice on request and as required or directed by the Inspector-General of Water Compliance.

The role of **Inspector-General of Water Compliance** (IGWC) was established in August 2021. Following amendments to the *Water Act 2007 (Cth)* and the Basin Plan, the IGWC is responsible for ensuring compliance with the Basin Plan. The IGWC has oversight of water management in the Basin and inquiry powers to investigate the implementation of the *Water Act 2007 (Cth)*, the Basin Plan and intergovernmental agreements, including the Murray–Darling Basin Agreement.

The ***Murray–Darling Basin Plan***, which came into effect in 2019, sets limits on the amount of water that can be extracted from the basin. These are known as sustainable diversion limits (SDLs) and are set to recover 2,750 gigalitres of water for the environment. This water will be used to help improve the environmental health of basin rivers, wetlands and floodplains and the habitats of plants and animals that rely on the river system.

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[4] The Port Phillip and Westernport Catchment Management Authority was integrated into Melbourne Water on 1 January 2022. As this change occurred after the end of the 2020–21 water year, it will be reported in the *Victorian Water Accounts 2021–22.*

The MDBA manages **The Living Murray** program on behalf of the basin states and the Commonwealth. This program is a partnership between the Commonwealth and the New South Wales, Victorian, South Australian and Australian Capital Territory governments. The Living Murray program focuses on achieving agreed ecological objectives at six icon sites, chosen for their high ecological and economic value and their cultural and heritage significance to Aboriginal people. The sites encompass areas of high conservation value — the floodplains, wetlands and forests along the Murray, the Murray's estuary and the river itself. The VEWH holds some entitlements in trust for the MDBA, and decisions about the use of water under these entitlements are made by the Southern Connected Basin Environmental Watering Committee.

1.3 Water entitlement and water resource planning frameworks

The Victorian water entitlement framework (Figure 1-7) sets out the ways in which individuals, companies, government and water corporations can share water. The elements of the entitlement framework are:

- secure entitlements to water with tenure that is certain and protected including bulk entitlements, environmental entitlements, water shares, take and use licences and the ability to enter contractual agreements to supply
- tools to set limits on how water is used under water entitlements: that is, specified volumes, extraction rates and locations, diversion rules and water-sharing arrangements
- provision for sharing of water between urban, irrigator, and environmental users including when water availability is reduced by:
  - resource managers making seasonal water allocation determinations against water entitlements, subject to water availability
  - the ability to trade water allocation and entitlements, subject to trading rules set by the Minister for Water to protect against adverse third-party impacts
  - the Minister for Water qualifying rights in regulated systems to ensure water availability for critical human needs at times of severe water shortage
  - in unregulated systems, through rosters, restrictions or bans on licence holders to take water
  - in groundwater systems, through restrictions on licence volumes
  - in towns, through urban water restrictions
- the ability for individuals to manage their own risks by being able to trade and carry over unused water allocation to the next water year (including in some groundwater systems where carryover of unused licence volumes is possible)
- clear, consultative processes before entitlements can be changed
- private rights enabling individuals to take water for domestic and stock purposes in certain circumstances without a licence
- Traditional Owners' rights to water.

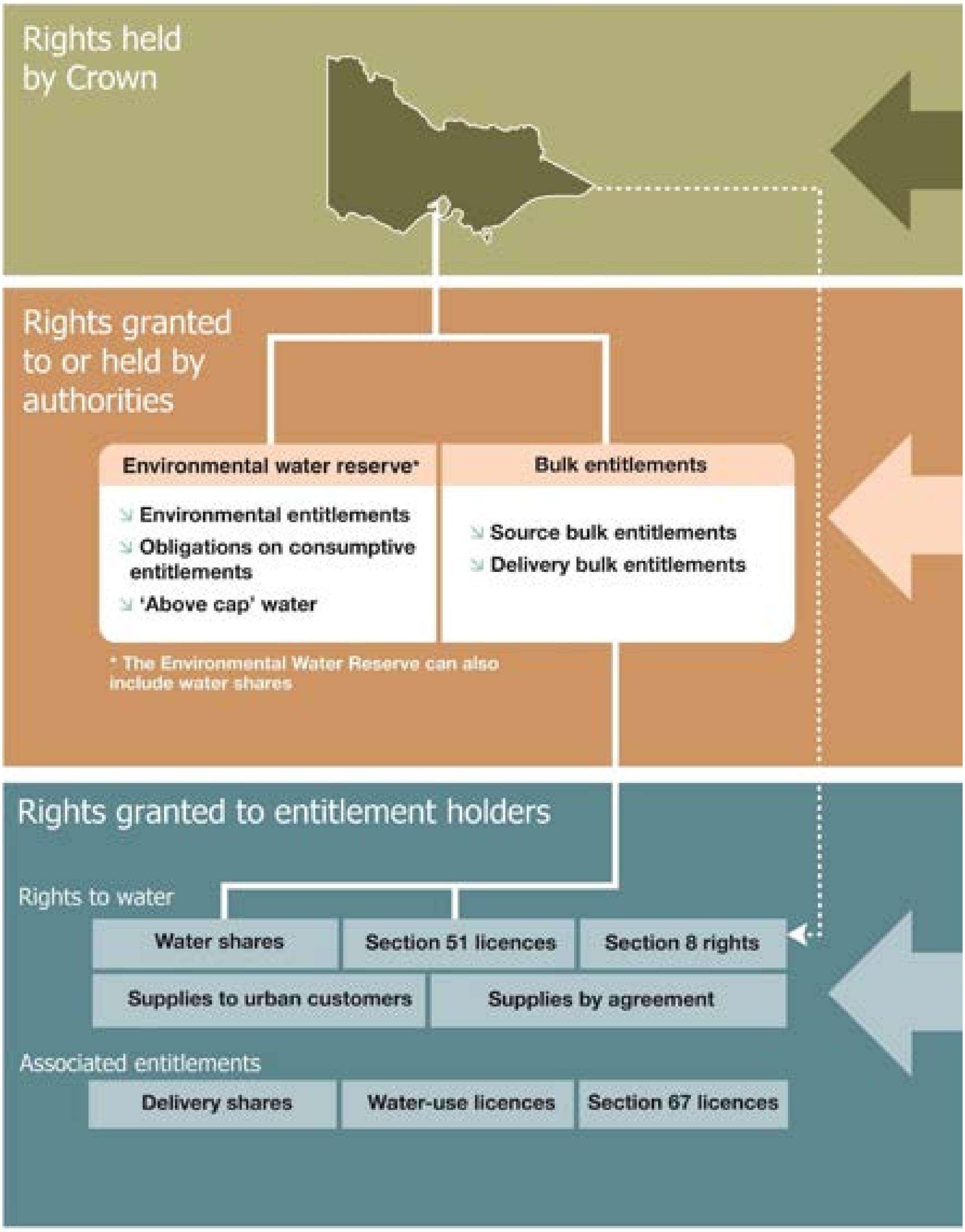
To support and guide the management of water allocated under the entitlement framework, Victoria has a water resource planning framework comprising:

- year-to-year or short-term planning through measures such as seasonal resource determinations on rural regulated systems, or water corporation drought response plans and annual water security outlooks in urban systems
- local planning to balance the demand for water and available supply in urban areas through the development of water corporation urban water strategies
- statutory management plans for the equitable sharing of available water and long-term sustainability of unregulated surface water and groundwater
- local planning to maintain and improve the health of rivers and wetlands through the development of regional waterway strategies every eight years (guided by the *Victorian Waterway Management Strategy*)
- strategic planning through the development of regional sustainable water strategies (SWSs) every seven to ten years
- long-term water resource assessments of the resource base and river health every 15 years.

The first *Long-Term Water Resource Assessment for Southern Victoria* looked at long-term changes in water availability and the health of our waterways. It is a backwards-looking technical assessment to see if water availability has declined and to see if there have been changes in how water has been shared between the environment and consumptive uses, which includes water for farms, industry, cities and towns. The Victorian Government is using the assessment as one of many inputs to plan for the next 50 years as it finalises the new *Central and Gippsland Sustainable Water Strategy*. The long-term water resource assessment for northern Victoria will start in 2025 and align with the review of the Murray–Darling Basin Plan scheduled for 2026.

One of the key principles of the water entitlement and water resource planning framework is that entitlement holders are responsible for managing their own water security and risks including during drought.

Figure 1-7 Victorian water entitlement framework



Water entitlements are defined in the *Water Act 1989* and are issued by the Minister for Water. A water entitlement is the amount of water authorised to be stored, taken and used by a person under specific conditions. Associated entitlements set conditions for water delivery or use.

Environmental water reserve (EWR)

The EWR is the legally recognised amount of water set aside to meet environmental needs. The objective of the EWR is to preserve the environmental values and health of water ecosystems.

Environmental entitlements are generally identical in nature to bulk entitlements. They provide for a share of the available resource.

Obligations on entitlements include the passing flows that water corporations or licensed diverters are obliged to provide out of storage or past a diversion point. The portion of passing flows that is provided to meet environmental needs is considered a part of the EWR.

'Above cap' water includes water that is left over after limits on diversions have been reached and unregulated flows which cannot be kept in storage. Most of the EWR is comprised of 'above cap' water, and this component is most susceptible to climate change.

Bulk entitlements

Held by water corporations with secure tenure in perpetuity. They provide the right to water for system operations, seasonal allocations and other rights and obligations.

Source bulk entitlements provide a share of inflows, storage capacity (if applicable) and releases.

Delivery bulk entitlements provide a set volume of water each year, subject to defined restrictions during periods of water shortages.

Water shares have secure tenure held in perpetuity. A share of the available resource in most regulated systems is allocated annually (through seasonal allocations), which can then be ordered to a specified location, at a specified time and rate.

Section 51 take and use licences allow for diversions from unregulated (and some regulated river systems) and extractions of groundwater. Licences are issued for a specified volume, period of time and with a range of conditions.

Section 8 rights provide for an individual to take and use water from a range of surface and groundwater sources for domestic and stock use under certain circumstances without a licence.

Supplies to urban customers must be provided by water corporations throughout their defined districts.

Supplies by agreement are arranged by water corporations to provide water outside of defined districts, and recycled and drainage water in special circumstances.

Delivery shares provide for water to be delivered to land in an irrigation district via a channel. Delivery shares are linked to delivery infrastructure and stay with the property if the water share is traded.

Water-use licences allow an irrigator to use water to irrigate land up to an annual use limit.

Section 67 licences provide for the construction and operation of a groundwater bore or any works on a waterway, such as a private pump or dam, when a section 51 licence is required.

1.3.1 Water entitlements

Victoria's water entitlement framework provides for the sharing of water. Under the *Water Act 1989*, a person may not take water unless they are authorised to do so. Authorisation for the take and use of water is provided under the Act through the water entitlement framework.

Water entitlements manage surface water and groundwater resources for both consumptive and environmental purposes at all phases of the water cycle. Consumptive uses include urban, irrigation and industry uses, and power generation. Environmental uses include providing flows within a waterway and diverting flows to wetlands. Water entitlements can be held by an individual, a water corporation, an environmental water holder or another specified body (such as a power company) (Figure 1-7). The conditions of an entitlement do not change based on who owns it.

A water entitlement authorises the volume of water that may be taken, extracted and used, and it may be limited by conditions including processes that restrict annual water use in response to seasonal variability (see chapter 1.3).

The Minister for Water issues water entitlements under the Act. These include:

- bulk entitlements
- environmental entitlements
- water shares
- take and use licences.

In addition to the water entitlements listed above, the Act allows individuals to take water from a range of surface water and groundwater sources without a licence. These rights are defined under sections 8 and 8A of the Act, and they are not formally issued. They include farm dams for domestic and stock purposes.

Bulk entitlements are a right to take and use water in a waterway, water corporation storage or groundwater. Bulk entitlements are held by specified authorities (such as water corporations) and are subject to a range of conditions. Appendix D lists the bulk entitlement holders for 2020–21.

Environment entitlements are a right to water held by state and Commonwealth government agencies, which are often referred to as environmental water holders. In Victoria, they include the VEWH, the CEWH and the Murray–Darling Basin Authority (MDBA) as part of The Living Murray program.[5] In most cases, water held by the CEWH or the MDBA that is required for delivery in Victoria is transferred to the VEWH to enable its delivery; the water is held by the VEWH until used or transferred back. The VEWH uses this water to improve the environmental values and health of water ecosystems and for other uses, depending on the condition of the environment.

Chapter 4 reports on environmental entitlements and their use in 2020–21.

Water shares are legally recognised perpetual entitlements to a secure share of the water available in a water system. To date, water shares have been issued only for large, regulated river systems with irrigation districts. These are systems with dams or storages that harvest large volumes of water for regulated release to a large number of irrigation customers. Water shares may be high-reliability or low-reliability. The amount of water that may be taken under a water share in any year will depend on the allocation that is made in relation to water shares in that system (see chapter 1.3.3.2). Systems containing water shares are declared and are unbundled (which is explained in the box on the next page).

Take and use licences are issued under section 51 of the Act. They are fixed-term entitlements to take and use water from a waterway (in unregulated systems), catchment dam or groundwater. Each licence is subject to conditions specified on the licence. Licences are issued and managed in accordance with the 2014 *Ministerial Policies for Managing Take and Use Licences*. These policies set out matters and actions the Minister requires delegates to consider or do.

Statutory rights are provided under sections 8 and 8A of the Act. These rights allow water to be taken without a licence under certain circumstances for specific uses, including:

- **domestic and stock:** under section 8(1) and section 8(4)(c) of the Act, individuals can take water for domestic and stock purposes from surface water and groundwater from a small catchment dam or a bore. The water must be used for the specific purposes set out in the Act. Under the Act, a works licence is required to construct, alter, remove or decommission a domestic and stock bore greater than 3 m in depth. For small catchment dams, a take and use licence and/or a works licence are required to divert water from a waterway
- **Traditional Owners:** under section 8A of the Act, any member of a Traditional Owner group who has a natural resource agreement under the *Traditional Owner Settlement Act 2010* can take and use water from a waterway or bore for traditional purposes, which means providing for the personal, domestic or non-commercial communal needs of group members.

[5] The Victorian water entitlements for The Living Murray program are held by the VEWH in trust for the MDBA. In 2020–21, the MDBA held water shares in Victoria.

Chapter 6 and chapter 7 describe the entitlements and use of water taken from river basins and groundwater catchments.

Victorian water entitlements are recorded in the Victorian Water Register, which provides an authoritative record of the entitlements and available allocation as carryover, seasonal allocation and trade. Useful information for water users about water entitlements, seasonal allocations, trade and transfers can be found on the Victorian Water Register website, waterregister.vic.gov.au.

There is more information about Victoria's entitlement framework at https://www.water.vic.gov.au/planning-and-entitlements/victorias-entitlement-framework.

Water systems may be **declared** in accordance with section 6A of the Act.

In declared water systems, entitlements previously called water rights and take and use licences (with some specific exceptions) have been separated, or 'unbundled', into three separate elements. These are a **water share**, a **delivery share** (or 'extraction share' in a works licence), a **water-use licence** or **a water-use registration**.

A **water share** is the legally recognised, perpetual entitlement to a secure share of the water available from a declared water system. It gives the owner a right to a share of the water in the dams. Water shares may be high-reliability or low-reliability. A water share is an entitlement to a share of the available water, which depends on seasonal inflows. Seasonal resource determinations specify the percentage of a water share that is available annually.

A **delivery share** is an entitlement to have water delivered to land in an irrigation area, and it is subject to the available allocation. It gives access to a share of the available capacity in a channel or piped network that supplies water to a property. A delivery share is tied to the land and stays with the property if it is bought or sold. It also stays with the property if the water share is sold separately.

A **water-use licence** is a licence that authorises the use of water for the purposes of irrigation on the land specified in that licence: the use of water depends on available allocation. The licence sets out the conditions for use (such as how much water you can use on your land in a single irrigation season). Water-use licences are required for irrigation from the regulated Murray, Goulburn, Broken, Loddon, Campaspe, Bullarook, Werribee or Macalister systems. A **water-use registration** works in the same way, but it authorises use of water for purposes other than irrigation.

Most of the state's regulated water systems have been declared.

The regulated systems in northern Victoria were declared on 1 July 2007. These are the Broken, Bullarook, Campaspe, Goulburn, Loddon, Murray and Ovens systems.

The Werribee and Bacchus Marsh and Thomson Macalister systems in southern Victoria were declared on 1 July 2008.

1.3.2 Managing resources

All water resources are managed in accordance with the Act and state policy. As mentioned in chapter 1.2, rural water corporations are responsible for managing regulated and unregulated systems.

In regulated water systems, rural water corporations manage the available water resource, with delegated responsibilities for the administration of entitlements and planning. They:

- plan for the management of their systems to supply the specified entitlements
- develop low-flow contingency plans for managing severe water shortages
- provide regular information to entitlement holders to assist with their planning.

Planning in unregulated surface and groundwater systems generally involves developing management arrangements so that available resources are managed equitably and sustainably. The management plans may include such things as triggers for rosters, restrictions and bans on extractions during low-flow periods, trade rules, metering, monitoring and reporting requirements.

Most Victorian water supply systems also have a **cap** or a limit placed on the total amount of water that can be taken from a system within a given timeframe, typically one year. Effectively, these caps limit the issue of entitlements in these systems so that water allocation and diversions do not:

- impact on the resource and on access to the resource for other entitlement holders
- impact on important environmental values
- exceed the cap or limits on take from a resource.

In 2012, the Victorian Government developed a framework for the management and reporting of groundwater resources. The groundwater management and reporting framework comprises:

groundwater management basins: the largest scale of connected hydrogeological resources, from highlands to sedimentary plains. This is also the scale of water resource plans for groundwater under the Basin Plan. Figure 1-3 shows Victoria's groundwater management catchments and basins

- **groundwater catchments**: the longitudinal flow path of connected groundwater resources, which are interconnected laterally within a region
- **groundwater management units (GMUs)**: defined areas where specific rules are used to manage the resource according to the needs of groundwater users and the environment. There are two types of GMUs:
  - **water supply protection areas (WSPAs)**: areas declared to protect groundwater or surface water resources through the development of statutory management plans
  - **groundwater management areas (GMAs)**: defined for the purposes of management, most commonly areas where no new groundwater entitlement is available. They may be intensively developed or have the potential to be.

There were several changes to GMUs in 2020–21, which are explained in chapter 3.2. Further details about the groundwater management framework in Victoria are available at https://www.water.vic.gov.au/groundwater/managing-groundwater.

Rural water corporations are responsible for managing groundwater. Rural water corporations continue to review management arrangements to ensure objectives are being met and to respond to changing climate, knowledge, use and legislation. Water corporations are also gradually working towards management on a catchment scale to reflect connected resources, reduce costs and achieve better environmental outcomes.

Lessons from the Millennium Drought

Between 1996 and 2010, Victoria experienced unprecedented dry conditions – a period now known as the Millennium Drought. These 13 consecutive years of drought, including the lowest annual inflows to storages recorded (2006–07), resulted in conditions well outside the boundaries within which water supply systems and water-sharing rules across Victoria were designed to operate. By the 2006–07 summer, many areas faced severe water shortages. These shortages were more extreme than envisaged possible when water entitlements were developed, and the effectiveness of Victoria’s water management frameworks was tested.

Despite water managers’ efforts to adapt to the unprecedented conditions, water carting was required to maintain essential water supplies for several towns and rural supply systems. Major infrastructure projects were brought forward, irrigation allocations were the lowest on record, and the Minister for Water was required to declare water shortages and temporarily qualify rights to water because existing water-sharing arrangements had failed. In many rivers across Victoria, the environment was disproportionately impacted compared to consumptive users. This occurred because most of the environmental flows were sourced from unregulated flows or spills from storage, which ceased during the drought, rather than secure entitlements that received a share of the limited water available.

The unprecedented nature of the Millennium Drought, particularly its length and severity, motivated and accelerated several responses to water scarcity including:

- major policy and planning initiatives (for example, SWSs)
- infrastructure upgrades (for example, the Wimmera Mallee Pipeline Project and Goulburn-Murray Water Connections Project)
- augmentations (for example, the Goldfields Superpipe)
- improved system management.

It should also be noted that a major water reform was implemented across northern Victoria in July 2007 and southern Victoria in July 2008: the unbundling of water rights from land to create water shares. This reform was unrelated to the drought but made the water market more accessible to individuals and water corporations during its last few years.

Significant hardship was endured during the Millennium Drought, but several positive outcomes were achieved that enable Victorian water managers to better manage water resources in future. They included:

- amendments to entitlements to incorporate sharing arrangements for dry conditions
- clearer entitlements for the environment and more-efficient use of water for the environment
- reserve rules that reduce the likelihood of years with zero allocation (in large, regulated systems)
- improved flexibility and options through measures (such as trade and carryover)
- streamlining of water-trading options to enable water to move from low- to high-value uses
- creation of new and alternative sources
- a modernised and reconfigured irrigation system.

The Millennium Drought highlighted that planning and system design cannot assume that climate is a stationary phenomenon. While unplanned measures were necessary to respond to the unprecedented conditions, the experience of managing through the Millennium Drought has served to reinforce the relevance of Victoria’s water entitlement and water resource planning frameworks and principles.

The uncertainty surrounding future conditions means that planning needs to be based on a wide range of plausible future climate scenarios. Guidelines for urban water supply-demand strategies, developed after the drought, emphasise scenario planning and adaptive management to ensure urban water supply security in the medium to long terms.

1.3.3 Responding to water availability

The amount of water available for consumptive and environmental uses will vary from year to year. The entitlement and planning frameworks include mechanisms to conserve and share water between users in response to seasonal variability and water shortages which come into play when water is scarce. These mechanisms include:

- urban water restrictions
- seasonal determinations in regulated systems
- restrictions to licence volumes in groundwater systems
- rosters, restrictions or bans on licence holders in unregulated surface water catchments.

When these mechanisms for managing the variability of water availability are not sufficient, water corporations may also undertake other measures (such as water carting) to augment local supplies. Chapter 2.5.5 reports on water carting in 2020–21.

The Minister for Water also has powers under section 33AAA of the Act to declare that a water shortage exists and to temporarily qualify rights to water. Temporary qualification of rights is a measure of last resort to be used during unforeseen and emergency events. Temporary qualification of rights results in a temporary change in water-sharing arrangements in a specified area to ensure critical water needs are met under these circumstances. Rights to water that may be qualified include licences, water shares, bulk entitlements and environmental entitlements. Chapter 2.5.6 reports on the temporary qualification of rights in 2020–21.

To facilitate the efficient use of water resources in Victoria, water can be traded between users and locations in accordance with trading rules, which are designed to protect third parties from unacceptable impacts. Water markets and trading water are important mechanisms for individual entitlement holders to manage seasonal variations in water availability, and they facilitate the sharing of available resources. Chapter 5 reports on water trading in 2020–21.

1.3.3.1 Urban water restrictions

As explained in chapter 1.3, in line with the water resource planning framework, water corporations undertake short-term and long-term planning to balance the demand for water with the available supply and to plan for the year ahead.

Water corporations develop long-term urban water strategies to support the development of resilient, liveable communities as well as to balance social, environmental and economic costs and benefits across the environment, agriculture, towns and businesses.

Each year on 1 December, water corporations also publish an annual water outlook. Outlooks report on the current condition of each water supply system including storage positions and predicted future water availability, and they outline strategies to meet customer demand over the next 12 months. Outlooks also indicate the likelihood of urban water restrictions under different climate scenarios.

All Victorian towns are subject to a uniform scale of water restrictions under the *Victorian Uniform Drought Water Restriction Guidelines*. The scale has four stages of restrictions, with increasing levels of severity as water shortages become more severe. While water corporations can tailor the restrictions under each stage to suit local conditions (that is, by providing exemptions), the nature of restrictions is consistent across the state. The trigger points for each stage of water restrictions are stated in the drought response plan of each water corporation. These plans also include contingency measures for temporary water supplies or savings beyond stage 4. Each urban water corporation also has permanent water-saving rules which apply at all times and set basic conditions for water use when water restrictions are not in place.

Chapter 2.5.1 reports urban water restrictions in 2020–21.

1.3.3.2 Seasonal allocations in regulated systems

The volumes of water available for use in some regulated systems are determined by the seasonal allocation process. This process differs from urban restrictions in that each water entitlement is allocated a share of the available water resource in proportion to the entitlement volume. Seasonal allocations are expressed as a percentage of entitlement. Entitlements can have differing levels of reliability, termed either high-reliability or low-reliability entitlements.

Seasonal allocations are determined for each system using a water budget. The water budget calculates how much water is currently in storages and is expected to flow into them over a specified period, to decide how much water can be allocated to entitlement holders in that system. Allocation policies vary between supply systems, and in some cases, there is a reserve policy, which means once allocations reach a certain level, some water starts to be set aside for the following year. Opening seasonal allocations can be low, particularly in systems where there is no reserve policy, but the water budget is reviewed by rural water corporations throughout the year, and seasonal allocations are increased as more water becomes available. In declared systems, this process is called a seasonal determination.

Goulburn-Murray Water is the Northern Victorian Resource Manager appointed by the Minister for Water, and it is responsible for making the seasonal determination for all northern Victorian declared water systems. Southern Rural Water is responsible for announcing seasonal determinations in their declared water systems.

Chapter 2.5.2 reports on seasonal allocations in regulated systems in 2020–21.

1.3.3.3 Restrictions on licence holders in unregulated systems

Statutory management plans and local management plans set out how water in unregulated streams will be shared between consumptive uses and the environment. Streamflow and/or groundwater statutory management plans are prepared to manage the unregulated surface water and/or groundwater resources of the area. (Non-statutory) local management plans advise how the water corporation is managing resources outside a WSPA.

Under statutory plans, water corporations may impose rosters, restrictions and bans on the water taken from streams by licensed diverters when streamflows drop below specified thresholds. Rosters and restrictions set out the order in which licence holders may take water and the quantity allowed to be taken (for example, 75% of licensed volume). When water is particularly scarce, bans on diversions from waterways are imposed.

The need to implement restrictions on diversions from unregulated streams fluctuates during the year, depending on rainfall and streamflows. Restrictions and bans are usually most severe in summer and autumn and are more likely to be eased over the winter and spring seasons. Victoria now only issues winterfill licences that permit take between July and October.

Chapter 2.5.3 reports on restrictions on diversions from unregulated streams in 2020–21.

Groundwater licences are all-year licences. Management plans for some GMUs may include levels that will trigger the introduction of a restriction that will reduce the volume water users can take under their licence.

A management plan may include restrictions to:

- reduce the risks from falling groundwater levels (risks can include reduced access in other licensed bores or domestic and stock groundwater supply, impacts on groundwater-dependent ecosystems and potential long-term irreversible impacts on the quality of the resource)
- allow the resource to be shared between all users
- recognise and reduce the social and environmental costs of lowering groundwater levels.

Chapter 2.5.4 reports on groundwater restrictions in 2020–21.

1.4 Monitoring and reporting

Local factors influence how much rainfall flows into streams and recharges groundwater aquifers. These factors include subsurface geology, soil permeability and moisture levels, vegetation cover and the pattern of individual rainfall events. Victoria has an extensive network of monitoring sites that record information about rainfall and temperature, river quantity and quality, groundwater levels and quality, and the production and quality of recycled water. The amount of water that is taken from rivers and groundwater is also monitored, and use is metered wherever practical.

Surface water and groundwater

Information gathered through monitoring enables us to make informed water resource management decisions. In Victoria, data is collected from about 1,400 groundwater sites from the State Observation Bore Network and about 780 surface water monitoring sites under Victoria's Regional Water Monitoring Partnerships program. The partnerships allow data to be collected to a well-defined standard once, then used for multiple business needs such as:

- availability and allocation management
- quality and compliance monitoring
- flood warning
- water resource assessment
- river health management
- linkages between groundwater and surface water systems.

The partnerships provide a coordinated, efficient approach to the statewide collection of information required for delivering a continuous program of water resource assessment for Victoria, as the Act requires. About 40 organisations invest in the program, and DELWP acts as both a partner and program manager.

The **Bureau of Meteorology** (BoM) is Australia's national weather, climate and water agency. The BoM provides observational, meteorological, hydrological and oceanographic services and research science- and environment-related issues in support of its operations and services. The BoM monitors rainfall and evaporation across Victoria. It is also one of the 40 partners involved in the Regional Water Monitoring Partnerships program. Chapter 2.1 reports on rainfall across the state in 2020–21. Evaporation and rainfall are reported for each of the river basins in chapter 6.

In Victoria, the EPA oversees the quality of recycled water, and the 16 urban water corporations monitor the production and use of recycled water.

All the water sector organisations mentioned in chapter 1.2 report annually on their operations and functions during the financial year. Information published in these reports and the monitoring data explained above are used in the accounts to report on Victoria's water resources each year.

2. Water availability

This chapter presents an overview of surface water and groundwater availability in Victoria in 2020–21. It reports rainfall, streamflows and levels in major reservoirs compared to previous years and the long-term average. It also reports the annual trend in groundwater levels in groundwater catchments and the management responses to water availability in 2020–21.

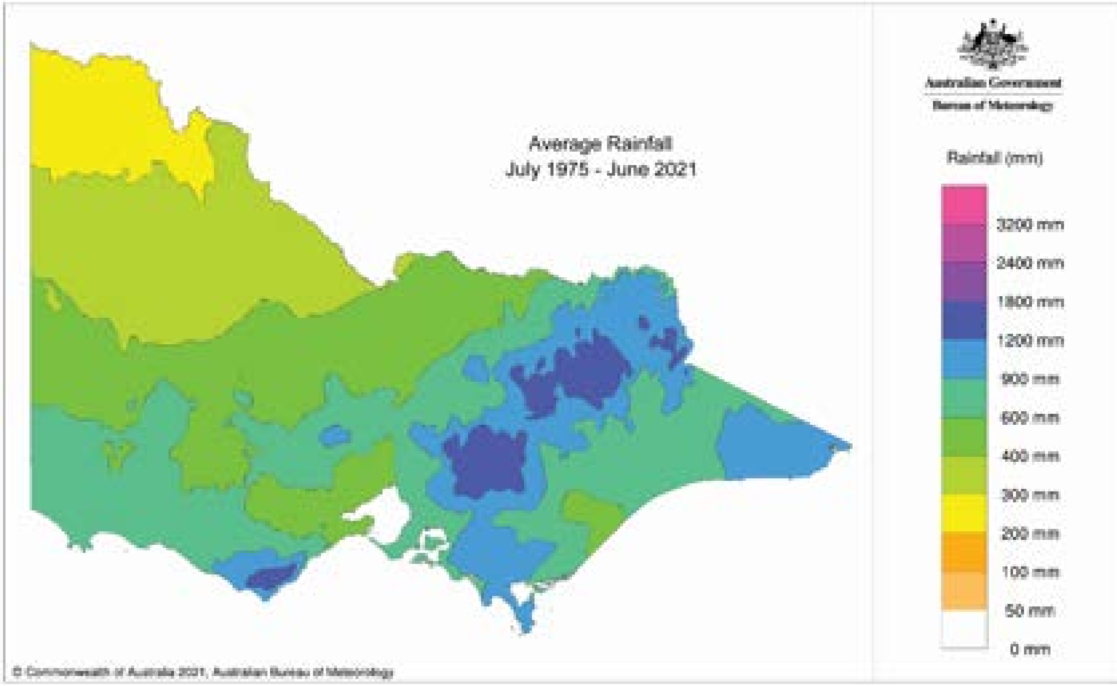
The following were the key water availability events in 2020–21.

- Most of the state received more rainfall than in the previous year. Rainfall was below average in the north-west and above average for most of the rest of the state.
- September 2020 was Victoria's sixth warmest on record, and November 2020 was Victoria's second warmest on record, both contributing to the state's third-warmest spring on record. Statewide, in 2021 it was the wettest January since 2011, the wettest March since 2012 and the wettest June since 2014.
- Although the above-average rainfall eased some of the rainfall deficiencies, there were still some short-term rainfall deficiencies in the north-west at the end of June 2021 (from February 2021) and multi-year rainfall deficiencies in the north-west, east Gippsland and parts of the north (from April 2017) (see chapter 2.1).
- On 28 September 2020, the Bureau's El Niño–Southern Oscillation (ENSO) outlook moved to LA NIÑA, indicating La Niña had been established in the tropical Pacific. This continued until 30 March 2021, when most ENSO indicators returned to neutral levels. Neutral ENSO levels continued for the rest of 2020–21 (see chapter 2.1).
- 99% of long-term annual average streamflows were received in Victoria, and 18 out of 29 river basins had annual streamflow volumes higher than those received in 2019–20 (see chapter 2.2). In only three of the previous 17 years were streamflow volumes greater than in 2020–21.
- Total annual inflows to Melbourne's major harvesting reservoirs were slightly lower than in the previous year. For only the second time since 2011–12, they were above the 30-year long-term annual average (see chapter 2.2).
- For the second year in a row, total Victorian storage levels at the end of the water year were higher than at the start. Storage levels began the water year at 50% of total capacity compared to 42% the previous year. Levels reached a peak of 65% in October 2020, much higher than the 53% of capacity in September 2019. Levels dropped during the summer and autumn to a minimum of 51% in April 2021, ending the year at 61% full (see chapter 2.3).
- Regional storages were 47% full at the start of the water year, reaching a peak of 64% of capacity in October 2020, much higher than the 51% in September the previous year. Storage levels declined through the summer and autumn to a minimum of 47% in April 2021 (compared to 38% in March 2020), and they finished higher than they were at the beginning of the water year, at 59% full on 30 June 2021 (see chapter 2.3).
- Melbourne's storages started the year at 64% full, reaching a peak of 75% in November 2020, much higher than the 64% in November 2019, and ended at 75% of total capacity. Levels dropped to a minimum of 71% in May 2021 compared to a low in the previous water year of 61% in April 2020. This is the second year since 2016–17 when Melbourne's storage levels were higher at the end of the water year than at the start (see chapter 2.2).
- The Victorian Desalination Project delivered a 125 GL water order in 2020–21. Without all the desalinated water delivered since 2016–17, Melbourne's storages would have finished the year at 55.5% in 2020–21.
- Groundwater level trends were more stable in 2020–21 than in 2019–20 (see chapter 2.4).
- Restrictions were generally fewer than in the previous year, and seasonal determinations and allocations were higher. In 2020–21:
  - there were no towns on urban water restrictions, with Permanent Water Saving Rules in place across Victoria. 32 towns had restrictions in 2019–20 (see chapter 2.5.1)
  - unlike the previous year, seasonal determinations to high-reliability entitlements in all declared water systems reached 100% (see chapter 2.5.2)
  - the number of unregulated streams on restrictions and bans reached a peak of 115 in February 2021 compared to 145 in January 2020 (see chapter 2.5.3)
  - entitlement holders in five groundwater management units (GMUs) were subject to restrictions on groundwater use: one more unit than in the previous year.

2.1 Rainfall

Long-term average rainfall in Victoria (July 1975 to June 2021) varies from less than 300 mm a year in the north-west of the state to up to 1,800 mm a year in the Alpine area of the north-east (Figure 2-1).

Figure 2-1 Long-term average annual rainfall, Victoria, July 1975 – June 2021



Note
Long-term average annual rainfall is the amount of rainfall across the geographical spread of an area, which is averaged over a grid of about 25 km by 25 km.

The Millennium Drought highlighted that planning and management cannot assume that the climate will always remain the same (see chapter 1.3.2). Victoria's climate and streamflow are highly variable, but within this variability, we have experienced a warming and drying trend in recent decades. Compared to historical conditions, we are already experiencing trends toward:

- higher temperatures and more hot days
- less rainfall in late autumn and winter
- in some locations, increases in rainfall during the warmer months and during extreme, short-duration rainfall events
- in many catchments, a shift in the streamflow response to rainfall, with less streamflow generated for the same amount of rain.

The Victorian Government is investing in further research to better understand how Victoria's climate is changing and the water-resource implications through the Victorian Water and Climate Initiative. More information about the observed changes and longer-term future climate and water projections is at www.water.vic.gov.au/climate-change/research/vicwaci.

For these 2020–21 accounts, the BoM has provided several maps:

Figure 2-1 shows Victoria's long-term (July 1975 to June 2021) average annual rainfall in millimetres

Figure 2-2 shows the total rainfall received in Victorian in 2020–21 in millimetres

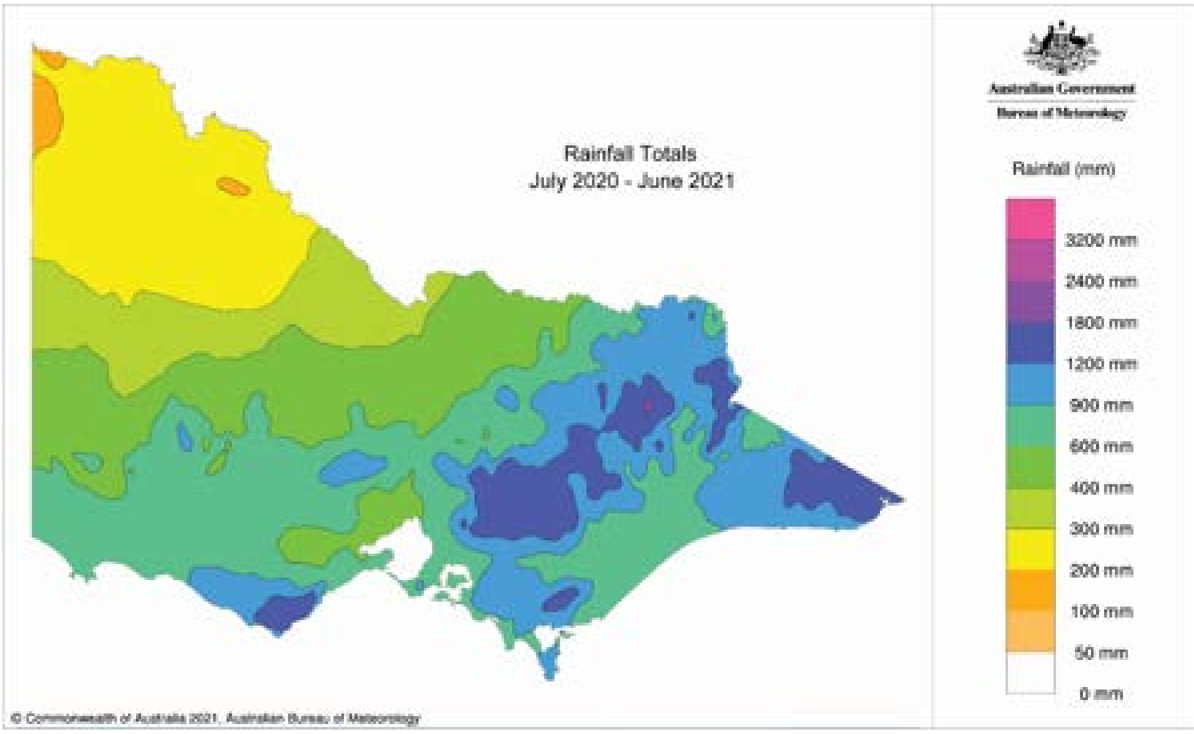
Figure 2-3 shows the percentage of total rainfall received in Victoria in 2020–21 as a percentage of the 1975–2020 calendar year average (financial year averages were not available)

Figure 2-4 A-D shows the seasonal rainfall deciles compared to Figure 2-1 (Victoria's long-term [July 1975 to June 2021] average annual rainfall)

Figure 2-5 shows the rainfall deciles for 2020–21 compared to the long-term average in Figure 2-1.

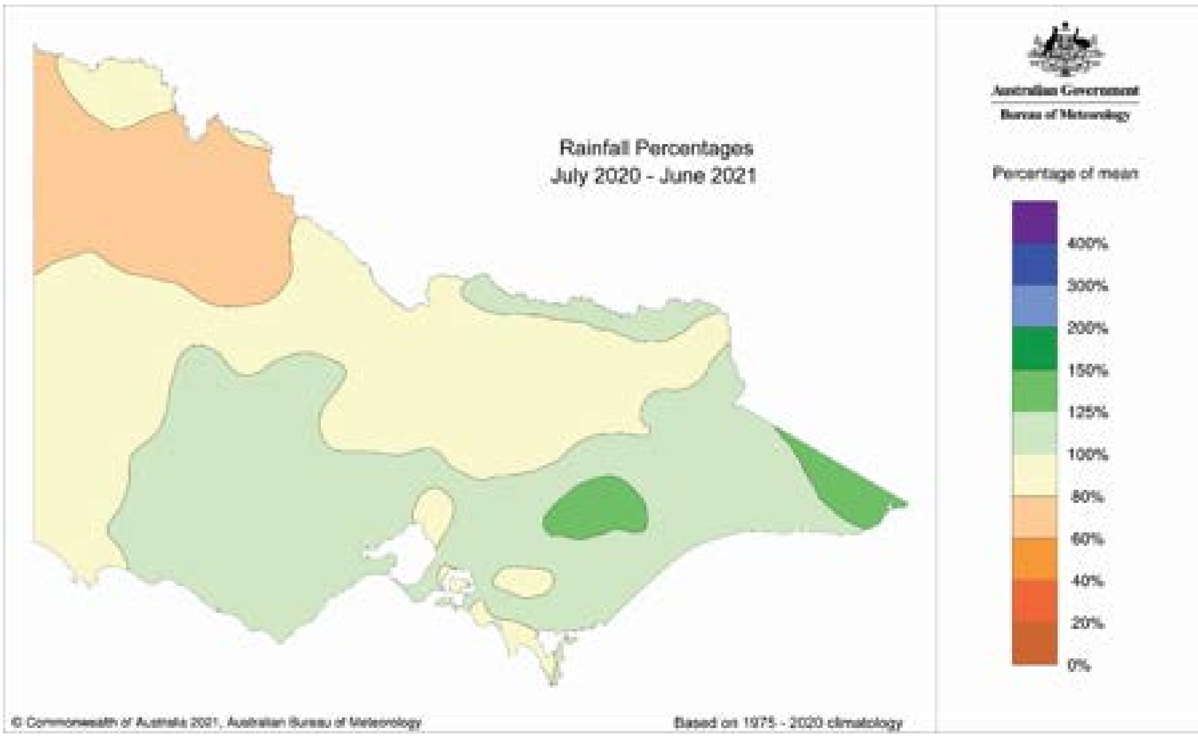
Total annual rainfall received varied across the state from 100 mm to 2,400 mm. The lowest rainfall — of between 100 to 300 mm — was received in the north-west; it was drier in the far north-west corner and near Ouyen. 300 to 600 mm was received in the north-central and west of the state and near Geelong and Werribee, and the south-west, central highlands, south-east and Gippsland received up to 900 mm of rainfall. From 900 to 1,200 mm was received in the north-east, near Warrnambool and Ballarat, and around Mansfield. Up to 1,800 mm was received in the Yarra Ranges, the Alpine region, the Otways and in parts of south Gippsland (Figure 2-2). The highest rainfall was received in a small area near Bright, up to 2,400 mm.

Figure 2-2 Rainfall, Victoria, 2020–21



Rainfall across Victoria was generally above average (Figure 2-3) compared to the 1975–2020 calendar year average. Above-average rainfall (125-150%) was received in the very east and in an area just south of Mount Buller. Up to 125% of average rainfall was received in most of the east, the western district, along most of the south-west coast and around the north-east border. Most of the rest of the state received between 80% and 100%, except in the north-west, which received between 60% and 80% of average rainfall.

Figure 2-3 Rainfall, Victoria, 2020–21, percentage of the 1975–2020 calendar year average



Averaged across Victoria as a whole, evapotranspiration in 2020–21 was estimated to be 560 mm. This is about 2% higher than long-term (1975–2021) average evapotranspiration. When estimated at a basin scale, evapotranspiration was typically higher than and within plus or minus 10% of the long-term average for most

Victorian basins. The exceptions were the Mallee and Avoca basins, where there was a reduction of more than 10% in estimated annual evapotranspiration relative to the long-term average, due to dry conditions. At the other end of the scale, the Lake Corangamite, Hopkins and Moorabool basins showed a greater than 10% increase in estimated annual evapotranspiration relative to the long-term average. However, in general, the estimated annual evapotranspiration for most basins was greater than the long-term average. This is because of above-average rainfall in 2020–21.

In 2020–21, the evapotranspiration-to-rainfall ratio was generally less than the long-term average. This is consistent with above-average rainfall generally being observed (Appendix A). However, the 2020–21 results highlight that the basins in northern Victoria tended to exhibit a higher ratio than the long-term average. Conversely, the basins in the far east of Victoria showed a lower evapotranspiration-to-rainfall ratio compared to the long-term average.

Winter 2020

Winter was drier than average in most of the state, mainly due to the very dry July (Figure 2-4A). It was wetter than average over Baw Baw National Park and in east Gippsland, where several coastal lows brought heavy rainfall. Daytime temperatures during winter were warmer than average in most of eastern and southern Victoria and close to average elsewhere. Night-time temperatures were cooler than average in most of western Victoria. Elsewhere, they were close to average, while in east Gippsland, night-time temperatures were much warmer than average.

Spring 2020

Spring rainfall was generally close to average across most of Victoria (Figure 2-4B). It was drier than average in some areas scattered across the east, and wetter than average in parts of the west-central area and along the state’s west coast. Rainfall was below average in September, above average in October, and well below average in November. Daytime temperatures were much warmer than average in most of eastern and northern Victoria and along the west coast. Night-time temperatures were much warmer than average across the state and the highest on record in eastern and central Victoria.

La Niña

On 28 September 2020, the Bureau’s El Niño–Southern Oscillation (ENSO) Outlook moved to LA NIÑA, indicating La Niña had been established in the tropical Pacific. This continued until 30 March 2021, when most ENSO indicators returned to neutral levels. Neutral ENSO levels continued for the rest of 2020–21.

Summer 2020–21

Rainfall during summer 2020–21 was average to above average for most of the state due to a wetter-than-average January (Figure 2-4C). Rainfall totals for the summer were above average in parts of central-western and south-western Victoria, as well as in the north-east. January rainfall was above average, while rainfall was below average in December and February. Daytime temperatures were cooler than average in parts of south-central and eastern Victoria. Night-time temperatures were close to average across most of the state other than in the north-west.

Autumn 2021

Rainfall totals for autumn were below to very much below average across much of western Victoria, particularly the north-west (Figure 2-4D). It was also drier than average in most of the north-east, but wetter than average in Gippsland. Daytime temperatures were close to average across Victoria, while night-time temperatures were cooler than average across much of the state's north and warmer than average along parts of the coast.

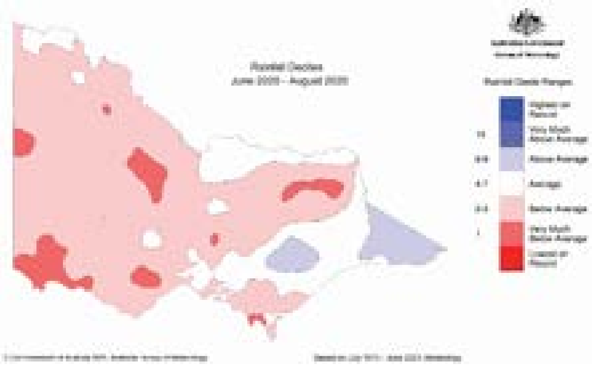
Floods

On 10 May 2021, many places in south-eastern Victoria received more than 100 mm of rain in the 24 hours, leading to flooding in low-lying areas. On 11 May 2021, flooding occurred along the Cann River around Chandler's Creek and in the Genoa River.

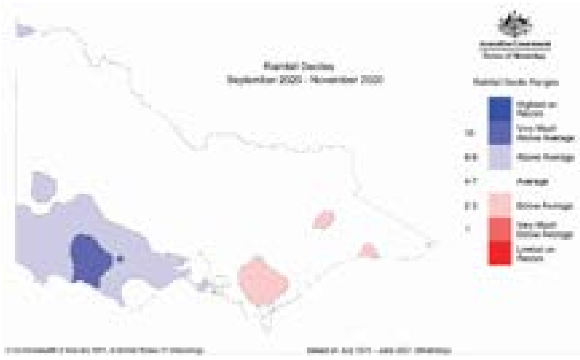
A complex low-pressure system also affected Victoria's east between 9 and 11 June 2021, bringing with it destructive winds and heavy rainfall. During this time, many sites in southern and western Gippsland received between 100 and 300 mm, leading to flooding in low-lying areas. More than 200,000 homes and businesses in Victoria were also left without power as the strong, sustained winds, with gusts exceeding 100 km/h, brought down trees and powerlines.

Figure 2-4 Seasonal Victorian rainfall deciles

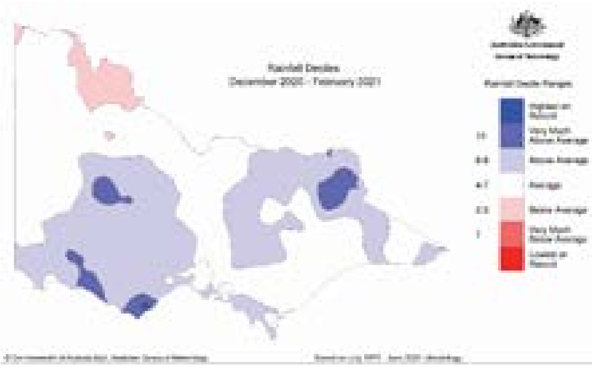
A. Rainfall deciles for winter 2020 (June–Aug)



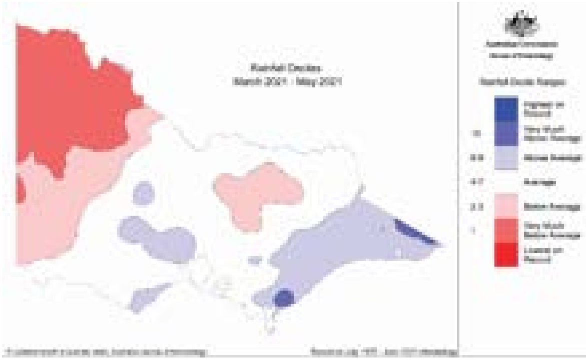
B. Rainfall deciles for spring 2020 (Sept–Nov)



C. Rainfall deciles for summer 2020–21 (Dec–Feb)

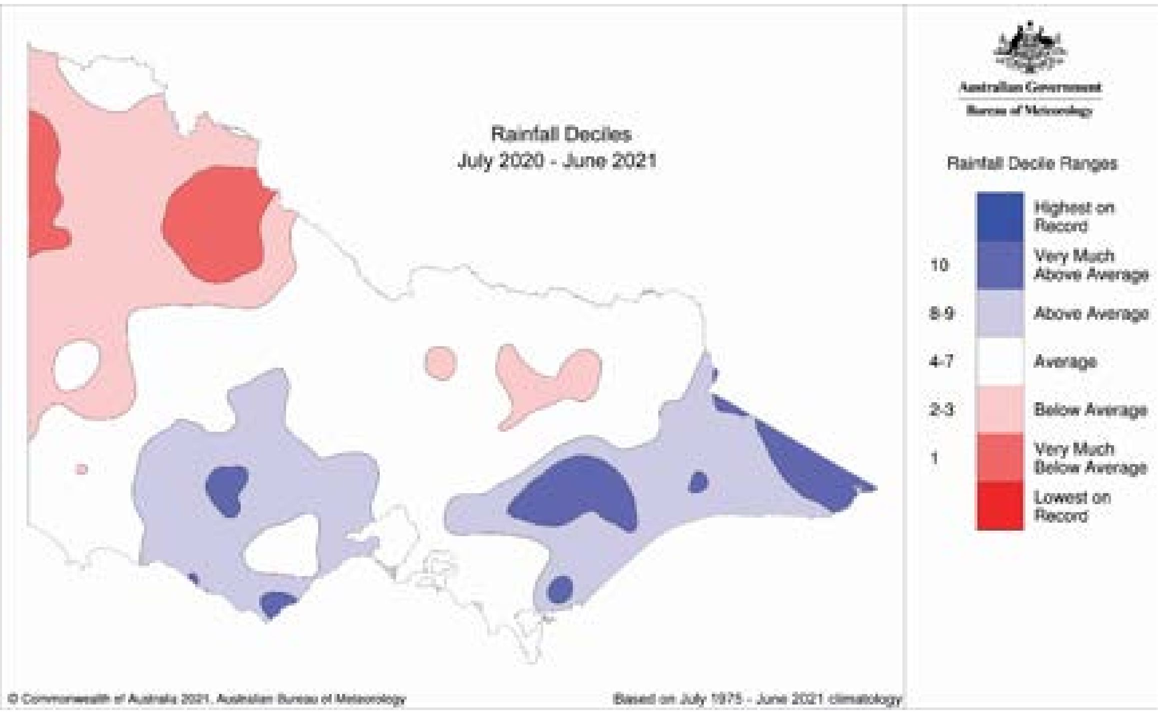


D. Rainfall deciles for autumn 2021 (Mar–May)



Overall, rainfall for 2020–21 was below average across most of the west and north-west and above average in the south (Figure 2-5). Above-average rainfall was received in most of the east and parts of the central-west, the Grampians and Hopkins/Corangamite areas and the south-west coast. Rainfall was very much above average in the Otways, near Lake Bolac, Yarram, Mount Baw Baw and the far east. Very-much-below-average rainfall was received in the north-west: on the South Australia border near Murrayville and from Swan Hill to Hopetoun. Although the above-average rainfall eased some of the rainfall deficiencies, there were still some short-term rainfall deficiencies in the north-west at the end of June 2021 (from February 2021) and multi-year rainfall deficiencies in the north-west, east Gippsland and parts of the north (from April 2017).

Figure 2-5 Rainfall deciles, Victoria, 2020–21



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2.2 Streamflow

In these accounts, streamflow is equivalent to 'catchment inflow' in the water balances presented in chapter 6. It provides an assessment of surface water availability by river basin. While streamflow in waterways varies month-by-month, this account makes an estimate of the annual volume only.

In this subchapter, the streamflows received for the year have been compared to the long-term average inflows received from 1975 to 2019.

In 2020–21, 18 out of 29 river basins had higher annual streamflow volumes than in 2019–20 (Table 2-1). When compared to the long-term annual average streamflows, 11 basins had above-average streamflows in 2020–21 compared to the previous year when seven basins had above-average streamflows. The total annual streamflow volume for Victoria was 22,304,578 ML, 99% of the long-term average (Table 2-1). This is more than the volume in 2019–20, which was 15,958,004 ML, 70% of the long-term average.

Compared to last year, there was more rainfall in 2020–21 across most of the state, which meant most streams received more rainfall. Average to above-average rainfall was received in most of the southern half of the state.. Rainfall was below-average in the north-west and north-central.

The Avoca basin was the driest basin in 2020–21, receiving 4% of long-term average inflows, lower than in the previous year. The Corangamite basin received the highest percentage of long-term average inflows: 245,512 ML, 283% of the long-term average, higher than in the previous year.

Nine basins received lower streamflows than in the previous year. These included six in the north (Avoca, Campaspe, Goulburn, Kiewa, Loddon and Wimmera) and three in the south (Moorabool, South Gippsland and Yarra). Of the 18 basins that received more streamflows than in the previous year, the East Gippsland, Snowy and Tambo basins received the largest increases.

Of the eastern and south-eastern basins:

- all basins except the Mitchell received above-average streamflows; the Mitchell was close to average, receiving 98% of the long-term annual average streamflows
- all basins except South Gippsland received more streamflows than in the previous year
- the Bunyip, East Gippsland and Snowy basins received the highest proportion of their long-term average streamflows (204%, 207% and 228% respectively)
- the Latrobe, South Gippsland, Thomson and Tambo basins all received streamflows of between 114% and 155% of the long-term annual average.

Of the northern basins:

- all northern basins received below-average streamflow, and only three out of 11 basins received more streamflows than in the previous year (Broken, Murray and Ovens)
- the Ovens, Murray, Goulburn and Kiewa basins received between 64% and 80% of the long-term average
- the Loddon, Campaspe and Broken basins received between 30% and 46% of the long-term average
- the Avoca and Wimmera basins in the north-west received 4% and 19% of the long-term average, respectively.

Of the south-western basins:

- three out of five basins received above-average streamflows, and all basins received more streamflows than in the previous year
- the Hopkins, Otway Coast and Corangamite basins received above-average streamflows (between 112% and 283% of the long-term average)
- the Portland Coast and Glenelg basins received below-average streamflows (53% and 63% of the long-term average, respectively).

Of the central basins:

- only the Yarra basin received above-average streamflows, and three out of five basins received more streamflows than in the previous year (Barwon, Maribyrnong and Werribee)
- the Barwon, Maribyrnong, Moorabool and Werribee basins received below-average streamflows (between 60% and 98% of the long-term average)
- the Yarra basin received above-average streamflows (107%), slightly lower than in the previous year.

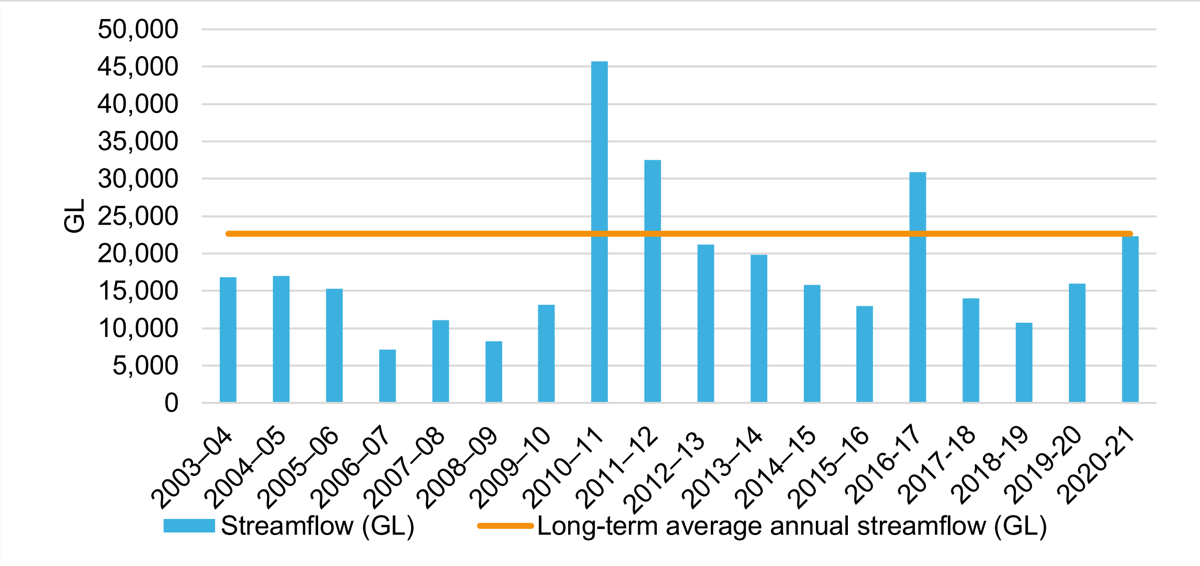
Table 2-1 Basin streamflows, compared to 1975–2019 average

Basin	Long-term average annual inflows (ML)	2020–21 streamflows (1)		2019–20 streamflows (1)	
		(ML)	(% of LTA)	(ML)	(% of LTA)
Avoca	87,100	3,789	4%	6,431	7%
Barwon (2)	248,000	163,448	66%	146,346	59%
Broken	260,800	119,914	46%	117,935	45%
Bunyip	564,400	1,150,940	204%	1,083,251	192%
Campaspe	258,600	111,328	43%	117,033	45%
Corangamite	86,800	245,512	283%	194,972	225%
East Gippsland	857,700	1,773,084	207%	125,854	15%
Glenelg	527,300	333,265	63%	217,010	41%
Goulburn (3)	2,859,000	2,134,641	75%	2,155,436	75%
Hopkins	325,100	365,711	112%	269,866	83%
Kiewa	676,700	538,368	80%	543,893	80%
Latrobe	843,300	961,926	114%	866,562	103%
Loddon	243,400	74,217	30%	107,751	44%
Mallee (4)	-	-	-	-	-
Maribyrnong	92,800	59,558	64%	50,964	55%
Millicent Coast (4)	-	-	-	-	-
Mitchell	804,100	790,885	98%	554,446	69%
Moorabool (2)	103,400	62,115	60%	64,258	62%
Murray	6,649,300	4,747,614	71%	3,501,757	53%
Otway Coast	733,300	1,166,244	159%	884,419	121%
Ovens	1,729,300	1,112,732	64%	1,007,608	58%
Portland Coast	462,200	245,606	53%	179,570	39%
Snowy (5)	795,600	1,815,274	228%	343,275	43%
South Gippsland	932,900	1,345,789	144%	1,439,013	154%
Tambo	297,200	460,084	155%	72,072	24%
Thomson (2)	936,400	1,368,986	146%	751,602	80%
Werribee	88,600	86,600	98%	73,090	82%
Wimmera	223,100	41,418	19%	54,700	25%
Yarra	954,200	1,025,530	107%	1,028,892	108%
Total	**22,640,600**	**22,304,578**	**99%**	**15,958,004**	**70%**

Notes

(1) 'Streamflow' is equivalent to 'catchment inflow' in the water balances in chapter 6.
(2) The Thomson, Moorabool and Barwon catchment inflow volumes have been corrected from the previous account. See chapters 6.13.3, 6.20.3 and 6.21.3 for more information.
(3) Only includes inflows within the Goulburn basin.
(4) Surface water resources within the Mallee and Millicent Coast basins are limited, and there are currently no streamflow gauges in these basins.
(5) Volumes shown for the Snowy basin exclude catchment inflows from New South Wales (upstream of Burnt Hut Crossing).

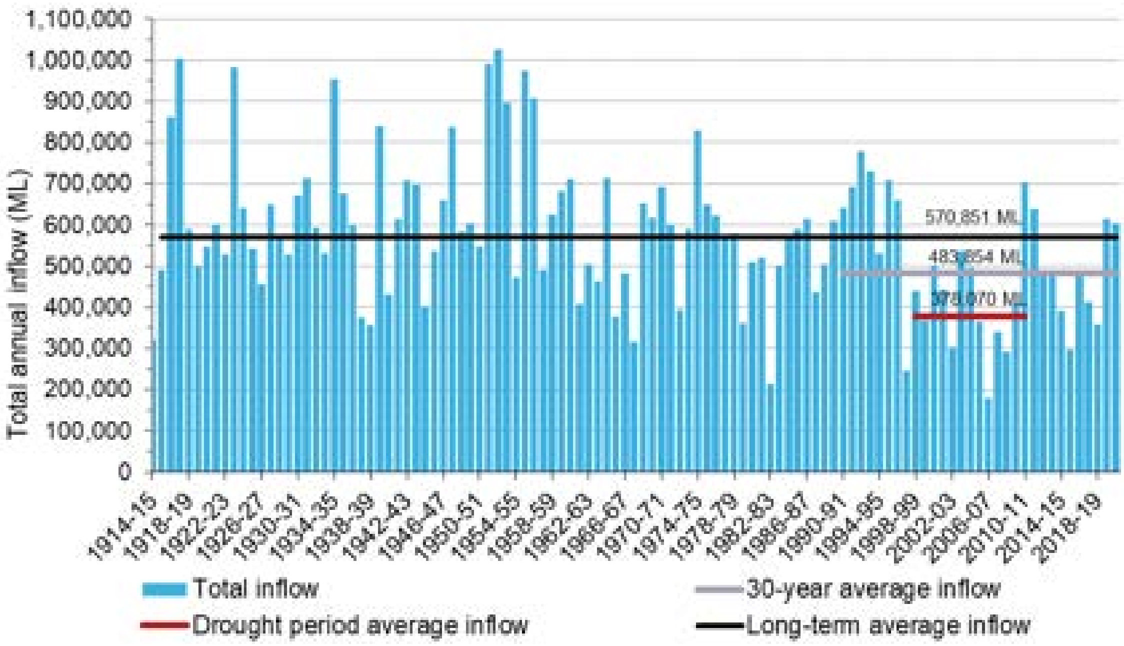
Figure 2-6 Total streamflow, Victoria, compared to 1975–2019 average



Streamflows have a major influence on Victoria's water storages. Figure 2-6 shows that Victoria's total annual streamflows in 2020–21 were higher than in the previous three years. Figure 2-7 shows that total annual streamflows received in Melbourne's main reservoirs were higher than in the previous year, and for the second time since 2011–12 they were above the 30-year long-term annual average.

The annual inflows to Melbourne's harvesting reservoirs in the Yarra and Thomson basins in 2020–21 were 125% (603,695 ML) of the 30-year long-term average (1990–91 to 2019–20) of 483,854 ML, which is 106% of the 100-year average of 570,851 ML. This is slightly less than the volume (615,401 ML) received in 2019–20, which was 127% of the 30-year long-term average and 108% of the 100-year long-term average (Figure 2-7). Although 2020–21 is the second year since 2011–12 that Melbourne has received above-long-term-average inflows into storages, inflows into storages have been below average in 13 of the past 20 years (Figure 2-7). Melbourne's largest reservoir, the Thomson Dam, has also not been full since 1996.

Figure 2-7 Annual inflows to Melbourne's main harvesting reservoirs (1)



Note

(1) Maroondah, O'Shannassy, Upper Yarra and Thomson reservoirs.

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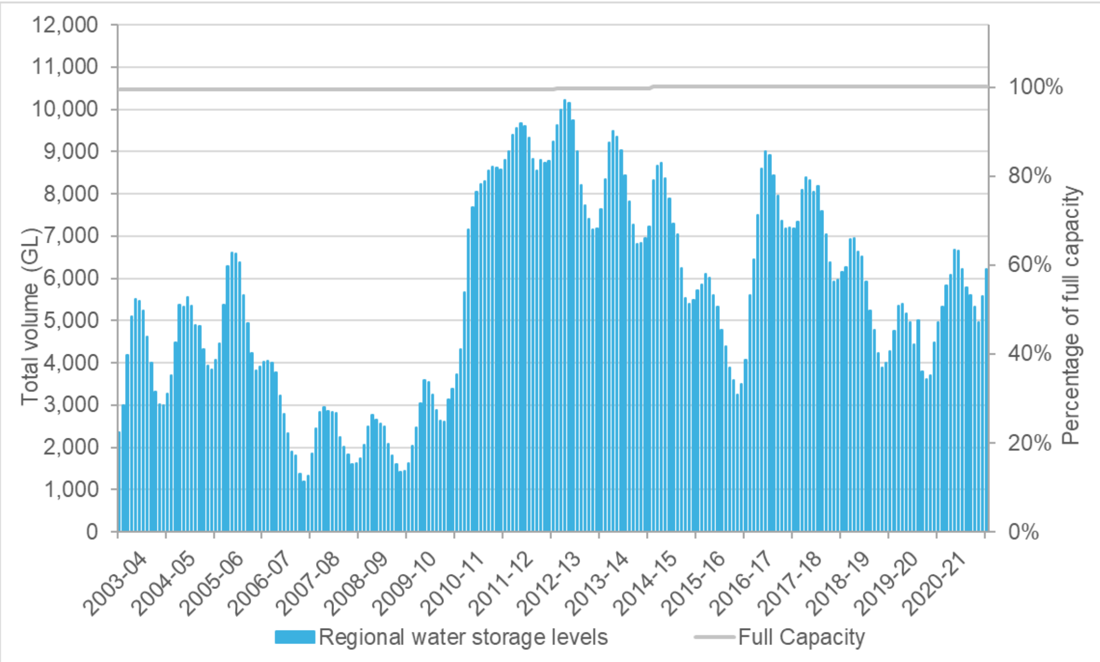
2.3 Storages

Victoria's major water storages can hold 12,344,093 ML. Of this, Melbourne's storage capacity is 1,812,175 ML, and the combined capacity of the state's major regional storages is 10,531,918 ML. Information about levels held in all major storages across Victoria's river basins is in Appendix B and in the water balances in chapter 6.

A subset of about 60 of the major storages was used to provide the summary information below and in Figure 2-8 and Figure 2-9. In 2020–21, Victoria's total storage levels started the year at 6,126 GL (49.6% of capacity) and ended at 7,566 GL (61.3% of capacity). Storage levels reached a peak of 65.2% of capacity in October 2020 compared to 53% in September of the previous year. The combined volume of water stored in Victoria's reservoirs varies both within a given year and between years.

Storage levels in Victoria's regional reservoirs started the year at 4,970 GL (47.2% of capacity) and ended at 6,209 GL (59% of capacity). Twenty-five (out of 56) of Victoria's regional storages reached at least 90% of capacity by October 2020 (the same as the previous year), and 13 of those reached full capacity and were spilling compared to 14 the previous year. In 2020–21, levels reached a peak of 63.5% of capacity by October 2020 compared to 51.3% in September 2019. Storage levels declined through the summer to a minimum of 47.2% of capacity by April 2021 compared to 34.2% in March 2020 (Figure 2-8).

Figure 2-8 Volume in major regional water storages, 1 July 2003 to 30 June 2021 (1) (2) (3)



Notes

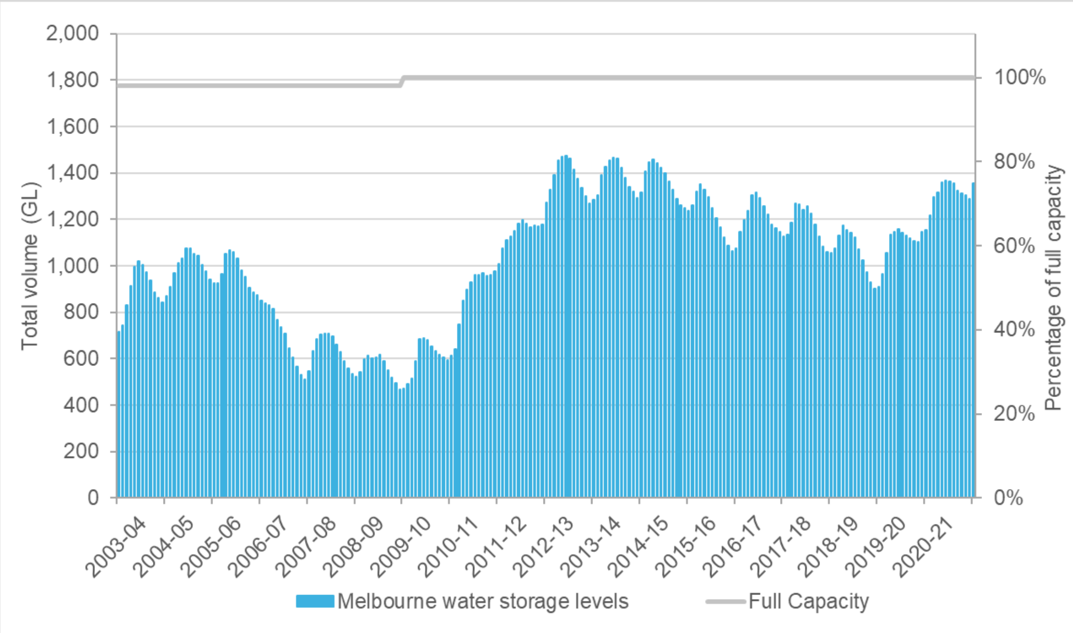
(1) The Y-axis percentage relates to the current storage capacity (i.e. after the addition of the Menindee Lakes 240,000 ML in 2015–16).

(2) The mid-Murray storages have been included for the first time in the *Victorian Water Accounts 2016–17*. Reporting on storage levels began in mid-2012.

(3) The maximum operating capacity of Rocklands Reservoir was changed in 2014–15 from 261,510 ML to 296,000 ML.

In 2020–21, Melbourne's storages started the year at 1,156 GL (63.8% of total capacity) and ended at 1,357 GL (74.9% of total capacity), after reaching a peak of 75.4% in November 2020 (Figure 2-9) and declining to a minimum of 71% in May 2021. This is the second water year since 2016–17 that Melbourne's storage levels have been higher at the end of the year than they were at the start, unlike the last two years and the latter years of the Millennium Drought (chapter 1.3.2) — between 2006–09 — when storages consistently ended each year at lower levels than they began. This year, inflows were above average in eight of the 12 months of the water year: they were below average in September, November and December 2020 and February 2021. Although rainfall was above average in seven months, this included January 2021 and March to June 2021. There was also a 125 GL Victorian Desalination Project water order which contributed to Melbourne's water storage levels. The increased inflows, rainfall and desalinated water all contributed to the storages finishing the year higher than they began.

Figure 2-9 Volume in Melbourne's water storages, 1 July 2003 to 30 June 2021 (1)



Note

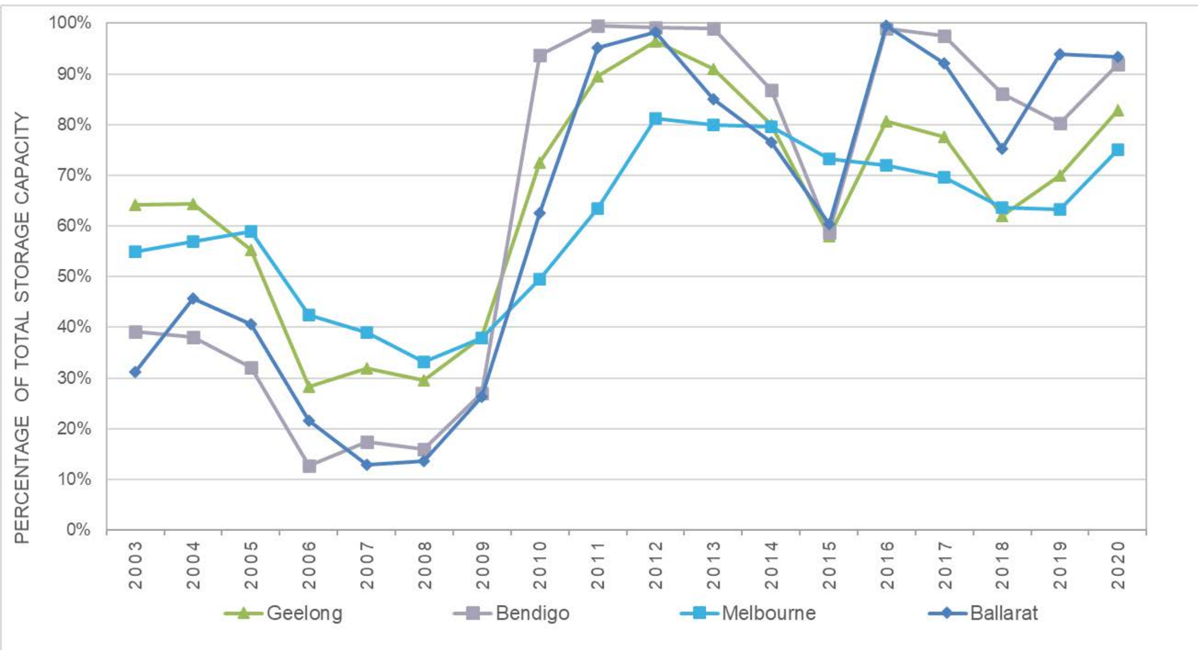
(1) The Y-axis percentage relates to the current storage capacity (i.e. after the addition of Tarago's 37,580 ML in 2010).

The Victorian Desalination Project began producing water in March 2017. The total volume delivered for the year to 30 June 2021 was 125 GL (representing 6.9% of Melbourne's storage capacity), the same as what was delivered in 2019–20. Without the water delivered since 2016–17, Melbourne's storages would have finished the year at 55.5% in 2020–21 instead of 74.9%. Chapter 1.1.4 has more information about the Victorian Desalination Project.

The total volume of water stored in Victoria's major reservoirs has historically been at its highest following winter and spring inflows, so storage levels at the end of October are traditionally a good indication of water availability for the remainder of that year. Figure 2-10 presents end-of-October storage levels as a percentage of storage capacity for Melbourne and selected major regional centres from October 2003 to October 2020.

During the Millennium Drought, October storage levels generally declined from 2003 to 2007 (Figure 2-10) as inflows were not sufficient for systems to recover. A significant drop in levels occurred between 2005–06 and 2006–07 when winter and spring rainfall was extremely low across Victoria. By October 2010, storage levels had recovered significantly, with further recovery in 2011–12 across all major centres. At the end of October 2020, storages in Melbourne and the selected regional centres were between 75% and 93%. The regional storages were between 83% and 93%, which was on average higher than in the previous year when regional storages were between 70% and 94%. Melbourne storages in October 2018 were at 75%, much higher than in the previous year when they were at 53% (Figure 2-10).

Figure 2-10 Percentage of total storage capacity of reservoirs for major urban centres, on 31 October 2003–20



2.4 Groundwater

Long-term trends in groundwater levels reflect differences between the amount of water flowing into (recharge) and out of (discharge) an aquifer and how much is used for consumptive purposes. Groundwater level trends in shallow aquifers are more likely to reflect more-rapid changes in annual recharge from either rainfall or discharge from irrigation, whereas confined aquifer trends may show a seasonal influence from pumping within a longer-term trend.

In the accounts, groundwater level trends for groundwater management units (GMUs) have been determined based on five years' consistent monitoring data from key bores in the State Observation Bore Network. Trend determinations are made quarterly when each reading is compared to previous readings in the same season (that is, a summer record is compared to previous summer records) to account for seasonality.

In 2020–21, groundwater level trends in water supply protection areas (WSPAs) and groundwater management areas (GMAs) stabilised more than in the previous year.

In the WSPAs in 2020–21, four were declining, four as stable and three as rising. This compared to seven declining, three stable and one rising in 2019–20 (Table 2-2 and Figure 2-11). In the state's GMAs, ten were declining compared to 16 in 2019–20; 17 were stable, the same as in the previous year; and 12 were rising compared to seven in 2019–20 (Table 2-3 and Figure 2-12).

Groundwater levels remained within historical averages. Resource managers monitor and manage declining levels through groundwater management plans and restrictions on use (see chapter 2.5.4).

Table 2-2 Groundwater level trends in water supply protection areas

Water supply protection area	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-20	
Central groundwater management basin					
Westernport groundwater catchment					
Koo Wee Rup	stable	stable	declining	**declining**	**stable**
West Port Phillip Bay groundwater catchment					
Deutgam	declining	declining	stable	**stable**	**declining**
Gippsland groundwater management basin					
Central Gippsland groundwater catchment					
Sale	stable	declining	declining	**declining**	**declining**
Yarram (1)	declining	declining	declining	**declining**	**declining**
Goulburn–Murray groundwater management basin					
Campaspe groundwater catchment					
Lower Campaspe Valley	declining	declining	declining	**stable**	**declining**

Goulburn–Broken groundwater catchment					
Katunga	declining	declining	declining	**declining**	**declining**
Loddon groundwater catchment					
Loddon Highlands	rising	rising	rising	**rising**	**declining**
Ovens groundwater catchment					
Upper Ovens	stable	stable	rising	**stable**	**rising**
Otway–Torquay groundwater management basin					
Glenelg groundwater catchment					
Glenelg	stable	stable	stable	**stable**	**stable**
Hopkins–Corangamite groundwater catchment					
Warrion	rising	rising	rising	**rising**	**stable**
Portland groundwater catchment					
Condah	rising	rising	rising	**rising**	**declining**

Note

(1) Yarram WSPA water levels are influenced by offshore oil and gas extraction.

Figure 2-11 Groundwater level trends in water supply protection areas

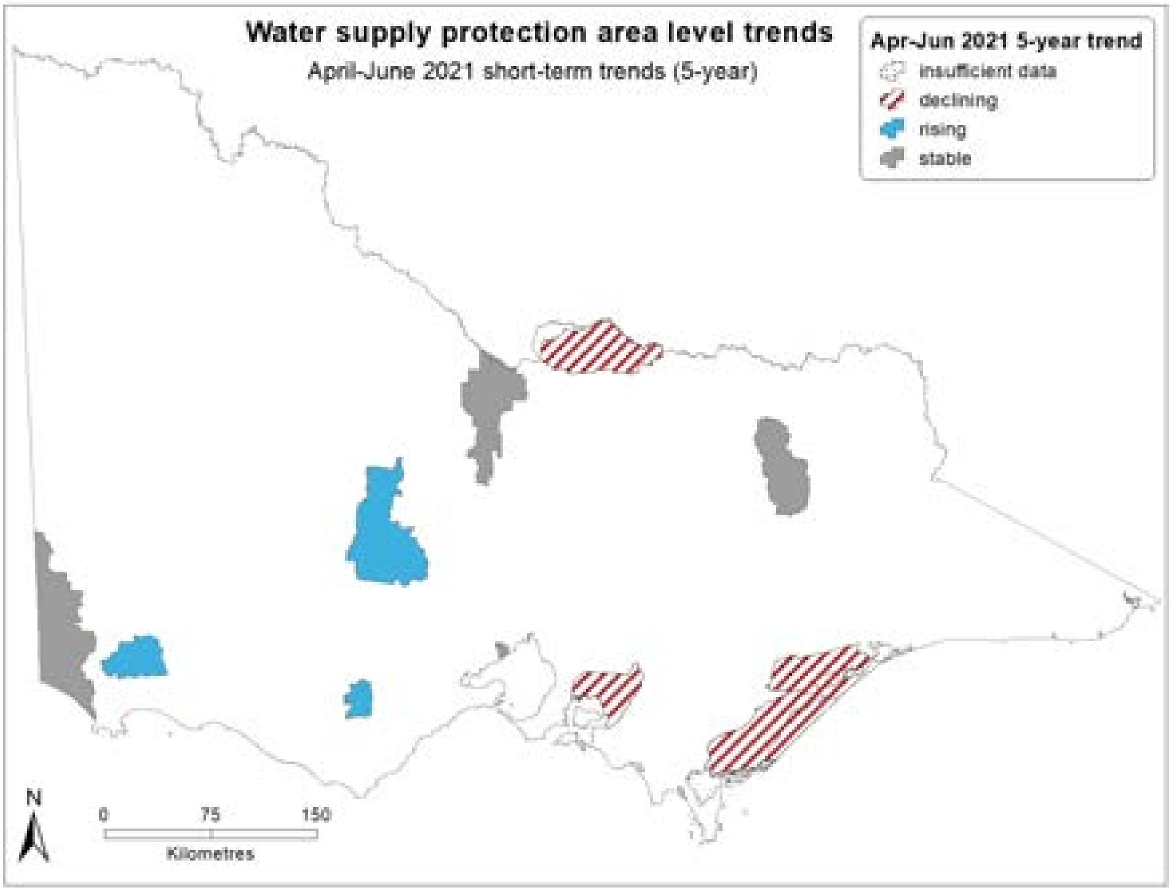


Table 2-3 Groundwater level trends in groundwater management areas

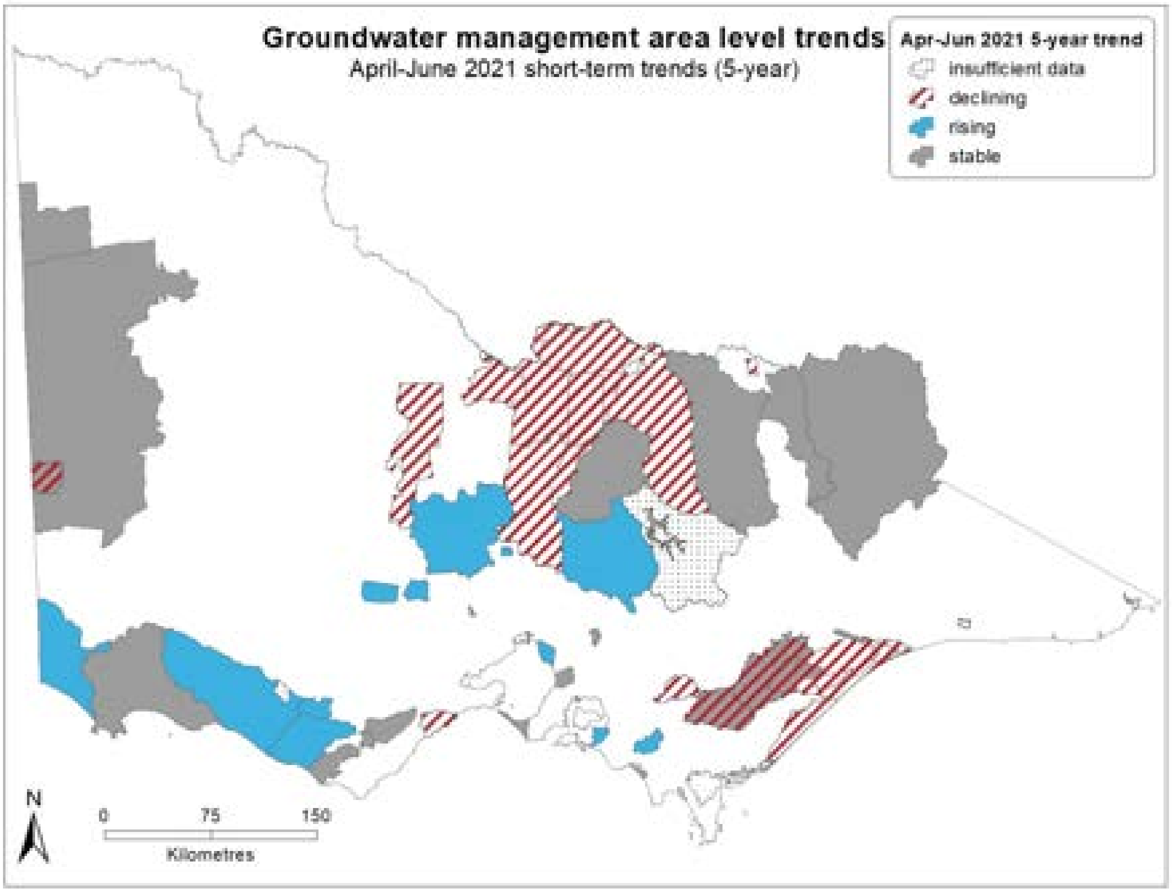
Groundwater management area [1]	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Central groundwater management basin					
East Port Phillip Bay groundwater catchment					
Frankston	declining	declining	declining	**stable**	**declining**
Moorabbin	stable	rising	rising	**rising**	**rising**
Nepean	stable	stable	stable	**stable**	**stable**
Wandin Yallock [2]	rising	rising	declining	**stable**	**declining**
Tarwin groundwater catchment					
Leongatha	rising	stable	rising	**rising**	**stable**

Tarwin	stable	stable	stable	**stable**	**rising**
Westernport groundwater catchment					
Corinella	stable	rising	rising	**rising**	**stable**
West Port Phillip Bay groundwater catchment					
Lancefield	rising	rising	rising	**rising**	**rising**
Merrimu	declining	rising	rising	**rising**	**declining**
Gippsland groundwater management basin					
Central Gippsland groundwater catchment					
Rosedale (2)	stable	stable	stable	**stable**	**stable**
Stratford (2)	stable	declining	declining	**declining**	**declining**
Wa De Lock	stable	stable	stable	**stable**	**declining**
Wy Yung	stable	stable	stable	**stable**	**declining**
East Gippsland groundwater catchment					
Orbost (3)	declining	declining	INS-DATA	**INS-DATA**	**declining**
Moe groundwater catchment					
Moe	declining	declining	declining	**declining**	**declining**
Seaspray groundwater catchment					
Giffard	stable	declining	declining	**declining**	**declining**
Goulburn–Murray groundwater management basin					
Campaspe groundwater catchment					
Central Victorian Mineral Springs (4)	rising	rising	rising	**rising**	**stable**
Goulburn–Broken groundwater catchment					
Broken	declining	declining	declining	**declining**	**declining**
Mid Goulburn	declining	declining	declining	**declining**	**declining**
Shepparton Irrigation	declining	declining	declining	**declining**	**declining**
Strathbogie	stable	stable	stable	**stable**	**stable**
Upper Goulburn	rising	rising	rising	**rising**	**rising**
West Goulburn	stable	declining	declining	**declining**	**stable**
Loddon groundwater catchment					
Mid Loddon	declining	declining	stable	**declining**	**declining**
Ovens groundwater catchment					
Barnawartha	declining	declining	declining	**declining**	**declining**
Lower Ovens	stable	stable	stable	**stable**	**declining**
Upper Murray groundwater catchment					
Kiewa	stable	stable	stable	**stable**	**declining**
Upper Murray	stable	stable	stable	**stable**	**stable**
Otway–Torquay groundwater management basin					
Hopkins–Corangamite groundwater catchment					
Bungaree	rising	rising	rising	**rising**	**rising**
Cardigan	rising	rising	rising	**rising**	**stable**
Colongulac	rising	rising	rising	**rising**	**stable**
Gellibrand	stable	stable	stable	**stable**	**stable**
Gerangamete	stable	stable	stable	**stable**	**stable**
Newlingrook	stable	stable	stable	**stable**	**stable**
Paaratte	rising	rising	rising	**rising**	**stable**
South West Limestone (5)	stable	stable	stable	**rising**	**rising**
Otway–Torquay groundwater catchment					
Jan Juc	stable	stable	stable	**declining**	**rising**
Portland groundwater catchment					
Portland (3)	stable	stable	INS-DATA	**stable**	**stable**
Wimmera Mallee groundwater management basin					
West Wimmera groundwater catchment					
West Wimmera	stable	stable	stable	**stable**	**stable**
West Wimmera – Neuarpur subzone1 (6)	declining	declining	declining	**declining**	**declining**
Wimmera Mallee groundwater catchment					
Murrayville	stable	stable	stable	**stable**	**stable**

Notes

(1) The following GMAs have been omitted from this table due to insufficient state observation bores to adequately define the groundwater resource or changes to the resource over time: Cut Paw Paw, Denison, Eildon and Glenormiston.
(2) Rosedale and Stratford include the dewatering activities from the Loy Yang coal mine.
(3) A trend could not be determined for the January to March 2021 quarter in the Portland GMA or the October 2020 to March 2021 period for Orbost because monitoring data was not available.
(4) The Central Victorian Mineral Springs GMA is partly contained within the Campaspe and Loddon groundwater catchments.
(5) The South West Limestone GMA extends into the Hopkins–Corangamite, Portland and Glenelg groundwater catchments.
(6) Restrictions on seasonal allocations are in place to address the trend deviation in the Neuarpur subzone in the West Wimmera GMA.

Figure 2-12 Groundwater level trends in groundwater management areas



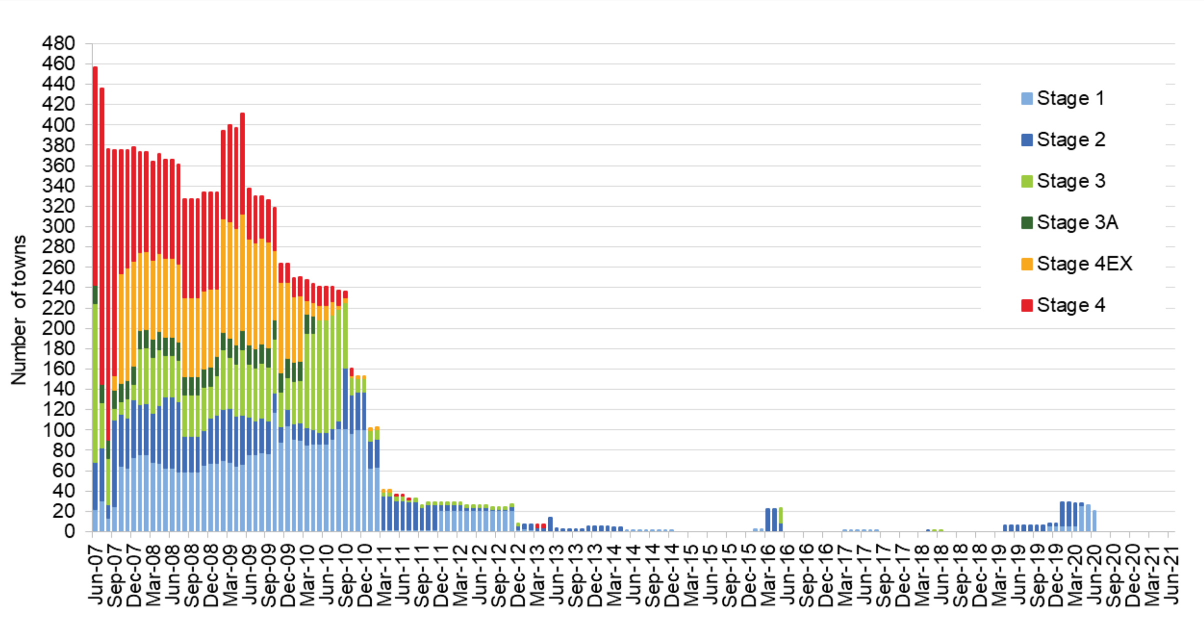
2.5 Response to water availability

Overall water availability in 2020–21 was greater than in the previous year, with higher rainfall and increased surface water availability (98% of the long-term average compared to 70% in 2019–20). Seasonal determinations were higher than in the previous year, and there were fewer restrictions on towns and licensed diversions from unregulated streams. Although groundwater restrictions were higher than in the previous year, there were fewer instances of water carting. Unlike the previous year, there also were no temporary qualifications of rights to water in 2020–21.

2.5.1 Urban water restrictions

There were no towns with urban restrictions in place in 2020–21, with all towns on permanent water-saving rules from 1 July 2020 to 30 June 2021 (Table 2-4). Thirty-two towns had restrictions in the previous year. More than 450 towns were subject to restrictions at the peak of the Millennium Drought in 2007 (Figure 2-13).

Figure 2-13 Number of towns and severity of water restrictions, Victoria, June 2007 to June 2021



Note
The restriction policy outlined in 1.3.2.1 was implemented in 2011 to standardise the application of water restrictions throughout the state. Before this, water corporations could use other restriction levels stage 3a and stage 4ex.

Table 2-4 Urban water restrictions

Water corporation	Water system and towns	Level of water restrictions in 2020–21
Central region		
Barwon Water	All towns	PWSR applied all year
Central Highlands Water	All towns	PWSR applied all year
Melbourne metropolitan retailers (Yarra Valley Water, South East Water, City West Water)	Metropolitan Melbourne	PWSR applied all year
Southern Rural Water (Werribee and Bacchus Marsh system)	All towns	PWSR applied all year
Westernport Water	All towns	PWSR applied all year
Western Water	All towns	PWSR applied all year
Northern region		
Coliban Water	All towns	PWSR applied all year
Goulburn-Murray Water	All towns	PWSR applied all year
Goulburn Valley Water	All towns	PWSR applied all year
Lower Murray Water	All towns	PWSR applied all year
North East Water	All towns	PWSR applied all year
Western region		
GWMWater	All towns	PWSR applied all year
Wannon Water	All towns	PWSR applied all year
Gippsland region		
East Gippsland	All towns	PWSR applied all year
South Gippsland Water	All town	PWSR applied all year
Gippsland Water	All towns	PWSR applied all year
Southern Rural Water (Macalister system)	All towns	PWSR applied all year

Note
PWSR = permanent water-saving rules.

2.5.2 Seasonal determinations in regulated systems

Unlike in the previous year, seasonal determinations to high-reliability entitlements in all northern declared water systems in 2020–21 reached 100%. Southern systems also had 100% high-reliability determinations made in the Thomson and Werribee systems. Opening allocations announced in July 2020 were a little higher than in the previous year but were low for almost all systems except Coliban and Thomson Macalister. By February 2021, all northern and southern systems had received seasonal determinations of 100% high-reliability water shares, higher than in the previous year when only three systems were at 100% at this time (Table 2-5).

In the north, the Bullarook and Broken systems also received seasonal determinations of 100% low-reliability water shares.

In southern Victoria, allocations were the same as in the previous year, when the Thomson Macalister and Werribee and Bacchus Marsh systems both received a 100% allocation against high- and low-reliability entitlements.

Allocations for the Wimmera Mallee Pipeline Product began with initial allocations of 0%, which ended at 57% in March 2021. In the Coliban Rural system, entitlement holders had access to 100% of their entitlement for the entire year for the tenth year in a row.

Table 2-5 Seasonal water allocations in regulated water systems

Water system	Water shares	2020–21			2019–20
		Opening allocation (1) (% of entitlement)	Mid-season allocation (2) (% of entitlement)	Final allocation (3) (% of entitlement)	Final allocation (% of entitlement)
Northern declared systems					
Murray	High-reliability	8	100	**100**	**66**
	Low-reliability	0	0	**0**	**0**
Goulburn	High-reliability	35	100	**100**	**80**
	Low-reliability	0	0	**0**	**0**
Broken	High-reliability	17	100	**100**	**2**
	Low-reliability	0	100	**100**	**0**
Campaspe	High-reliability	32	100	**100**	**80**
	Low-reliability	0	0	**0**	**0**
Loddon	High-reliability	35	100	**100**	**80**
	Low-reliability	0	0	**0**	**0**
Bullarook	High-reliability	0	100	**100**	**100**
	Low-reliability	0	100	**100**	**100**
Southern declared systems					
Thomson Macalister	High-reliability	100	100	**100**	**100**
	Low-reliability	0	20	**100**	**100**
Werribee and Bacchus Marsh	High-reliability	30	100	**100**	**100**
	Low-reliability	0	80	**100**	**100**
Non-declared systems					
Wimmera Mallee	Pipeline product	0	56	**57**	**42**
Coliban Rural	Rural licences	100	100	**100**	**100**

Notes

(1) Opening allocations are taken as the initial determination made by each resource manager at the start of July.

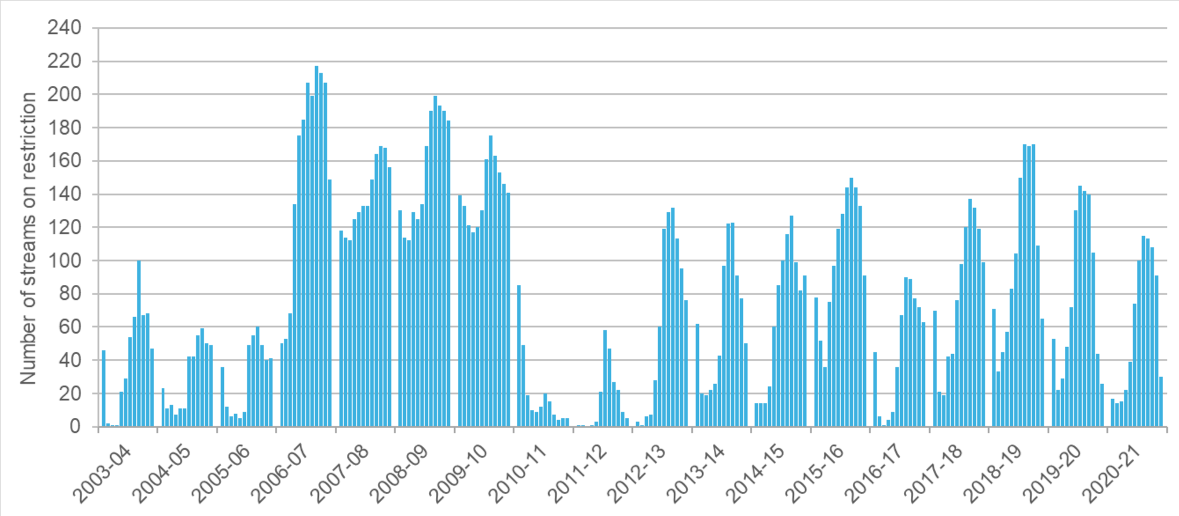
(2) Allocations in February are provided as an indication of mid-season allocations.

(3) Goulburn-Murray Water (Northern Victoria Resource Manager) announces final allocations in April, while Southern Rural Water and the Wimmera Mallee Storage Manager announce final allocations in June.

2.5.3 Restrictions on diversions from unregulated streams

The number of streams on restrictions and bans reached a peak of 115 in February 2021 compared to 145 in January 2020 (Figure 2-14). There were 91 streams subject to restrictions in May 2020, more than double the number of streams restricted at the same time in the previous year (44). There were 30 streams on restrictions at the end of 2020–21 compared to 26 at the end of 2019–20.

Figure 2-14 Victorian unregulated streams on restrictions, number, June 2003 – June 2021



2.5.4 Groundwater restrictions

Entitlement holders in five groundwater management units (GMUs) were subject to restrictions on licensed groundwater diversions in 2020–21, one more than in the previous year. Unless noted otherwise, restrictions on groundwater use in the following GMUs applied for the whole of 2020–21.

In the Lower Campaspe Valley WSPA, Goulburn-Murray Water announced an allocation of 75% for all management zones of the Lower Campaspe Valley Water Supply Protection Area. This is the first time the three northern management zones have had an allocation of less than 100% since the Lower Campaspe Valley WSPA Groundwater Management Plan was implemented.

In the West Wimmera groundwater catchment, GWMWater announced an 80% seasonal allocation for the Neuarpur subzone 1, a trading zone in the West Wimmera GMA.

As a result of the new restriction method in the amended version of the Katunga WSPA Groundwater Management Plan, licensed use in Katunga WSPA in the Goulburn–Broken groundwater catchment was restricted to 70% of the entitlement volume.

In the Loddon Highlands WSPA in the Loddon groundwater catchment, licensed diversions from all zones except Blampied and Newlyn were able to take 100% of their entitlement volume in 2020–21. Licensed diversions from the Newlyn Zone were restricted to 75% of entitlement volume for the whole year, whereas Blampied Zone was restricted to 75% from August 2020, with the restriction lifted in early January 2021.

In the West Port Phillip Bay groundwater catchment, licensed diversions from the Deutgam WSPA were restricted to 25% of entitlement volume in July 2020 and then 50% of the entitlement for the rest of 2020–21.

2.5.5 Water carting

Water carting is an option that water corporations use to augment town supplies when local sources cannot meet demand. Doing so can be a time-consuming, expensive exercise and is usually a last resort to supply smaller towns. In recent years, water carting has been required to address water scarcity, particularly during drought periods. In 2020–21, there was one instance where water carting was required compared to three in the previous year.

In South East Water's area in August 2020, a water quality incident caused by a power outage at Silvan Dam disrupted supply to customers. Six specially fabricated foot-operated hydrants were connected to water carter tanks for affected customers.

2.5.6 Temporary qualification of rights to water

There were no temporary qualifications of rights to water in 2020–21.

3. Water for consumptive use

Water for consumptive use in Victoria is taken from reservoirs, streams and aquifers under entitlements issued and authorised under the *Water Act 1989*, as explained in chapter 1.

Generally, water for consumptive use is allocated to either water corporations (which are granted bulk entitlements) or to individuals (who are issued a water share or a take and use licence).

In addition to formally issued entitlements, the Act enables individuals to take water for domestic and stock use from a range of surface water and groundwater sources without a licence (for example, from a small catchment dam). These domestic and stock rights are defined in section 8 of the Act and are not formally licensed.

A small catchment dam can be either registered and licensed or unlicensed, depending on the amount of use and capacity. If the dam's capacity is small and use is restricted to domestic household and stock watering, the dam does not require a licence, consistent with section 8 of the Act. Where its capacity is larger and/or use is for commercial purposes including irrigation, owners must register dams and obtain a licence.

These accounts include estimates of the volumes of domestic and stock use captured in small catchment dams and pumped from groundwater, but they do not include estimates of domestic and stock use pumped from a waterway: this volume is assumed to be small.

As well as consumptive uses, the Act provides for water to be used for environmental purposes (see chapter 4). Environmental use is not reported in this chapter.

Table 3-1 shows the volume of water defined in entitlements for consumptive use in Victoria in 2020–21 and 2019–20. The total volume of consumptive entitlements changes each year as new entitlements are issued or existing entitlements are modified.

All basins in the state have a cap, which limits the volume of water that can be allocated. In catchments that have reached the cap and allocated all available water within the limit, no new entitlements are created unless water savings are made, and so there is no net increase in entitlement volume. This 'cap and trade' system requires that the only way for a customer to get more entitlement is to purchase it from someone selling unwanted or unused entitlement.

Most basins in Victoria have reached their cap, and so only a minor change in the total statewide number of entitlements is likely to occur annually.

Table 3-1 Consumptive water entitlements, 2020–21 and 2019–20

Entitlement type	Volume 2020–21 (ML)	Volume 2019–20 (ML)
Surface water		
Bulk entitlements (1)	4,577,584	4,578,846
Licences (2)	225,525	228,700
Small catchment dams (3)	164,095	157,666
Total surface water entitlements	*4,967,204*	*4,965,212*
Groundwater		
Licences	938,278	938,037
Bulk entitlements	10,000	10,000
Total groundwater entitlements	*948,278*	*948,037*
Desalinated water		
Bulk entitlements (4)	150,000	150,000
Total desalinated water entitlements	*150,000*	*150,000*
Total entitlements	**6,065,483**	**6,063,249**

Notes

(1) Bulk entitlement volumes are represented as the volume that can be taken in a one-year period. They are not adjusted to reflect carryover available, trade, caps that are climatically adjusted or caps that are long-term rolling averages. The amounts include entitlement volume for loss in irrigation areas. Bulk entitlements and environmental entitlements held by the VEWH are not included, as water taken under these entitlements is not considered to be for consumptive purposes.

(2) Includes licences issued for unregulated rivers only. The volume of licences within regulated water supply systems is not included as these licences are included under rural water businesses' bulk entitlements.

(3) This includes small catchment dams required to be licensed or registered under the *Water Act 1989*, as well as the volume estimated for domestic and stock use, but it excludes domestic and stock use pumped from a waterway. The total entitlement volume is assumed to be equal to the estimate of total water taken by small catchment dams for the year.

(4) The three metropolitan water corporations — City West Water, Yarra Valley Water and South East Water — hold the bulk entitlements to desalinated seawater.

The availability and use of Victoria's water resources for 2020–21 are summarised in Table 3-2.

Overall, the total available volume of Victoria's surface water, groundwater, desalinated water and recycled water in 2020–21 was 23,942,065 ML, more than the amount available in the previous year. Of this, 3,395,361 ML was taken for consumptive uses, slightly higher than the 3,340,078 ML taken in 2019–20.

The volume of water taken presented in this overview and in the surface water river basin accounts is reported as the volume of water diverted from a water source. It is the bulk volume of water extracted from a stream or groundwater bore. It is not the end use on a farm or in a town.

The volume of water taken in 2020–21 was 55% of the total entitlement volume (excluding recycled water, as there is no relevant entitlement volume).

Table 3-2 Water availability and water taken for consumptive use

Water source	Available resource (ML)	Total entitlements (ML)	Total taken (ML)
Surface water (1)	22,304,578	4,967,204	2,806,372
Groundwater (2)	999,820	948,278	377,030
Recycled water (3)	512,667	n/a	86,959
Desalinated water (4)	125,000	150,000	125,000
Total 2020–21	**23,942,065**	**6,065,483**	**3,395,361**
Total 2019–20	17,586,610	6,063,249	3,340,078

Notes

(1) The volume of available surface water resources is assumed to be the volume of catchment inflow for all Victorian basins, as determined in the surface water balance for each basin presented in chapter 6.

(2) The actual groundwater resource (that is, the volume of water in aquifers) is unknown. The total resource has been assumed to be the sum of the permissible consumptive volume (PCV) of each GMU plus entitlement volume where the GMU does not have a PCV.

(3) The volume of available recycled water is assumed to be the volume of water produced at treatment plants. There is no applicable entitlement volume for recycled water.

(4) Available resource for desalinated water is considered to be the volume produced in the water year.

3.1 Surface water entitlements and use

The following provides an overview of surface water taken under consumptive entitlements across Victoria.

Table 3-3 summarises the volume of water taken under bulk entitlements, licences and small catchment dams in each basin in 2020–21. Part 2 has more information about diversions under surface water entitlements in each basin. The entitlements and their volumes are detailed in chapter 6 for each basin. Environmental entitlements are explained separately in chapter 4, as they are not considered to be consumptive uses entitlements.

The amount of water taken for consumptive uses increased in 2020–21 compared to the previous year. Most of the increase was in the bulk entitlement volume taken in the Murray system. The volume of water taken under bulk entitlements in 2020–21 was 57% of the total volume of bulk entitlements, similar to the previous year. The volume of water taken under unregulated take and use licences was 24% of the total volume of licences, which was consistent with previous years.

Table 3-3 Volume of surface water entitlements and volume and percentage taken for consumptive use, 2020–21

Basin	Bulk entitlements (1)			Licences (2)			Small catchment dams (3)
	Entitlement volume (ML)	Volume taken (ML)	Proportion of entitlement taken (%)	Entitlement volume (ML)	Volume taken (ML)	Proportion of entitlement taken (%)	Volume taken (ML)
Murray (4)	1,413,920	1,103,527	78%	13,788	2,906	21%	5,794
Kiewa	2,206	1,041	47%	13,659	4,051	30%	2,929
Ovens	49,165	11,513	23%	13,796	4,326	31%	7,183
Broken	24,621	7,639	31%	1,395	527	38%	3,369
Goulburn	1,643,647	743,503	45%	15,767	5,302	34%	16,983
Campaspe	98,658	30,597	31%	978	404	41%	8,397
Loddon	33,234	11,597	35%	15,892	4,566	29%	9,615
East Gippsland	622	111	18%	657	9	1%	564
Snowy	2,201	645	29%	3,919	403	10%	1,169
Tambo	342	22	6%	4,041	277	7%	1,232
Mitchell	9,208	4,370	47%	18,238	9,653	53%	1,297
Thomson (4)	404,612	240,655	59%	17,207	4,423	26%	1,734
Latrobe (4)	221,692	78,284	35%	12,940	925	7%	11,021
South Gippsland	18,887	7,230	38%	11,998	1,931	16%	16,765
Bunyip	36,595	17,263	47%	16,858	2,826	17%	17,223

Yarra	400,000	234,257	59%	34,245	6,882	20%	10,923
Maribyrnong	10,711	2,305	22%	1,895	197	10%	3,387
Werribee (4)	40,285	13,695	34%	697	39	6%	1,861
Moorabool	40,600	17,704	44%	2,143	739	34%	5,479
Barwon	44,233	30,965	70%	4,618	698	15%	6,854
Corangamite	0	0	0%	875	96	11%	2,981
Otway Coast	19,667	12,713	65%	4,424	43	1%	9,693
Hopkins	629	155	25%	9,176	1,377	15%	5,989
Portland Coast	0	0	0%	1,003	0	0%	1,564
Glenelg	4,554	1,691	37%	963	114	12%	6,012
Millicent Coast	0	0	0%	4	4	100%	406
Wimmera	57,016	17,591	31%	2,076	422	20%	2,594
Mallee	0	0	0%	0	0	0%	0
Avoca	278	28	10%	2,275	33	1%	1,077
Total 2020–21	**4,577,584**	**2,589,103**	**57%**	**225,525**	**53,175**	**24%**	**164,095**
Total 2019–20	4,578,846	2,525,008	55%	228,700	60,703	27%	157,666

Notes

(1) Bulk entitlement volumes are represented as the volume that can be taken in a one-year period. They are not adjusted to reflect carryover available, trade, caps that are climatically adjusted or caps that are long-term rolling averages. Entitlements held for the environment are not included in this table as entitlement volume and water taken under these entitlements are not considered to be for consumptive purposes.

(2) This includes only take and use licences issued for unregulated rivers. Licences within regulated water supply systems are not included as they are part of rural water corporations' bulk entitlements.

(3) This volume includes all licensed and unlicensed small catchment dams. Not all small catchment dams are required to be licensed or registered under the Act (for example, farm dams for domestic and stock use); the estimated volume of water used is presented.

(4) The volume taken under bulk entitlements in the Murray, Thomson, Latrobe and Werribee basins is net of returns to the waterway.

There were three amendments made to bulk entitlements in 2020–21:

- 3 June 2021 – *Bulk Entitlement (Eildon-Goulburn Weir) Conversion Order 1995*: the provision for the East Loddon (North) waterworks district was adjusted and a provision set up for the new Mitiamo waterworks district. This allows Goulburn–Murray Water to operate the Mitiamo Pipeline and to transfer 1,000 ML of water recovery to the Commonwealth Environmental Water Holder
- 30 June 2021 – *Bulk Entitlement (Eildon-Goulburn Weir) Conversion Order 1995:* entitlement and accounting arrangements were set up to support the issue of 77 GL long-term average annual yield (LTAAY) of water shares to irrigators from the completion of stage 1 of the Connections Project.
- 30 June 2021 – *Bulk Entitlement (River Murray - Goulburn-Murray Water) Conversion Order 1999*: entitlement and accounting arrangements were set up to support the issue of 77 GL LTAAY of water shares to irrigators from the completion of stage 1 of the Connections Project

All changes to bulk entitlements are administered under part 4, division 1 of the Act and require consultation and consideration of matters including the impact on current users and the environment.

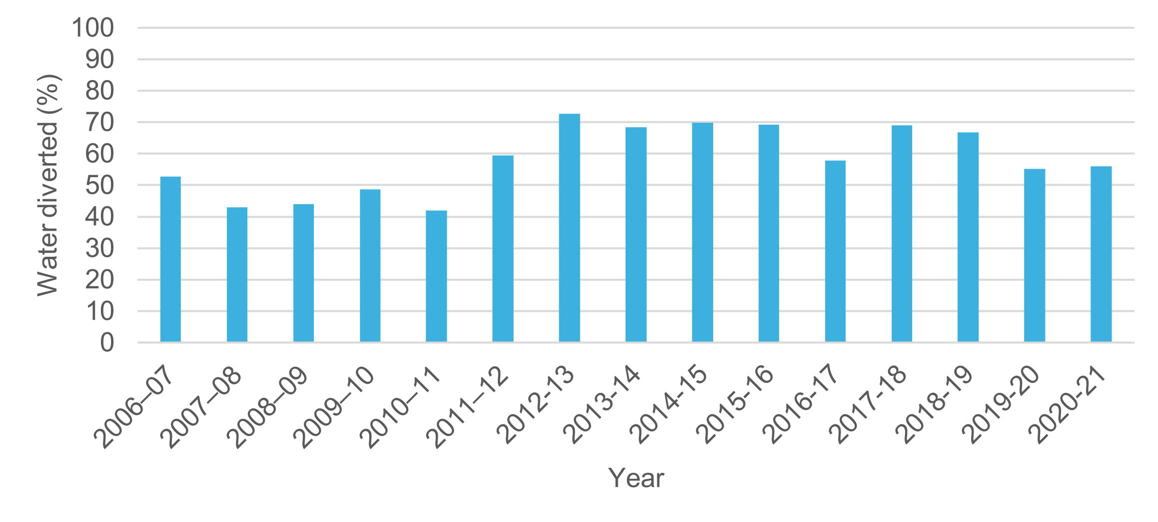
Figure 3-1 shows the volume of water taken under surface water entitlements in the past 15 years.

In any given year, there is typically a gap between the total volume of entitlements — water that can be legally used — and the actual volume of water taken. This is due to various reasons including:

- dry climatic conditions: there is not enough water available to take the total volume of entitlements
- wet climatic conditions: there is less need to take the total volume of entitlements
- individual entitlement holders choosing not to take all the water they have a right to use.

The lower water use over the period 2006–07 to 2009–10 is a reflection of the extremely dry climatic conditions and limited water availability during the Millennium Drought. During this period, restrictions on water use by urban customers, low seasonal allocations in the irrigation districts and rosters and restrictions on licensed diversions from unregulated streams were widespread. In contrast, the low water use recorded in 2010–11 and 2011–12 is a reflection of suppressed demand for water due to the wet conditions during these years. Water use was slightly higher in 2020–20 compared to the previous year.

Figure 3-1 Percentage of surface water entitlement volume diverted for consumptive use



Surface water entitlements are used for many different purposes, but they can broadly be classified according to the following end uses of water:

- irrigation (agriculture)
- domestic and stock (rural household use and stock watering)
- urban (town water supply for households and businesses) and commercial (major non-agricultural water use)
- power generation (a separate category due to the water-intensive nature of its operations).

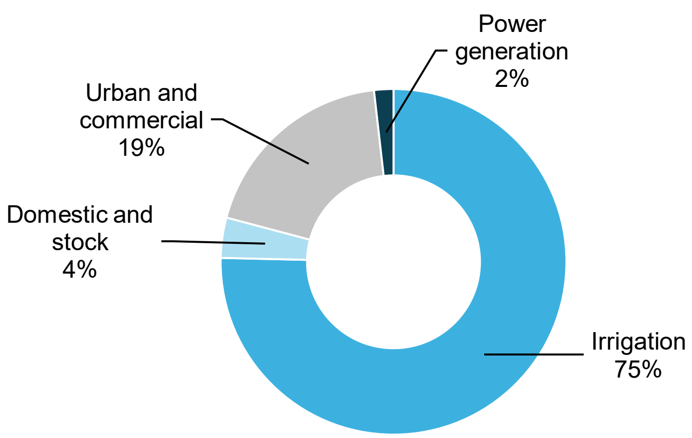
As Table 3-4 shows, the volume of water taken for consumptive use under surface water entitlements in 2020–21 was more than in 2019–20.

Irrigation is the largest consumptive use of surface water in the state, comprising 75% of all water taken in 2020–21, as shown in Figure 3-2.

Table 3-4 Volume of water taken for consumptive use under surface water entitlements

Consumptive end use	2020–21		2019–20	
	Volume diverted (ML)	Proportion of total consumptive diversions (%)	Volume diverted (ML)	Proportion of total consumptive diversions (%)
Irrigation	2,114,852	75%	1,910,166	71%
Domestic and stock	105,630	4%	100,375	4%
Urban and commercial	535,129	19%	651,765	24%
Power generation	50,761	2%	41,409	1%
Total	**2,806,372**	**100%**	**2,703,715**	**100%**

Figure 3-2 Percentage of water taken for different consumptive uses under surface water entitlements



3.2 Groundwater entitlements and use

There were no gazetted changes made to GMUs in 2020–21. Full details of water entitlements and use from each GMA and WSPA in 2020–21 are in Appendix C.

In 2020–21, total groundwater licensed entitlement was 948,278 ML across the state (948,037 ML in 2019–20). The total groundwater use across the state including domestic and stock use was 377,030 ML, which was less than the volume used in 2019–20 (438,649 ML).

There were 18,637 stock and domestic bores in Victoria in 2020–21. Domestic and stock use (31,152 ML) was estimated to account for about 7% of total groundwater use (less than the 32,212 ML estimated use in 2019–20).

In 2020–21, metered use was lower than in the previous year. In Victoria's GMAs, licensed groundwater entitlements totalled 610,281 ML (compared to 609,390 ML in 2019–20) with total metered use of 230,774 ML (263,531 ML in 2019–20). Licensed groundwater entitlements in WSPAs totalled 242,345 ML, with total metered use of 99,267 ML (242,354 ML entitlements and 123,013 ML use in 2019–20). The volume of groundwater entitlements outside GMUs was 95,652 ML, with 15,838 ML of metered extraction (96,293 ML entitlements and 19,894 ML use in 2019–20).

The total volume of groundwater extracted for urban use in 2020–21 was 8,222 ML — less than the 11,328 ML in the previous year — which was about 2% of the total groundwater extracted.

A total of 70 cities and towns have a groundwater entitlement for primary or supplementary water supply. In 2020–21, 53 of these recorded some level of groundwater extraction. The largest urban users were Sale and Portland, with extractions of 1,830 ML and 1,502 ML, respectively.

Figure 3-3 shows cities and towns where there is an entitlement to extract groundwater and where groundwater was extracted for urban water supply in 2020–21.

Figure 3-3 Towns with groundwater extraction entitlement and extractions for urban supply

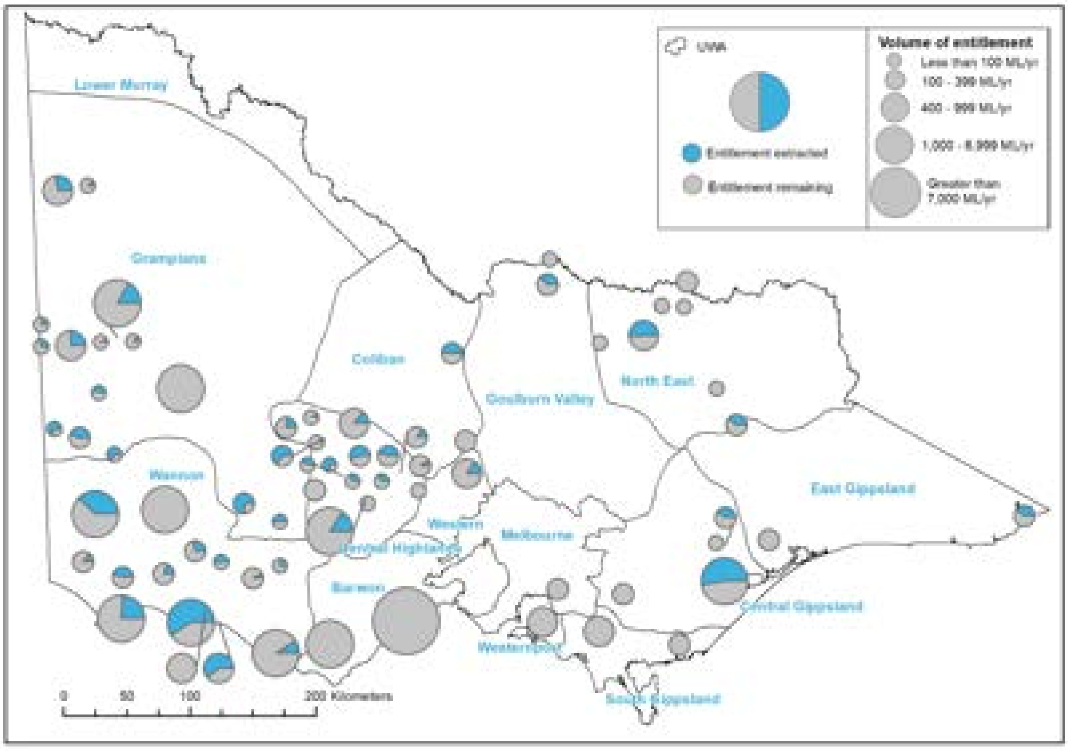


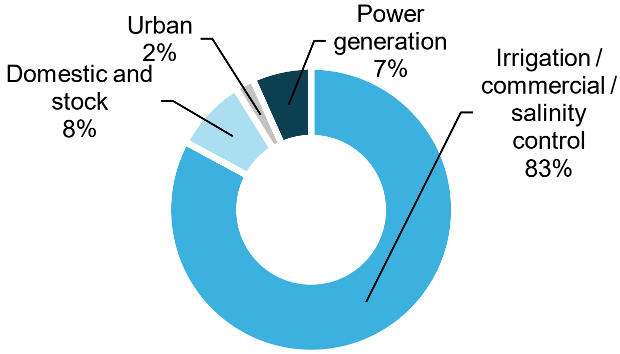
Table 3-5 and Figure 3-4 show the groundwater extraction by type of use in 2020–21.

Table 3-5 Groundwater extraction by type of end use

Consumptive end use	2020–21		2019–20	
	Volume diverted (ML)	Proportion of total consumptive diversions (%)	Volume diverted (ML)	Proportion of total consumptive diversions (%)
Irrigation / commercial / salinity control	312,428	83%	372,016	85%
Domestic and stock	31,152	8%	32,212	7%
Urban	8,222	2%	11,328	3%
Power generation	25,229	7%	23,094	5%

Total	377,030	100%	438,649	100%

Figure 3-4 Groundwater extraction by type of end use



3.3 Recycled water production

The total volume of 512,667 ML of water produced by wastewater treatment plants in 2020–21 was slightly lower than the 510,583 ML produced in 2019–20 (Table 3-6). In 2020–21, use of recycled water was 86,959 ML, which was higher than recycled water use in 2019–20 (79,389 ML). The recycled water use included 13,021 ML that was used in wastewater treatment processes.

The volume of water recycled for use in Melbourne (which is defined as water treated in the Bunyip, Werribee and Yarra basins less the regional towns in those basins) was 49,856 ML (13% recycled). This was higher than the 43,988 ML or 12% recycled the previous year. The percentage of water recycled is generally higher outside Melbourne where weather conditions, the availability of land and access to potential purchasers (that is, agricultural producers) are more favourable. Excluding the wastewater recycled in Melbourne, the remainder of the state recycled 37,103 ML (27% recycled) of the water available for re-use. This was a slightly higher volume than in the previous year, when 35,401 ML (or 27%) was recycled.

A significant portion of recycled water production occurs at two treatment plants: the Eastern Treatment Plant in the Bunyip basin and the Western Treatment Plant in the Werribee basin. The quantities of water recycled vary from year to year, partly depending on customer demand. During wet years, customer demand is typically lower. In 2020–21, the volume of water recycled by the Eastern Treatment Plant was 14,442 ML, similar to the 14,373 ML recycled the previous year. The volume of water recycled by the Western Treatment Plant increased from 22,157 ML in 2019–20 to 26,488 ML in 2020–21.

Table 3-6 Volume and use of recycled water

Basin	Wastewater produced (ML)	Volume of wastewater recycled (ML)	Percentage of wastewater recycled (%) (1)	End uses of recycled water (ML)				Volume discharged to the environment (ML)	Released to ocean/Other (ML)
				Urban and industrial	Agriculture	Beneficial allocation (2)	Within process (3)		
Avoca	141	124	88%	30	94	0	0	17	0
Barwon	37,633	3,433	10%	1,509	427	195	1,302	9,871	24,329
Broken	473	473	100%	0	473	0	0	0	0
Bunyip	167,494	17,681	10%	6,157	1,858	0	9,666	2,205	147,608
Campaspe	2,416	1,806	66%	216	1,589	0	1	610	0
Corangamite	2,530	445	21%	10	368	0	67	2,085	0
East Gippsland	85	85	100%	0	85	0	0	0	0
Glenelg	558	550	100%	22	528	0	0	8	0
Goulburn	8,604	6,680	87%	668	6,012	0	0	1,924	0
Hopkins	6,978	1,163	16%	165	873	0	125	208	5,607
Kiewa	393	201	47%	3	198	0	0	192	0
Latrobe	24,380	742	3%	21	86	635	0	4,110	19,528
Loddon	9,952	2,311	22%	1,147	1,164	0	0	7,641	0
Mallee	0	0	0%	0	0	0	0	0	0
Maribyrnong	4,522	1,564	28%	288	921	0	355	2,958	0
Millicent Coast	0	2	100%	2	0	0	0	-2	0

Mitchell	1,723	1,723	100%	0	377	1,346	0	0	0
Moorabool	1,219	1,219	100%	1,095	35	0	89	0	0
Murray	10,361	4,031	43%	172	3,756	0	103	6,330	0
Otway Coast	1,661	304	19%	19	245	0	40	170	1,187
Ovens	2,810	889	44%	64	825	0	0	1,921	0
Portland Coast	3,023	71	3%	0	71	0	0	280	2,672
Snowy	271	271	100%	0	271	0	0	0	0
South Gippsland	6,046	328	6%	4	317	0	8	1,563	4,205
Tambo	769	769	100%	0	769	0	0	0	0
Thomson	1,375	1,276	97%	0	1,276	0	0	99	0
Werribee	203,298	32,997	14%	6,923	17,348	8,252	789	2,556	167,430
Wimmera	1,885	1,983	85%	567	1,416	0	0	-98	0
Yarra	12,067	3,838	16%	586	1,037	0	476	9,968	0
Total 2020–21	**512,667**	**86,959**	**17%**	**19,668**	**42,419**	**10,428**	**13,021**	**54,616**	**372,566**
Total 2019–20	510,583	79,389	16%	19,699	41,825	5,552	12,313	47,004	384,190

Notes

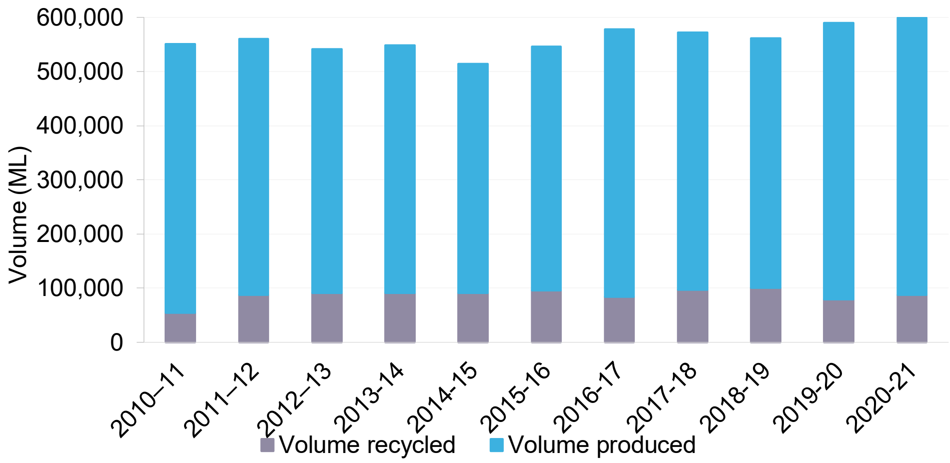
(1) The percentage of wastewater recycled includes water recycled ‘within plant process’, which refers to water reused in treatment processes. This treatment is consistent with the Essential Service Commission’s performance report.

(2) Volume used to deliver specific environmental flow benefits.

(3) Water reused in wastewater treatment processes, for example, to back-flush filters. This value is included in the total percentage recycled.

Figure 3-5 shows the trend in recycled water over the ten years to 2020–21.

Figure 3-5 Recycled water volume and percentage, 2010–11 to 2020–21



3.4 Desalination water production

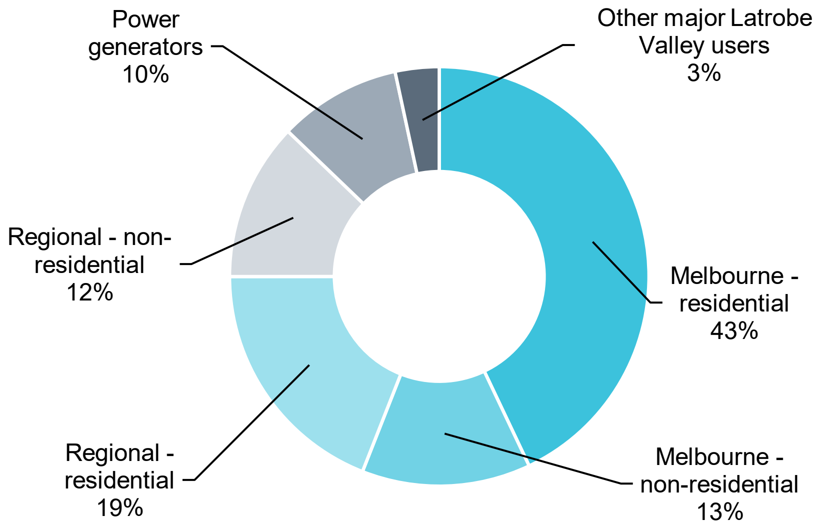
Water produced by the Victorian Desalination Project is transferred into Cardinia Reservoir and combined with water sourced from upstream catchments and reservoirs including O’Shannassy Reservoir, Upper Yarra Reservoir and Thomson Reservoir. Chapter 1.1.4 has more information about the project.

The total volume delivered in the year to 30 June 2021 was 125 GL, representing 6.9% of Melbourne’s storage capacity, the same as in the previous year.

3.5 Metered urban and commercial consumptive use

Consumption in urban areas is typically measured by the metered volume of water delivered to customers: household (residential use) and business (commercial use) customers. This figure differs from the bulk water diversion figures in Table 3-4 because water is lost in the distribution network through evaporation and leakage between the points of diversion and delivery. Therefore, the metered consumption volumes in Figure 3-6 are less than the urban diversion volumes in Table 3-4 and Figure 3-2.

Figure 3-6 Metered urban and commercial consumption of water



4. Water for the environment

Many of Victoria's rivers and wetlands have been modified as the population has grown, to provide water important for towns, industry and food production. In some rivers, up to half of the water that would have naturally flowed in them is removed each year for urban consumption, irrigation and industry. In addition, the flow timing is disrupted: instead of flowing naturally with high flows in winter and low flows in summer, many rivers run higher when water needs to be delivered for farming and urban use. These changes have interrupted many of the natural river and wetland processes native plants and animals need to survive, feed and breed. As a result, it is necessary to manage flows in these waterways and to wetlands to mimic some of the flows that would have occurred naturally, to facilitate these important environmental outcomes.

Water is specifically set aside for the environment in Victoria's water management framework in three ways:

- **water entitlements (managed environmental water)**: these are rights to a share of water available each year. Most of the water entitlements held for the environment are specified as a legal right to a share of the water available in storages that can be released to meet particular environmental needs. Carryover, trade and seasonal allocation provisions are typically the same as water entitlements held for consumptive purposes. When actively managed, water available under water entitlements can be made available in the right place at the right time: for example, when fish, birds, turtles and other animals need water to trigger feeding, breeding, fledging or migration, that water is available for them. For this reason, water entitlements held for the environment are often called managed environmental water.
- **obligations on consumptive entitlements**: these are volumes of water that water corporations or licensed diverters are obliged to provide out of storages or past diversion points before water can be taken for consumptive use.
- **above cap water**: this is water available above the total volume that can be allocated under entitlements for consumptive use. It includes water that is left over after limits on diversions have been reached and unregulated flows which cannot be kept in storage. This water also provides social, recreational and cultural benefits. The volume of above cap water could not be quantified for these accounts.

4.1 Managed environmental water

Managing and delivering water for the environment involves careful planning by a range of people and organisations (see chapter 1.2). The Victorian Environmental Water Holder (VEWH) is an independent statutory body responsible for holding and managing Victoria's environmental water entitlements. Each year, the VEWH develops a statewide seasonal watering plan that guides the Victorian environmental watering program, the ongoing collaborative management of water for the environment used to improve the health of Victoria's rivers and wetlands and the native plants and animals that depend on them. Relationships between local communities, Traditional Owners, waterway managers, storage managers, environmental water holders and land managers form the foundation of the program.

The seasonal watering plan supports the collaborative management of water for the environment to improve the health of waterway and wetland systems including their biodiversity, ecological function and water quality. It provides program partners, stakeholders and communities with a sense of what to expect during the water year. The plan for the upcoming water year is released before 30 June each year.

There is more information about how water for the environment is managed in Victoria at http://vewh.vic.gov.au/watering-program/managing-water-for-the-environment.

4.1.1 Annual overview

This year was the VEWH's ninth year managing water for the environment in Victoria. The VEWH's *Seasonal Watering Plan 2020–21* identified 286 potential watering actions across Victoria that could be delivered under a range of planning scenarios, and 211 of these actions were required in 2020–21.

During 2020–21, 92% (194) of the 211 required watering actions either fully or partially achieved their intended hydrological outcomes (Table 4-1). Of the 194, 154 relied on the contribution of managed water for the environment. The remaining 40 potential watering actions were achieved through passing flows, natural flows, unregulated flows and/or the delivery of consumptive water, or a drying regime was intentionally implemented at the site.

In 2020–21, the VEWH coordinated delivery of environmental water to 87 priority river reaches and 84 wetlands, a total of 171 sites across Victoria. This was higher than in the previous year (168).

Table 4-1 Watering actions achieved

Managed water for the environment sites	2020–21	2019–20
Number of river reaches delivered to	87	92
Number of wetlands delivered to	84	76
Number of required watering actions achieved	194	187

Percentage of required watering actions achieved (new assessment method)	92%	87%
Percentage of required watering actions achieved using managed environmental water (new assessment method)	79%	81%

The total volume of VEWH, Commonwealth Environmental Water Holder (CEWH) and The Living Murray managed environmental water available in 2020–21 was 1,924,052 ML, which was more than the year before. Of this, 656,717 ML was delivered during the year to priority river reaches and wetlands in Victoria. Table 4-2 summarises Victoria's managed environmental watering in 2020–21.

Table 4-2 Summary of managed water for the environment

Managed environmental water	2020–21 (ML)	2019–20 (ML)
Availability		
Carryover	440,057	900,287
Seasonal allocations	1,355,743	860,658
Return flows (1)	431,888	668,814
Less carryover/allocation written off (2)	60,756	8,920
Less borrowed BMF EWA at 30 June (3)	242,880	282,750
Total available (4)	**1,924,052**	**2,138,089**
Environmental deliveries		
Volume delivered to off-stream wetlands	85,301	53,255
Volume delivered in-stream	571,416	838,533
Total volume delivered	**656,717**	**891,788**

Notes

(1) 'Return flows' means the volume of water released in-stream by the VEWH and made available for further re-use by the environment at a downstream location.

(2) 'Carryover/allocation written off' includes deductions to carryover or allocation to account for a spill, evaporation or change in storage event.

(3) In 2020–21, 242,880 ML of the BMF EWA (Barmah-Millewa Forest Environmental Water Allocation) available in the year was borrowed to support Victorian Murray high-reliability water share allocations in accordance with the BMF EWA rules, and it was therefore not available for use during the year.

(4) 'Total available' includes the volume carried over from the previous year plus seasonal allocations in the current year, plus any 'return flows' credited during the year. It does not include any water traded to the environmental water holders from another party.

Return flows

In some systems, water for the environment delivered through upstream sites can be used again downstream without impacting other entitlement holders. This helps to ensure it is used efficiently and effectively to achieve optimal environmental benefits. Access to return flows for the environment is enabled through rules in the VEWH's bulk and environmental entitlements.

In 2020–21, a total of 417,690 ML was re-credited to the VEWH's accounts for return flows delivered through upstream sites to the Murray River, less than the 648,352 ML available the previous year. Also, 13,637 ML delivered in the Goulburn River between Lake Eildon and Goulburn Weir was re-credited to the VEWH in Waranga Basin (20,284 ML in 2019–20), and 561 ML delivered from Lake Merrimu in the Werribee system was re-credited in Melton Reservoir (178 ML in 2019–20).

To manage their water portfolios, environmental water holders use trade to move water between different environmental water accounts for delivery: these are known as administrative transfers. Occasionally, the environmental water holders will either sell or buy water from other water entitlement holders. Such trades are recorded as commercial water trades, with a price determined via the relevant water market. Also, other water entitlement holders can choose to donate water (either as water shares or seasonal allocation) to environmental water holders.

In 2020–21, allocation trades undertaken by environmental water holders included:

- transferring water between Victorian systems to achieve outcomes and maximise water availability
- transferring all allocations made to the Snowy Water Initiative entitlements to the Snowy Scheme in accordance with the conditions of those entitlements (see chapter 4.1.3 for further details)
- transferring allocation to South Australia for delivering environmental outcomes in the downstream Murray River
- transfers of water that is privately owned or held by other entities to the VEWH

In 2020–21, the following transfers occurred:

- a net volume of 87,169 ML of environmental water held by the CEWH was transferred into the VEWH's accounts for use in northern Victorian systems. This water was used for watering actions in the Murray, Ovens, Goulburn, Broken, Campaspe and Loddon systems

- 393,386 ML of return flows was re-credited from the VEWH's accounts to South Australia for use in the South Australian Murray system (for example, in the Lower Lakes, Coorong and Murray Mouth). Of the return flows re-credited, 286,069 ML was Commonwealth environmental water, 61,999 ML was VEWH water, and 45,318 ML was The Living Murray water
- 90,681 ML was transferred from the VEWH to the Snowy inter-valley transfer account.
- the Taungurung Land and Water Council Aboriginal Corporation transferred 36 ML of water allocation to the VEWH for delivery in the Ovens system (King River) for environmental and cultural outcomes

Table 4-3 presents key trade activities undertaken by environmental water holders in 2020–21.

Table 4-3 Summary of key trade activities undertaken by environmental water holders

Managed environmental water – other actions	2020–21 (ML)	2019–20 (ML)
Net volume traded to non-environmental users	-36	-301
Volume transferred to the Snowy Scheme (1)	90,681	53,766
Volume delivered via the Murray River to South Australia	543,386	723,507

Note

(1) This is the volume of allocation transferred from the Victorian Murray, Goulburn and Loddon systems to the Snowy Mountains Scheme to increase environmental flows in the Snowy and Murray rivers.

4.1.2 Water entitlements, availability and use

Managed environmental water is held in 14 Victorian river basins. Table 4-4 presents for each river basin the volume of entitlements on 30 June 2021 and the volumes made available and used during 2020–21. A total of 2,186,286 ML was made available under these entitlements during the year (before trade) (2,138,089 ML in 2019–20), of which 656,717 ML was used for environmental benefits within Victoria (891,788 ML in 2019–20).

There were no changes to VEWH water entitlements in 2020–21.

Table 4-4 includes entitlements held in Victorian river basins for environmental purposes by the VEWH, the CEWH and the Murray–Darling Basin Authority (MDBA) (for The Living Murray program). Entitlements in each system can have different levels of reliability (or security of supply). Table 4-4 shows these levels, which are:

- high (reliability): legally recognised, secure entitlements to a defined share of water; full allocations are expected in most years
- low (reliability): legally recognised, secure entitlements to a defined share of water; full allocations are expected only in some years
- provisional: entitlements that provide access to water based on specific conditions in the related bulk or environmental entitlement
- unregulated: entitlements linked to flow conditions in the river rather than volumes of water in a storage; unregulated entitlements permit diversion of in-river flows above a certain height or rate or flows that are in excess of what can be captured in storage
- share of inflows: shares of inflows into water storages that can be released to meet particular environmental needs.

In some systems, the VEWH is able to carry over unused water from one year to support watering actions in subsequent years. Carryover provides flexibility and enables water for the environment to be delivered when it is of the greatest value to the environment

Table 4-4 Environmental water availability and use (ML)

Entitlement type / reliability	Entitlement volume at 30 June 2021	Net carryover at July 2020 (a)	Seasonal allocation / Share of inflows (b)	Carryover / Allocation lost to spill (c)	Return flows (1) (d)	Total available (pre-trade) (e) = (a)+(b)+(c)+(d)	Net trade in (2) (f)	Volume used (g)	Unused water at 30 June 2021 (3) (h) = (e)+(f)+(g)
NORTHERN SYSTEMS									
Murray (4)									
High	475,170	204,667	789,488	-50,000	417,690	1,361,845	-590,445	288,598	482,802
Low	152,210								
Provisional	75,024								
Unregulated	83,300								
Ovens									
High	123	0	123	0	0	123	36	159	0
Broken									
High	624	117	530	0	0	647	588	1,235	0

Low	23								
Goulburn									
High	430,551	122,194	428,295	0	13,637	564,126	-45,483	262,378	256,265
Low	231,247								
Campaspe									
High	27,372	6,848	28,181	0	0	35,029	-1,431	25,090	8,508
Low	8,409								
Passing flows	30								
Loddon									
High	8,134	2,154	16,291	-100	0	18,344	2,705	17,489	3,560
Low	2,551								
Provisional (5)	7,590								
Passing flows	0								
Total northern systems		**335,979**	**1,262,908**	**-50,100**	**431,327**	**1,980,114**	**-634,225**	**594,948**	**750,940**
WESTERN SYSTEMS									
Wimmera & Glenelg									
High	40,560	22,802	26,864	0	0	49,667	0	18,431	31,236
Provisional	1,000								
Passing flows	0								
Supply by agreement	28,000								
Total western systems		**22,802**	**26,864**	**0**	**0**	**49,667**	**0**	**18,431**	**31,236**
CENTRAL SYSTEMS									
Tarago									
Share of inflows	10.3%	3,766	3,025	-2,457	0	4,334	0	1,334	3,000
Yarra									
High	17,000	26,137	17,000	0	0	43,137	0	8,504	34,633
Werribee									
High	734	1,066	1,273	-102	561	2,798	0	1,609	1,189
Low	361								
Share of inflows	10%								
Maribyrnong									
n/a	n/a	0	0	0	0	0	17	0	17
Moorabool									
Share of inflows	11.9%	3,991	3,515	0	0	7,506	0	2,400	5,106
Barwon									
Share of inflows	3.8%	537	1,172	0	0	1,709	0	883	827
Unregulated	n/a								
Total central systems		**35,271**	**25,850**	**-2,559**	**561**	**62,282**	**17**	**14,729**	**44,411**
GIPPSLAND SYSTEMS									
Latrobe									
Unregulated	n/a	18,746	507	-450	0	18,803	0	0	18,803
Share of inflows	9.45%								
Thomson / Macalister									
High + Share of inflows	22,461	27,258	39,614	-7,647	0	59,225	0	28,609	30,616
Low	6,230								
Total Gippsland systems		**46,004**	**40,122**	**-8,098**	**0**	**94,224**	**0**	**28,609**	**49,419**
Total		**440,057**	**1,355,743**	**-60,756**	**431,888**	**2,186,286**	**-634,208**	**656,717**	**876,006**

Notes

(1) 'Return flows' is the volume of water released in-stream under an entitlement and made available for further re-use by the environment at a downstream location.
(2) 'Net trade in' is the net trade to all environmental water holders into the river basin.
(3) Unused water is all remaining volume at 30 June 2021. It includes water that will be carried over into 2021–22, water that was lost to evaporation and water written off where no carryover provisions exist.
(4) The Barmah-Millewa Forest Environmental Water Allocation is included in the Murray basin.
(5) The 100 ML environmental entitlement for Birch Creek in the Bullarook system is included in the Loddon provision entitlement volume.
n/a A specified volume is not applicable.

4.1.3 Snowy Water Initiative

The Snowy Water Initiative was formally established in 2002 to increase flows in the Snowy River — in response to the impacts the Snowy Mountains Scheme (Snowy Scheme) was having on the river's health — by regulating and diverting large volumes of water into the Murray–Darling Basin. As part of this initiative, the Victorian, New South Wales and Commonwealth governments committed to recovering water from the Murray–Darling Basin to increase flows in the Snowy and Murray rivers.

The Victorian Government met its commitment to recover water from the Murray, Goulburn and Loddon systems by 2012. This resulted in the creation of water entitlements, which are now held by the VEWH. Each year, the water allocated to these entitlements as of 31 January is transferred to the Snowy Scheme, where it is made available for release into the Snowy and Murray rivers for environmental benefit. These transfers reduce the amount of water Snowy Hydro Limited is required to release from the Snowy Scheme to the Murray in the following year. In accordance with intergovernmental agreements, two-thirds of the withheld water is released to the Snowy River for environmental benefit, and the remaining third provides flows for the environment in the Murray River.

In January 2021, the VEWH transferred a total of 90,681 ML allocation to the Snowy Scheme. This is more than the volume made available in the previous year (53,766 ML). Including contributions from New South Wales, a total of 271,077 ML was transferred to the Snowy Scheme in 2020–21 (Table 4-5). Of this volume, 201,077 ML was assigned for release to the Snowy River and 70,000 ML to the Murray River.

Table 4-5 Water available under Snowy Water Initiative (1)

Entitlement source	Entitlement volume (ML)	Allocation in 2020–21 (ML)	Allocation in 2019–20 (ML)
Victoria (2)	115,939	90,681	53,766
New South Wales (3)	192,219	180,396	70,698
Total	**308,158**	**271,077**	**124,464**
Volume apportioned to Snowy River Increased Flows		*201,077*	*82,976*
Volume apportioned to Murray River Increased Flows		*70,000*	*41,488*

Notes

(1) The information about the Snowy River entitlements was sourced from the New South Wales Department of Industry.

(2) This includes 83,508 ML of high-reliability entitlements and 32,431 ML of low-reliability entitlements.

(3) This includes 52,635 ML of high-security entitlements, 115,084 ML of general-security entitlements and 24,500 ML of conveyance entitlements.

In 2020–21, water allocation recovered under the Snowy Water Initiative was released for environmental benefit in both the Snowy and Murray rivers. A total of 82,700 ML of Snowy River Increased Flows was released to the Snowy River from Jindabyne Dam, in addition to the 8,500 ML base passing flow and 500 ML riparian flow released from Mowamba Weir. 50,000 ML of River Murray Increased Flows (RMIF) was released from the Snowy Scheme to the Murray system.

4.2 Obligations on consumptive water entitlements

Obligations on consumptive water entitlements are an important component of water for the environment. Obligations set out arrangements for sustainably managing available water resources to balance the needs of all consumptive users and the environment. Obligations are typically described as passing flows: these are flows that an irrigator or a water corporation must pass at its weir or reservoir before it can take water for other uses. Other obligations on entitlements are documented in statutory and local management plans.

4.2.1 Passing flows on bulk entitlements

Most consumptive bulk entitlements include obligations expressed as 'passing flow requirements'. Passing flow requirements are specified as obligations in bulk entitlements and environmental entitlements. The holders of these entitlements must report on their compliance with these requirements. Passing flows provide benefits to the environment and other purposes, including delivery entitlements and water for domestic and stock use.

No major breach of passing flow compliance was reported in 2020–21. However, there were three minor failures by Western Water to meet passing flow requirements, as reported below.

- In the Maribyrnong basin, Western Water did not meet passing flow requirements for Willimigongon Creek over a small number of days, totalling 2.2 ML of missed passing flows. Western Water compensated by releasing an extra 166 ML of flows, resulting in overall compliance with the bulk entitlement.
- In the Maribyrnong basin, Western Water released an extra 87 ML more than needed, to compensate for passing flow shortfalls of 0.3 ML over two occurrences at Riddells Creek.
- In the Campaspe basin, Wester Water had difficulty complying with passing flow requirements for Woodend due to very high rainfall events over short periods of time and delays in receiving data, which delayed its response to adjust the flow. To compensate, Western Water released the missed flows the following month.

4.2.2 Management plans

Statutory and local management plans in unregulated river systems set obligations on consumptive entitlements:

- **statutory management plans** follow a legislated process to determine how water from a waterway or groundwater will be shared between consumptive users and the environment in unregulated systems. These plans are developed with the community, water users and other stakeholders and include rules to meet management objectives in the area.
- **local management plans** are developed by water corporations for unregulated systems. These plans explain to licensees and the broader community the specific management arrangements for the water resource from which they extract and the rules that apply to them as users of that resource. They also explain how water will be shared in times of shortage. These typically apply in areas where there are no statutory management plans. For groundwater in southern Victoria, local management plans are prepared through groundwater catchment statements.

Water corporations report their compliance with each relevant statutory management plan (streamflow and groundwater) annually to the Minister for Water. They publish statutory and local management plans on their websites.

4.2.2.1 Streamflow management plans

In unregulated river systems, statutory management plans are documented as streamflow management plans. Streamflow management plans will include flow thresholds at which rosters, restrictions and bans are placed on the water taken from streams by licensed diverters. Rosters and restrictions set out which licence holders are allowed to take water and the quantity allowed to be taken (for example, 75% of licensed volume). When water is particularly scarce, bans on diversions from waterways are imposed.

In 2020–21, the number of streams on restrictions and bans reached a peak of 115 in February 2021 compared to 145 in January 2020. (see chapter 2.5.3).

In 2020–21, there were eight streamflow management plans (SFMPs) in place in Victoria (Table 4-6). Seven SFMPs were in place in the Yarra basin. There was also a management plan for the Upper Ovens River in the Ovens basin. The *Upper Ovens River WSPA Water Management Plan* provides for integrated management of surface water and groundwater. It is the only integrated management plan developed in Victoria so far.

Melbourne Water completed the formal review of two SFMPs in 2020–21, for Hoddles Creek and Stringybark Creek. These reviews were completed with extended catchment modelling updates and refinements. Following these reviews, Melbourne Water determined that the Hoddles Creek SFMP and Stringybark Creek SFMP can remain unamended for a further five years.

Table 4-6 Status of streamflow management plans

Basin	Stream(s)	Streamflow management plan status	Responsible authority
Ovens	Upper Ovens River (above Myrtleford)	Integrated surface water and groundwater management plan approved and operational; review completed in 2017–18	Goulburn-Murray Water
Yarra	Hoddles Creek	Approved and operational; review completed in 2020–21	Melbourne Water
	Little Yarra and Don rivers	Approved and operational	Melbourne Water
	Olinda Creek	Approved and operational; amended in May 2018	Melbourne Water
	Plenty River	Approved and operational; review completed in 2019–20	Melbourne Water
	Steels, Pauls and Dixons creeks	Approved and operational; review completed in 2019–20	Melbourne Water
	Stringybark Creek	Approved and operational; review completed in 2020–21	Melbourne Water
	Woori Yallock Creek	Approved and operational	Melbourne Water

4.2.2.2 Groundwater statutory and local management plans

Water for the environment is not restricted to surface water and can include groundwater. An amendment in 2005 to the *Water Act 1989* established the environmental water reserve to sustain the long-term health of our rivers and groundwater systems. Water for the environment can include water above the permissible consumptive volume and rules that restrict groundwater extraction when aquifer levels reach specified triggers, to protect the environment.

Groundwater is managed through a range of actions to ensure sustainable and equitable sharing of the resource. Statutory and local management plans outline the obligations for consumptive groundwater users including restrictions or rosters. In 2020–21, there were five groundwater management units subject to restrictions, one more than in the previous year (see chapter 2.5.4).

In 2020–21, statutory management plans were in place in seven groundwater WSPAs (Table 4-7).

Table 4-7 Status of statutory management plans in groundwater catchments

Groundwater catchment	Water supply protection area	Status	Responsible authority
Goulburn–Broken	Katunga	Amended in June 2017	Goulburn-Murray Water
Loddon	Loddon Highlands	Approved in November 2012	Goulburn-Murray Water
Campaspe	Lower Campaspe Valley	Approved in October 2012	Goulburn-Murray Water
Ovens	Upper Ovens River	Approved in January 2012	Goulburn-Murray Water
Westernport	Koo Wee Rup	Approved August 2010	Southern Rural Water
Hopkins–Corangamite	Warrion	Approved August 2010	Southern Rural Water
Seaspray	Yarram	Approved October 2010	Southern Rural Water

Water corporations report their compliance with each relevant statutory management plan (streamflow and groundwater) annually to the Minister for Water and the relevant catchment management authority. Statutory and local management plans and management plan annual reports (which report on compliance) are available on water corporations' websites:

- Goulburn-Murray Water:
  - https://www.g-mwater.com.au/water-resources/ground-water/management/katungawspa
  - https://www.g-mwater.com.au/water-resources/ground-water/management/loddonhighlandswspa
  - https://www.g-mwater.com.au/water-resources/ground-water/management/lowercampaspevalleywspa
  - https://www.g-mwater.com.au/water-resources/ground-water/management/upperovenswspa
- Melbourne Water:
  - https://www.melbournewater.com.au/water/waterway-diversions/stream-flow-management
- Southern Rural Water:
  - http://www.srw.com.au/ via > Publications > Groundwater management rules and plans.

4.3 Water leaving river basins

This subchapter provides information about total flows leaving river basins; that is, flowing out of basins at their downstream ends. This flow measure includes all water flowing through the system, excluding diversions and losses. In terms of water for the environment, it includes managed environmental water delivered in-stream, obligations on consumptive entitlements (such as passing flows) and above cap water.

Figure 4-1 shows the total volume for all Victorian rivers of flows leaving the downstream end of basins as a proportion of total flow in the rivers for the last 18 years. The proportion of flows leaving Victorian river basins is not in itself a reliable indicator of river health due to the complex interaction of ecological processes and the seasonal variability of streamflows.

Figure 4-1 Volume leaving Victorian river basins, as a proportion of total flows, 2003–04 to 2020–21

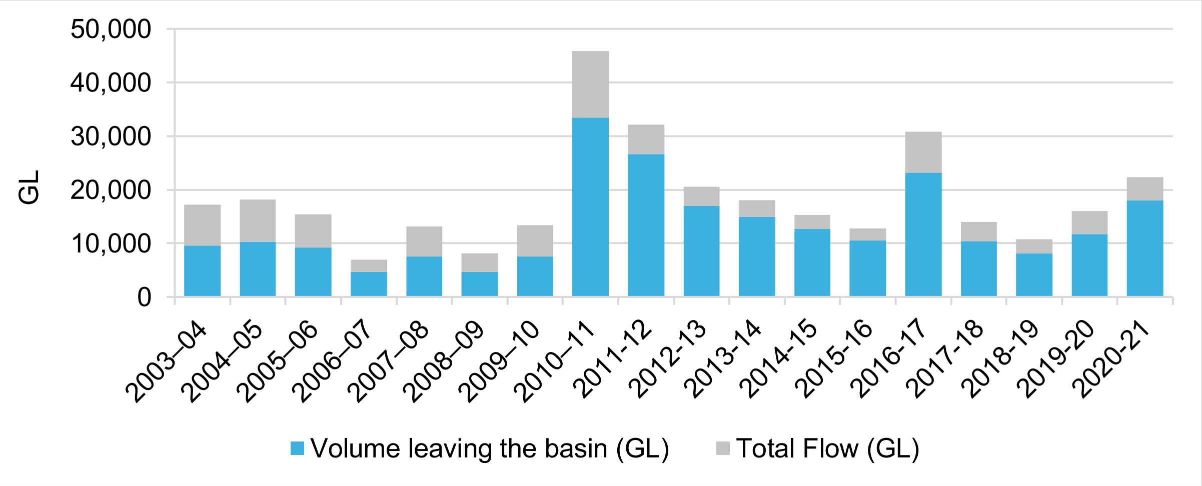


Table 4-8 shows the volume of water leaving each basin at the downstream end. The increase in rainfall and streamflows experienced across parts of the state in 2020–21 meant that this water flowing right through the basin was higher than in the previous year: a total of 18,021,371 ML across all rivers compared to 11,664,536 ML in 2019–20. As a percentage of total inflow volume, the water reaching basin outlets was higher than in the previous year, with 81% reaching basin outlets in 2020–21 compared to 73% the previous year (Table 4-8).

In 2020–21 compared to the previous year, the proportion of total flows leaving the basin increased in 18 of the basins, decreased in seven and remained the same in two (Table 4-8). The basins that experienced the lowest proportions of water leaving the basin as a percentage of total flows in 2020–21 were the Avoca (0%) and Wimmera (29%) basins. The proportion of annual flows leaving the basin was 90% or above in 13 basins, mainly in the south of the state: this was one more than in 2019–20. The Snowy basin recorded the highest proportion of total flows leaving the basin in 2020–21 (129%) due to the fact that this account only considers inflows to the Victorian component of the Snowy, but some flows from the upstream New South Wales reaches were included in the final outflows.

Table 4-8 Volume leaving Victorian river basins

Basin	Outflow to	2020–21			2019–20		
		Total flow if no diversions (ML)	Volume leaving the basin (ML)	Proportion of total flow leaving the basin (%)	Total flow if no diversions (ML)	Volume leaving the basin (ML)	Proportion of total flow leaving the basin (%)
Murray (1)	South Australia	4,747,614	2,410,400	51%	3,501,757	1,894,900	54%
Kiewa (2)	Murray River	538,368	499,134	93%	543,893	503,904	93%
Ovens	Murray River	1,112,732	1,073,144	96%	1,007,608	958,488	95%
Broken	Murray River	119,914	89,526	75%	117,935	77,417	66%
Goulburn	Murray River	2,134,641	998,782	47%	2,155,436	959,052	44%
Campaspe	Murray River	111,328	50,825	46%	117,033	48,003	41%
Loddon	Murray River	74,217	35,590	48%	107,751	40,453	38%
East Gippsland	Bass Strait	1,773,084	1,772,421	100%	125,854	125,322	100%
Snowy (Vic. only) (3)	Bass Strait	1,815,274	2,336,568	129%	343,275	473,437	138%
Tambo	Gippsland Lakes	460,084	457,927	100%	72,072	69,893	97%
Mitchell	Gippsland Lakes	790,885	774,969	98%	554,446	535,437	97%
Thomson	Gippsland Lakes	1,368,986	946,224	69%	751,602	262,115	35%
Latrobe	Gippsland Lakes	961,926	895,257	93%	866,562	750,337	87%
South Gippsland	Bass Strait, Western Port	1,345,789	1,317,789	98%	1,439,013	1,409,126	98%
Bunyip	Bass Strait, Western Port, Port Phillip Bay	1,150,940	1,104,242	96%	1,083,251	1,030,987	95%
Yarra (4)	Port Phillip Bay	1,025,530	734,422	72%	1,028,892	633,617	62%
Maribyrnong	Port Phillip Bay	59,558	48,400	81%	50,964	43,222	85%
Werribee	Port Phillip Bay	86,600	54,840	63%	73,090	47,448	65%
Moorabool	Port Phillip Bay	62,115	27,076	44%	64,258	22,111	34%
Barwon	Port Phillip Bay, Bass Strait	163,448	122,672	75%	146,346	118,171	81%
Corangamite (4)	Corangamite Lakes	245,512	243,246	99%	194,972	192,049	99%
Otway Coast	Bass Strait	1,166,244	1,143,168	98%	884,419	860,164	97%
Hopkins	Bass Strait	365,711	355,436	97%	269,866	258,130	96%
Portland Coast	Bass Strait	245,606	243,466	99%	179,570	177,556	99%
Glenelg	Bass Strait	333,265	273,703	82%	217,010	158,990	73%
Millicent Coast (5)	South Australia	-	-	-	-	-	-
Wimmera (6)	Lakes Hindmarsh and Albacutya	41,418	12,138	29%	54,700	14,188	26%
Mallee (5)	Murray River	-	-	-	-	-	-
Avoca (6)	Lake Bael Bael and the Marshes	3,789	6	0%	6,431	19	0%
Total		**22,304,578**	**18,021,371**	**81%**	**15,958,004**	**11,664,536**	**73%**

Notes

(1) This table includes only the Victorian component of Murray basin streamflows and Victoria's contribution to the environment's share of total flows. In this case, the environment's share is taken to be Victoria's contribution to flows at the Victorian–South Australian border.
(2) Includes New South Wales' share of Kiewa River flows under the Murray–Darling Basin Agreement.
(3) 'Total flow if no diversions' means flows from the Victorian tributaries of the Snowy River only. 'Volume leaving the basin' means all water flowing from the Snowy River into Bass Strait, which includes water originating from the New South Wales portion of the Snowy River.
(4) Transfers of water into this basin are not included in the total flows.
(5) There are no significant streams in this basin.
(6) For the purpose of this table, flows leaving the basin are taken as flows entering the terminal lakes.

5. Water trade

Water trading is the process of buying, selling or exchanging rights to water and facilitates the efficient use of water resources. While unofficial trade was likely occurring as early as the 1940s, official temporary trades first occurred in 1987, and official permanent trades first occurred in 1991–92.

Reporting on trade allows the examination of how availability and demand for water influence its movement and efficient use in Victoria. This chapter reports on trade activity during the 2020–21 water year, the volume of water traded and the movement of the water traded.

Further information about water trading in Victoria is available at waterregister.vic.gov.au (search 'Trade reports Victorian Water Register').

5.1 Victoria's water trade framework

Water trade in Victoria occurs under trading rules and policies set by the Minister for Water to facilitate the trade of water wherever possible while minimising negative impacts on other users and the environment.

Trade can be a permanent transfer of ownership of a water entitlement (the ongoing right to water) or trade of allocation (the physical water available in a given year). There are four main avenues for trading water in Victoria. For declared systems, there is trade of allocation and trade (or transfer) of water shares. In non-declared systems, trade may involve 'entitlement volume trade' between licences or the 'change of ownership' of a licence due to land ownership change. Chapter 1.3.1 has more information about declared systems.

5.1.1 Allocation trade

Allocation is water available each season under water entitlements. Water is allocated based on the available resource in any given year ((see chapter 2.5.2 for information about allocations in 2020–21).

The allocation made against a water entitlement may be traded separately from the water entitlement and from the land title. Allocation trade can occur either within a trading zone or between trading zones, in line with the trading rules for declared water systems. Visit the Victorian Water Register Trading rules web page for more information.

Allocation trade includes trade of allocation made available under water shares and bulk entitlements. Most allocation trade occurs in declared water systems. In northern Victoria, water systems that are declared systems are the Broken, Bullarook, Campaspe, Goulburn, Loddon, Murray and Ovens systems; in southern Victoria, the Thomson Macalister and Werribee systems. In other parts of the state, trade of allocation available under bulk entitlements may also occur.

Environmental water holders also use allocation trade to move water between different environmental water accounts.

5.1.2 Trade of water shares

As explained in chapter 1, a water share is a legally recognised, secure entitlement to a share of the water available for use in a declared water system. Trade of water shares can mean a transfer of ownership from one person to another, a change of the location where the water share is used, or both. This chapter provides summary information about transfers of ownership of water shares.

More detailed reporting on the movement of water shares within, into or out of different water delivery systems in Victoria is provided in the *Victorian water trading annual report*. Movement occurs with:

- a change of ownership (when there is a change in the named holder of the water share; this could occur for the new owner to have the right to be issued allocation)
- an association or variation of the water share (when an existing owner wishes to vary the allocation account that the water share is linked or the works that are associated with the water share).

5.1.3 Trade of take and use licences

Outside declared water systems, take and use licences allow water to be taken from either unregulated surface water systems or from groundwater to be used on the land defined in the licence. Trading of take and use licences is subject to the requirements of the *Water Act 1989*, the ministerial policies for managing take and use licences and any approved local management rules or plans.

Transfer of entitlement volume for a take and use licence can be either a 'permanent volume transfer' or a 'temporary volume transfer' to transfer part or all of the volume from one licence to another. Such transfers usually include a change in location. The other type of transfer is 'change of ownership', which changes ownership of a licence due to a land ownership change without affecting the volume and location of the licence.

In this chapter, unregulated surface water trades and groundwater trades are reported separately.

5.2 Overview of trade in 2020–21

5.2.1 Allocation trade

A total of 3,360,465 ML of allocation was traded in Victoria in 2020–21, less than in 2019–20 when 3,433,262 ML was traded. Most of this occurred in northern Victoria (3,340,564 ML), with small volumes in southern Victoria (16,340 ML) and western Victoria (3,561 ML).

Table 5-1 Summary of trade of seasonal allocation trade

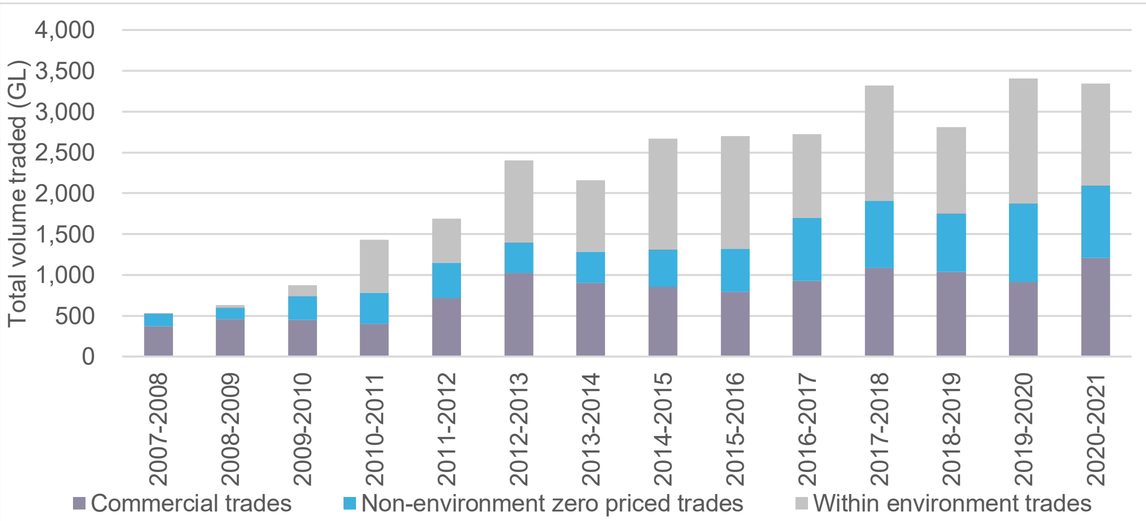
Trade type	2020–21		2019–20	
	Number of trades	Volume (ML)	Number of trades	Volume (ML)
Northern Victoria				
Commercial trades	11,151	1,211,838	12,518	913,458
Zero-priced allocation trades	4,667	884,117	7,182	965,086
Within-environment trades	93	1,244,609	108	1,524,751
Northern Victoria subtotal	**15,911**	**3,340,564**	**19,808**	**3,403,385**
Southern Victoria				
Commercial trades	32	1,753	98	5,319
Non-commercial trades	134	14,587	151	14,912
Southern Victoria subtotal	**166**	**16,340**	**249**	**20,231**
Western Victoria				
Commercial trades	9	3,561	8	9,646
Western Victoria subtotal	**9**	**3,561**	**8**	**9,646**
Total	**16,086**	**3,360,465**	**20,065**	**3,433,262**

Northern Victoria

In northern Victoria, the volume of allocation trade shows the reliance on trade to meet water requirements and to manage accounts for commercial purposes and the environment (Table 5.1 and Figure 5.1). Generally, there has been an increasing trend in trade since 2007–08. Commercial trades, where allocation is sold for a specified price, represented 1,211,838 ML of the total volume of allocation water traded in 2020–21, the highest volume on record (36% of the total volume traded). This amount includes interstate trade volume. Zero-priced trades or non-commercial trades, where water is traded from one account to another without payment, represented 884,117 ML or 26% of the total volume traded (Figure 5-1), lower than in the previous year. These trades may include trades between accounts owned by the same person, between related parties as part of an entitlement transfer, a contractual lease or carryover parking return.

The VEWH uses trade to move water between areas across Victoria, according to the annual seasonal watering plan. As in previous years, environmental trades made up a significant portion of the volume traded in 2020–21: there were 1,244,609 ML of within-environment allocation trade in northern Victoria (Table 5-1), which equates to 37% of the total volume traded, lower than in the previous year. For information about the assumptions made to distinguish between environmental and consumptive trading, see the *Victorian Water Trading 2020–21 Annual Report*.

Figure 5-1 Volume of allocation trade in northern Victoria



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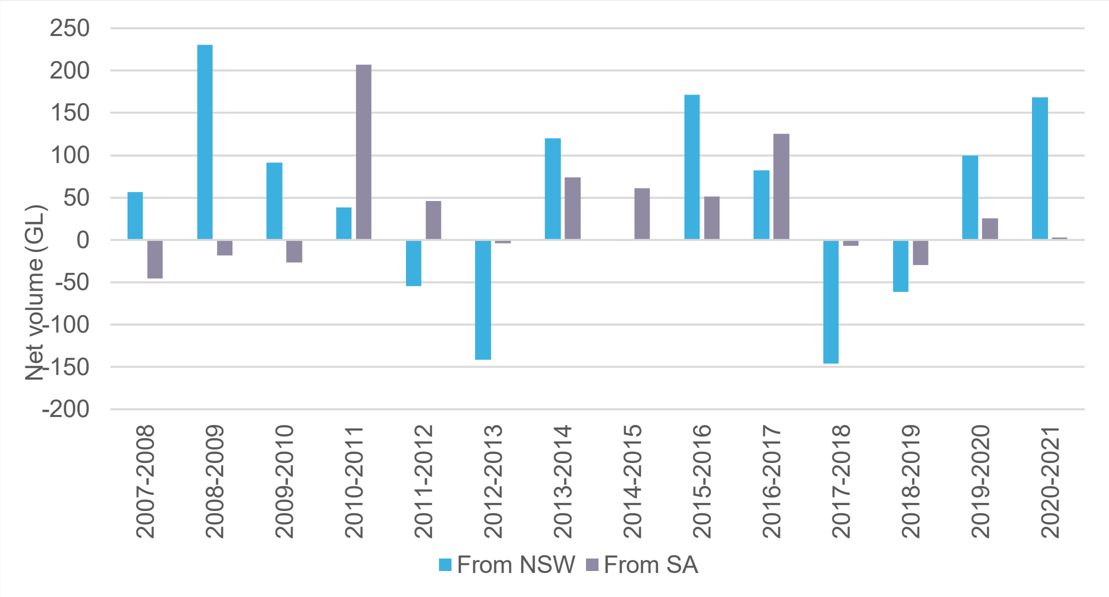
Water trade between Victoria, New South Wales and South Australia is permitted subject to trading rules. Excluding trade within environmental accounts, there was net trade from New South Wales into Victoria of 168,111 ML and net trade from South Australia into Victoria of 2,511 ML in 2020–21 (Figure 5-2).

Figure 5-2 Net volume of allocation trade into Victoria from New South Wales and South Australia (excluding within-environment trade)



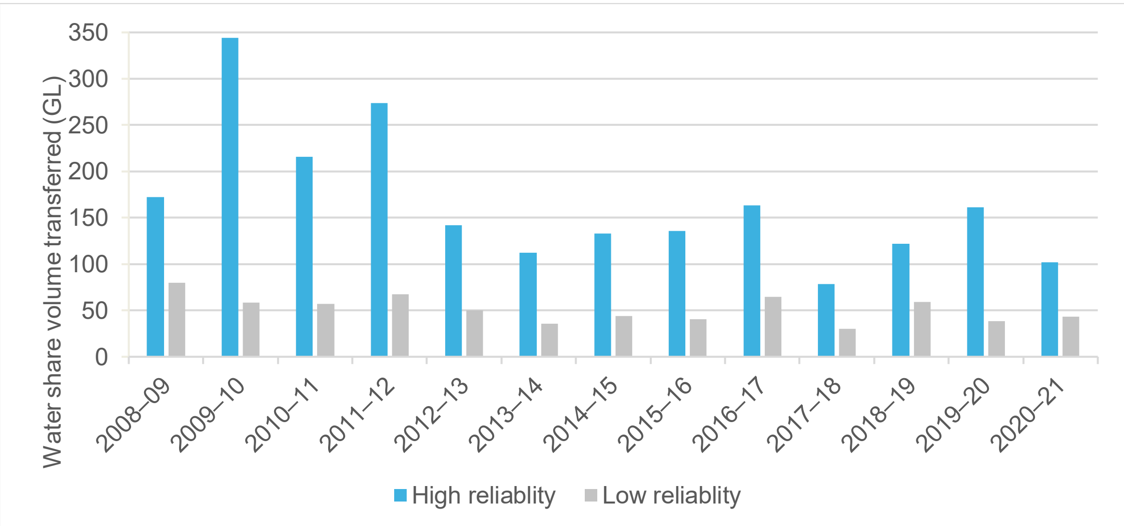
5.2.2 Water share transfers

Water share transfer across Victoria in 2020–21 included 101,838 ML of high-reliability and 43,555 ML of low-reliability water shares transferring ownership (Table 5-2 and Figure 5-3). As with allocation trade, most of this occurred in northern Victoria, with a small amount in southern Victoria.

Table 5-2 Water share transfers

Water share type	2020–21		2019–20	
	Number of transfers	Volume (ML)	Number of transfers	Volume (ML)
High-reliability				
Northern Victoria	1,516	89,106	1,723	156,345
Southern Victoria	168	12,732	91	5,097
High-reliability total	**1,684**	**101,838**	**1,814**	**161,442**
Low-reliability				
Northern Victoria	477	37,357	454	36,295
Southern Victoria	146	6,198	68	2,395
Low-reliability total	**623**	**43,555**	**522**	**38,690**

Figure 5-3 Transfer of ownership of water shares



5.2.3 Unregulated surface water

Surface water take and use licence trading during 2020–21 resulted in 1,043 ML of water permanently traded and 3,548 ML of water temporarily traded. Unlike allocation and water share trading, most of the surface water take and use licence trading occurred in southern Victoria. Lower volumes were traded in northern Victoria, with very small volumes traded in the west of the state.

As shown in Table 5-3, trade in surface water take and use licences was much lower than trade in groundwater take and use licences. In 2020–21, trades as part of land transfers (take and use licence change of ownership) were the most common trade type, with the volume and number of temporary trades decreasing significantly from the year before.

Table 5-3 Trade of surface water take and use licences

Region	Temporary trade		Permanent trade		Trade as part of land transfer	
	Number	Volume (ML)	Number	Volume (ML)	Number	Volume (ML)
North	36	1,400	45	420	209	2,738
South	55	2,148	33	623	197	5,328
West	0	0	0	0	13	188
Total 2020–21	**91**	**3,548**	**78**	**1,043**	**419**	**8,254**
Total 2019–20	128	4,735	172	2,383	433	12,784

5.2.4 Groundwater

The volume of temporary and permanent groundwater take and use licence trading was lower in 2020–21 than in the previous year, with 22,031 ML of temporary trade and 2,862 ML of permanent trade.

Table 5-4 shows that in 2020–21, trades of groundwater take and use licences were mostly part of land transfers (take and use licence change of ownership), with 355 trades amounting to 51,348 ML. These were higher than in the previous year.

Table 5-4 Trade of groundwater take and use licences in groundwater management units

Region	Temporary trade		Permanent trade		Trade as part of land transfer	
	Number	Volume (ML)	Number	Volume (ML)	Number	Volume (ML)
North	114	14,618	25	1,306	172	25,475
South	58	4,368	34	1,538	177	21,253
West	17	3,045	1	18	6	4,620
Total 2020–21	**189**	**22,031**	**60**	**2,862**	**355**	**51,348**
Total 2019–20	246	25,503	111	9,251	295	40,813

Part 2: Water accounts 2020–21

Part 2 of the *Victorian Water Accounts 2020–2021* presents an account of surface water, groundwater and distribution systems in Victoria for 2020–21.

Chapter 6 provides the water accounts for each of Victoria's 29 river basins. Each basin subchapter includes:

- a map of the basin
- a basin overview including a summary of information presented for the basin, management responsibilities in the basin and, where applicable, information about water for the environment
- the basin's total water resources
- detailed information about surface water entitlements in the basin
- detailed information about the use of surface water and recycled water in the basin.

The basin water accounts presented in chapter 6 track surface water from the time it appears as inflows to a waterway to the time it is diverted from the surface streams of the basin or flows from the basin to another basin or to the sea.

Chapter 7 provides the water accounts for each of Victoria's 20 groundwater catchments. Each catchment subchapter includes:

- a map of the catchment
- an overview of groundwater resources and management responsibilities in the catchment
- detailed information about licensed entitlements and unlicensed stock and domestic bores (private rights to water) as well as groundwater use in the catchment.

The groundwater catchment accounts presented in chapter 7 help to describe Victoria's groundwater resource and track groundwater extracted for irrigation, urban and domestic and stock use.

The surface water and distribution systems chapters of the *Victorian Water Accounts 2020–2021* are online at https://accounts.water.vic.gov.au/, and you can delve into the detail of each surface water basin and distribution system (previously included as chapter 8 of the accounts).

Continuous improvement of the Victorian Water Accounts

In 2018, DELWP initiated a project to transform the VWA from a large, hardcopy report into a digital water information resource. The transformation began with https://howmuch.water.vic.gov.au/, which provides a high-level overview of water resource management in Victoria. The next phase, with an initial focus on surface water basin accounts, was the development of https://accounts.water.vic.gov.au/.

Each year since the project began, we have continued to make minor improvements to both digital products. The long-term vision is to refine and expand the digital resource and bring the VWA's rich data to new audiences.

New features have been included in the online water accounts for 2020–21. Users can toggle between the 2020–21, 2019–20 and 2018–19 accounts, and each surface water basin has interactive maps with layers that can be toggled on and off. In future years, more features of the Victorian Water Accounts will be moved online.

6. River basin accounts

6.1 Methodology

6.1.1 Introduction

This chapter outlines the basis for the information presented in the river basin accounts. It explains some important assumptions and limitations of the data in the accounts, which should be read in conjunction with the information in the basin accounts.

The river basin accounts are compiled from information obtained from:

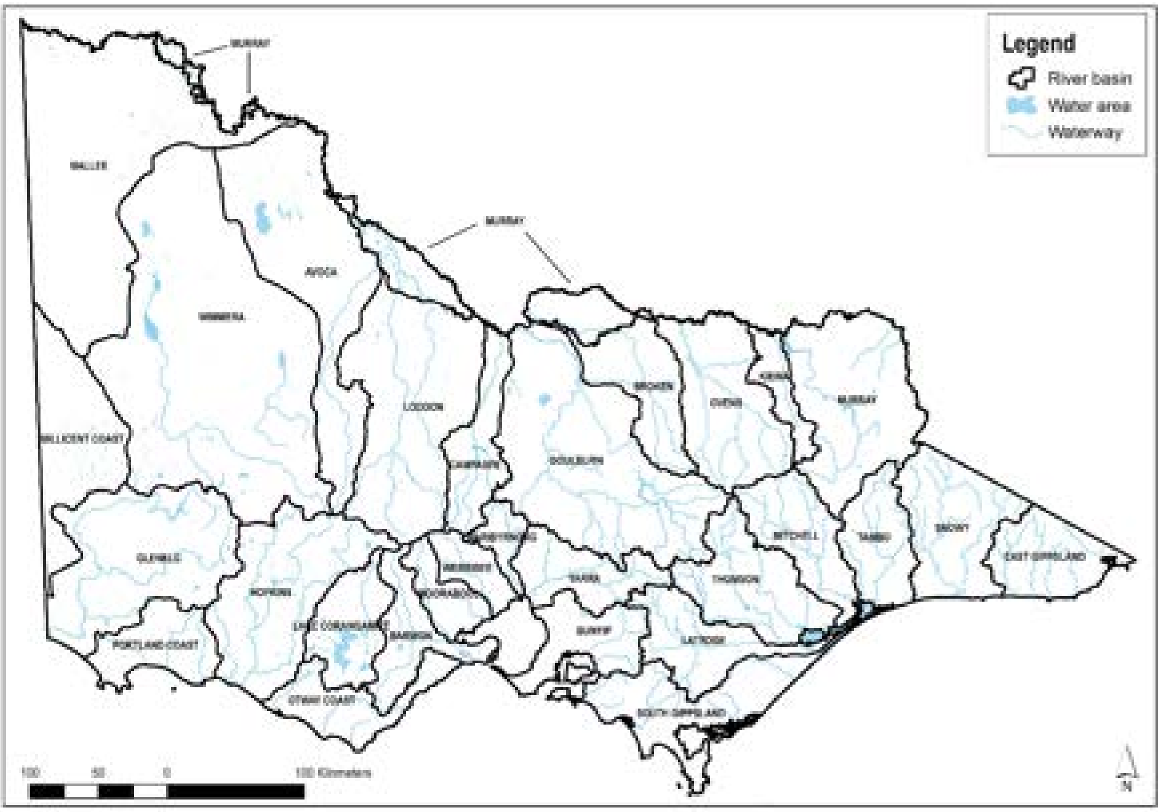
- responses to requests for data from water corporations, the VEWH, DELWP, major users of water and the MDBA
- water consumption and recycled water data collected from water corporations by the Essential Services Commission
- hydrologic information from selected streamflow monitoring sites
- climate information from selected rainfall and evaporation monitoring sites provided by the Bureau of Meteorology and water corporations
- estimated relationships between water use and climate or hydrologic data, which is produced by water supply system modelling, held by DELWP
- water corporations' annual reports and related documents.

All information for each of the 29 river basins is provided for the period 1 July 2020 to 30 June 2021. River basin boundaries are shown in Figure 6-1. Responsibilities for water management are reported in the accounts as they were in 2020–21. This is done to align with the actual management arrangements that occurred during the water year. Any changes to responsibilities since the end of June 2021 will be reported in future water accounts.

Surface water data generally aligns well with river basin boundaries, except where water is diverted from a waterway in one river basin and is then used in another. For the purposes of the basin water accounts, water is accounted for at the point of diversion from the waterway and not at the point of use. For example, information about diversions to supply the Rochester Irrigation Area, located at the downstream end of the Campaspe basin, is accounted for in the Goulburn basin, where the source of supply is located.

Towns with wastewater treatment plants have been assigned to river basins according to the point of discharge from the plant into the receiving waters. If all water is reused and none is discharged into waterways, the treatment plant is assigned to a basin according to the location of the plant.

Figure 6-1 River basin boundaries



6.1.2 Surface water resources

Chapter 6 provides information about surface water in 2020–21, with a subchapter for each of the 29 river basins. Each subchapter has a brief description and map of the basin, then four parts: management arrangements, 2020–21 water resources overview, water balance and compliance against entitlements.

6.1.3 Management arrangements

This part details the relevant organisations in each basin and their management responsibilities.

6.1.4 2020–21 water resources overview

This part provides a snapshot of the water resource for 2020–21. It summarises:

rainfall received: the percentage of rainfall received in each basin is estimated from the Bureau of Meteorology's rainfall map (Figure 2-3 in chapter 2.1, which determines the percentage of long-term average rainfall received in Victoria for 2020–21 compared to the long-term average (July 1975 to June 2021)

- **catchment inflows and storage levels**: catchment inflows from the water balance are compared to the long-term average inflow (chapter 2.2) for each basin, and the starting and ending storage volumes for the year are provided. This part also presents a chart that plots catchment inflows, long-term average inflows and the total capacity and volume of water held in major storages including both off- and on-stream storages in the basin for the past ten years
- **seasonal allocations, restrictions and water use**: any seasonal allocation determinations (chapter 2.5.2), urban restrictions (chapter 2.5.1) or licensed diversion restrictions (chapter 2.5.3) that applied during 2020–21 are detailed here, along with a summary of consumptive uses from the water balance and water for the environment.

6.1.5 Water balance

The surface water balance is the principal water accounting tool in the Victorian Water Accounts. It provides key information about surface water availability and use, as required under section 22 of the *Water Act 1989*.The water balance provides a statement of the water flows in a basin for a specified year, in which the sum of the outflows from the area equals the sum of the inflows less the water accumulated in the area (that is, water in storages). The water balance table is presented first with a notes column. Any notes are then described in detail below the water balance.

A surface water balance is presented for all basins except the Mallee basin and Millicent Coast basin. A lack of significant surface water resources in these basins means there is insufficient data available to prepare a water balance.

The three components of the water balance — major on-stream storages, inflows and outflows — are explained below.

6.1.5.1 Major on-stream storage

The overall change in storage volume in a basin for the year is provided as the difference between the volume in storage at the start of the year and at the end of the year. In general, only on-stream storages with a total capacity of more than 1,000 ML are included in this component of the water balance. Storages of less than 1,000 ML are important locally, but they are generally not material to the total volume of water at a basin and statewide level. Note that the volume of water in off-stream storages is not reported in the surface water balance, because this would, in some instances, result in double-counting water that has been diverted from rivers or extracted from groundwater.

6.1.5.2 Inflows

Inflows are the volume of water flowing into waterways within a basin. The inflow components included in the water balance — catchment inflow, rainfall on major storages, transfers from other basins, return flow from irrigation and treated wastewater discharged back to river — are explained below.

Catchment inflow: this item represents the total volume of surface run-off from rainfall that becomes streamflow into the basin or is captured by small catchment dams. This is generally the unaccounted-for item in each water balance: that is, it is calculated as a balancing item. Catchment inflows are determined to be the difference between the total outflows and the known inflows plus accumulated storage volume. The only exception to this is the Murray basin. In the Murray basin, this item represents known inflows, which include Victoria's share of inflows to Lake Dartmouth, Lake Hume and the Menindee Lakes, Victoria's share of inflows from the Kiewa River and inflows from the Ovens, Goulburn, Broken, Campaspe and Loddon basins into the Murray River. It also includes estimated inflows to small catchment dams in the Murray basin.

In addition to the above, the estimated volume harvested by small catchment dams in each basin makes up part of the catchment inflow volume in the water balance. It is determined by calculating the water balance around each individual dam based on the annual climate including inflows, extractions, rainfall and evaporation. The total volume harvested is the difference between dam inflows and outflows. Aggregating volumes harvested by dams across each basin, this estimates how much water is harvested by small catchments over the course of a year.

Rainfall on major storages: this item represents inflows from rain falling directly on major on-stream storages. Estimates are based on rainfall data and the surface area of storages. Information about storages in each basin with storages is presented in the notes below the balance including the capacity, starting and ending volume in store, rainfall and evaporation. An amount representing catchment inflows less regulated releases is also provided. This volume is the balancing item for each storage and represents the flows of water into or out of the storage that are not shown as rainfall or evaporation, and it includes major and minor components influencing the change in storage during the year.

Transfers from other basins: this item is included in a basin's water balance only if these transfers are known to affect streamflows in the receiving basin. These transfers (for example, to rivers or on-stream storages) are included principally because the volume may contribute to the in-stream loss and/or outflow components of the water balance. If water transferred across basin boundaries is supplied directly into a distribution/reticulation system and does not affect streamflows, it is considered as a diversion to an end use (for example, urban and irrigation district diversions) and is not accounted for as a transfer in the water balance.

Return flow from irrigation: this item represents outfalls from an irrigation system that return to waterways. These outfalls arise as part of the normal operation of systems that rely on delivering water by gravity. Return flows from power stations, and major industries are also included in the water balance for the Latrobe basin.

Treated wastewater discharged back to river: this item represents the volume of water discharged from wastewater treatment plants back into waterways as part of the water recycling process. Recycled water from towns with wastewater treatment plants has been assigned to basins according to the point of discharge to the receiving waters. If all water from a treatment plant is reused and none is discharged to rivers or lakes, the volume is reported in the basin where the plant is located. A table in each basin chapter provides information about:

- the volume of water produced from wastewater treatment plants (excluding evaporation)
- the total volume recycled
- the percentage recycled for use
- the class (A, B or C) of recycled water produced; this information included in the water accounts for the first time in 2020–21
- a breakdown into the following end-use categories:
    - the volume recycled for urban and industrial uses
    - the volume recycled for agricultural uses
    - the volume recycled for beneficial allocations, which refers to the volume used to deliver specific environmental benefits
    - the volume recycled within plant process, which refers to water reused in wastewater treatment processes (for example, to maintain biological processes or back-flush filters). This value is included in

the total 'Percent recycled', consistent with its treatment in the Essential Services Commission's performance report

- the volume discharged to the environment: that is, the volume returned back into the river system
- the volume of other discharges, which could either refer to an ocean outfall, a change in onsite effluent storage or other minor items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.1.5.3 Outflows

This term represents water that has left a waterway, whether by natural processes (such as evaporation and seepage), by being diverted by water corporations and individuals or by being passed at the outlet of the basin. The outflow components included in the water balance — diversions, losses and water passed at outlet of basin — are explained below.

Diversions include water that is deliberately diverted from a waterway to meet a specific use and includes the following types of diversions.

- **Urban diversions:** this item represents the total volume of water diverted from waterways by water corporations to supply urban customers.
- **Irrigation district diversions:** this item represents the bulk volume of water diverted from waterways by rural water corporations to supply customers in declared irrigation districts.
- **Licensed diversions from regulated or unregulated streams:** this item represents the volume of water diverted directly from waterways by licence holders. Licensed diversions occur where the extraction and delivery of water to a property from a watercourse is the responsibility of the licence holder. Information about licensed diversions is reported separately for regulated and unregulated water sources. Domestic and stock water users are assumed to divert their full entitlement volume unless otherwise reported by water corporations. The water balance excludes diversions under private rights for domestic and stock use (under section 8 of the *Water Act 1989*), which do not require a licence. The volume associated with these rights is relatively small.
- **Transfers to other basins:** this item represents the transfer of water to another basin where it is either used or contributes to the in-stream flows in the other basin. The corresponding transaction is reported as inflows in the receiving basin.
- **Environmental water diversions to wetlands:** this item represents environmental water used to support streamflows within a waterway, which contributes to the volume leaving a basin outlet. In some instances, environmental water is diverted from a waterway to off-stream wetlands. Metered diversions to off-stream +wetlands under environmental entitlements are accounted for in this component of the water balance.
- **Small catchment dams:** this item represents the estimated volume of extractions from small catchment dams within a basin. The volume extracted — the volume used in each basin — is calculated by multiplying the estimated capacity of each dam by an extraction factor and reducing this number as necessary if the dam had insufficient inflows to actually supply the volume required.
- **Losses:** this item represents catchment inflows that are lost from the waterway via natural processes. Losses represent a volume that is unable to be diverted for use and that does not contribute to the flows at a basin outlet. They include the following.
  - **Evaporation from major storages:** this item represents direct evaporation from major on-stream storages. It is estimated, based on evaporation rates and the surface area of the storage.
  - **Losses from small catchment dams:** this item is represented as 'net evaporation loss', an estimated volume of evaporation from the dam's surface minus direct rainfall. This volume is determined directly from a water balance calculated for each individual dam. When rainfall is high and evaporation is low, this can be represented as a negative loss in the water balance.
  - **In-stream infiltration to groundwater, flows to floodplain and evaporation** *(also referred to as in-stream losses)*: this item represents the volume of water that is lost from the waterway via natural processes and is not directly measurable. In-stream losses include infiltration to groundwater, overbank spills and evaporation. However, the natural processes giving rise to in-stream losses are difficult to measure directly. Consequently, in-stream losses are typically estimated as a proportion or function of gauged streamflow.

In the Murray basin, in-stream losses for the year are considered to be the unaccounted-for item in the water balance and are used as balancing items. In this instance, in-stream losses are determined to be the difference between the known outflows and the total inflows plus the net change in storage volume.

In most other basins, in-stream losses for the year are estimated based on loss functions used in water resource models (such as REALM). Where suitable models are available, in-stream losses are derived by applying measured streamflow data for the year into the loss functions included in the model. The basins with suitable models are documented in Table 6-1.

There are ten basins that do not have water resource models suitable for calculating in-stream losses for use in the accounts: the East Gippsland, Snowy, Tambo, Latrobe, South Gippsland, Yarra, Corangamite, Otway Coast, Hopkins and Portland Coast basins. In the absence of water resource models, in-stream losses could be calculated using water balances. However, this would require streamflow data at the source and outlet of each major river. Although there are a reasonable number of gauged locations across the basins, their distribution means that deriving comprehensive estimates of in-stream losses is not possible. This does not mean there are no in-stream losses in these basins, rather that they cannot be estimated using currently available models or as the balancing item in the water balances.

Table 6-1 Models used to derive in-stream losses

Basin(s)	Model(s)
Kiewa	Kiewa River REALM (1)
Ovens	Ovens River REALM
Broken, Goulburn, Campaspe, Loddon	Goulburn Simulation Model (covering the Goulburn, Broken, Campaspe and Loddon systems) Wandella Creek REALM (Loddon system only, downstream of Loddon Weir)
Avoca	Kerang Lakes REALM
Wimmera	Wimmera–Glenelg REALM (also referred to as Wimmera Mallee REALM)
Mitchell	Mitchell River REALM, Mitchell River Streamflow Management Plan REALM
Thomson	Thomson Macalister REALM
Bunyip	Tarago and Bunyip River REALM
Maribyrnong	Maribyrnong REALM
Werribee	Werribee REALM
Moorabool, Barwon	Barwon–Moorabool REALM
Glenelg	Glenelg River REALM, Wimmera–Glenelg REALM

Note
(1) REALM = REsource ALlocation Model.

Water passed at outlet of basin represents the total volume of flows that leaves the end of the basin. The types of outflows vary from basin to basin and are:

- **outflows to ocean:** common in southern Victoria, where most rivers flow to the sea
- **outflows to other rivers:** common in northern Victoria, where most rivers flow north and join the Murray River
- **outflows to terminal lakes:** several rivers in western Victoria outflow to lakes that are referred to ‘terminal lakes’ as they are not connected to the ocean or to other rivers
- **outflows to another state:** the outlet of the Murray River is considered to be the boundary with South Australia for accounting purposes. Flows across the boundary into South Australia from Victoria’s share of the Murray River resources are considered to be water passed at the outlet of the basin.

The volume of water passed at basin outlets is estimated by using gauged streamflow data at a point as close to the basin outlet as possible and then extrapolating the gauged data to the ungauged basin area.

6.1.6 Compliance against entitlements

Compliance against water entitlements is reported in these accounts in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions**: holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

One table in this part shows the entitlement volumes in the basin; the other shows the volume of available water in 2020–21 and the volume taken.

In accordance with section 43 of the *Water Act 1989*, bulk entitlements may specify rules and obligations on its holder including:

- rules about when, where and how much water can be taken
- rules about how the water can be used
- rules about the right to a share of storage capacity and a share of inflows
- obligations to release flows for environmental uses
- obligations to supply primary entitlement holders
- obligations to contribute to the payment of operation and maintenance costs
- obligations to meter water, maintain accounts and report.

Bulk entitlement holders report on compliance each year. Specific instances of non-compliance are reported in these accounts in the key compliance points box in each basin subchapter.

6.1.6.1 Entitlement issued

A table in each basin subchapter shows the volume of entitlements as of 30 June of each water year.

Bulk entitlements specify a maximum volume of water that may be diverted over a given number of years. The 'Annual entitlement volume' column provides the entitlement volume as of the end of the water year and represents the maximum volume that may be diverted in any one year. Where the entitlement volume is an amount specified over more than one year, the total volume that may be taken over the period of the entitlement is shown in the notes. For example, the Gisborne–Barringo Creek bulk entitlement in the Maribyrnong basin specifies that up to 585 ML can be diverted in any one year, while the maximum volume that can be taken over any five-year period is 1,600 ML (320 ML annual average).

In the large, regulated systems, bulk entitlements are normally specified in one of two ways:

- **source bulk entitlement:** this is an entitlement to harvest water directly from a water source. Source entitlements typically cover multiple storages operated in an integrated way within a river basin. They also include obligations to divert or release water to supply primary entitlement holders (such as customers within irrigation districts, licensed diverters in regulated streams, water corporations that hold delivery bulk entitlements and environmental entitlements held by the VEWH).
- **delivery bulk entitlement:** this is an entitlement to be supplied with water from another water corporation's dam or within a water supply system that is regulated by the works of another water corporation.

The bulk entitlement volume for a source bulk entitlement will include the volumes supplied to delivery entitlement holders and other primary entitlement holders specified in the source bulk entitlement. To account for this, primary entitlements are presented inset as a part of the source bulk entitlement. Appendix D lists all Victoria's bulk entitlements and their entitlement holders.

Entitlements to water also include rights granted to individuals (for example, water shares and take and use licences). These are reported as a group of each entitlement type and show the total volume of licences issued per basin.

Unregulated licences have been reported separately and include:

- **take and use licences – unregulated surface water**, which includes all licence volume that is considered to be for water taken from the waterway. It includes licences to take from a waterway to fill an off-water dam (dams for which no harvesting from the catchment is possible)
- **licensed small catchment dams – on-waterway**, which includes licensed small catchment dams that are on-waterway; they are considered to harvest water from the catchment as well as the waterway
- **licensed small catchment dams – off-waterway**, which includes licensed small catchment dams that are off-waterway; they harvest all water from the catchment and do not take any water from the waterway.

Note that the volume of usage, loss and water harvested for small catchment dams is an estimate based on a small catchment dam interception model.

6.1.6.2 Water taken

This part presents the available water and the water taken in the basin for 2020–21. The components — opening carryover, allocation issued, net trade in/out, total water available and water taken — are described below.

Opening carryover: this item represents any water carried over from 2019–20 that could be taken in 2020–21.

Allocation issued: this item represents the water allocation made available under the entitlement that was available for use and trade in the 2020–21 water year. Individuals or authorities that hold water entitlements in Victoria are allocated water according to the size of their entitlement and the available resource. For example, in 2020–21, entitlement holders with low-reliability water shares in the Thomson Macalister system were allocated 100% of their entitlement. That is, for every 100 ML of low-reliability entitlement they owned, they were allocated 100 ML of water they could use or trade.

Water issued and used under take and use licences is also represented as allocation in the allocation account balance tables. This allocation issued represents the volume that was available under licences throughout the water year, and it can be different to the entitlement volume at the end of the water year. Where licences have been cancelled during the year, the allocation volume presented may be greater than the entitlement volume as of the end of the water year. The volumes may also be different as a result of temporary trading between systems. For example, temporary trade of licences can occur between unregulated and groundwater systems in the Ovens basin: this would affect the allocation volume issued to licences in the Ovens basin.

Net trade in/out: this item represents the volume of water that may have been traded in for use within the basin or traded out of the basin.

Total water available: This represents the volume of water that was available to be taken in 2020–21. This item is the sum of the first three components: opening carryover, allocation issued and the net of the in/out trade of water.

Water taken: this item represents the volume of water used during the year under the entitlement. Where a source bulk entitlement exists, a total diversion is reported. This represents the volume of water diverted from the waterway to supply the primary entitlements specified in the bulk entitlement.

6.1.7 Small catchment dams

Small catchment dams harvest water from their local catchment. The presence of small catchment dams changes the hydrology in a basin by reducing the rate of overland flows (that is, surface run-off) and by altering evaporation and groundwater seepage. Small catchment dams reduce the volume of surface run-off that might otherwise become streamflows in a basin.

In the Victorian Water Accounts before 2016–17, the total volume of water harvested by small catchment dams was estimated from computer-based simulation modelling of the impact of small catchment dams on mean annual streamflows, based on estimates of the total volume of small catchment dams in a basin.

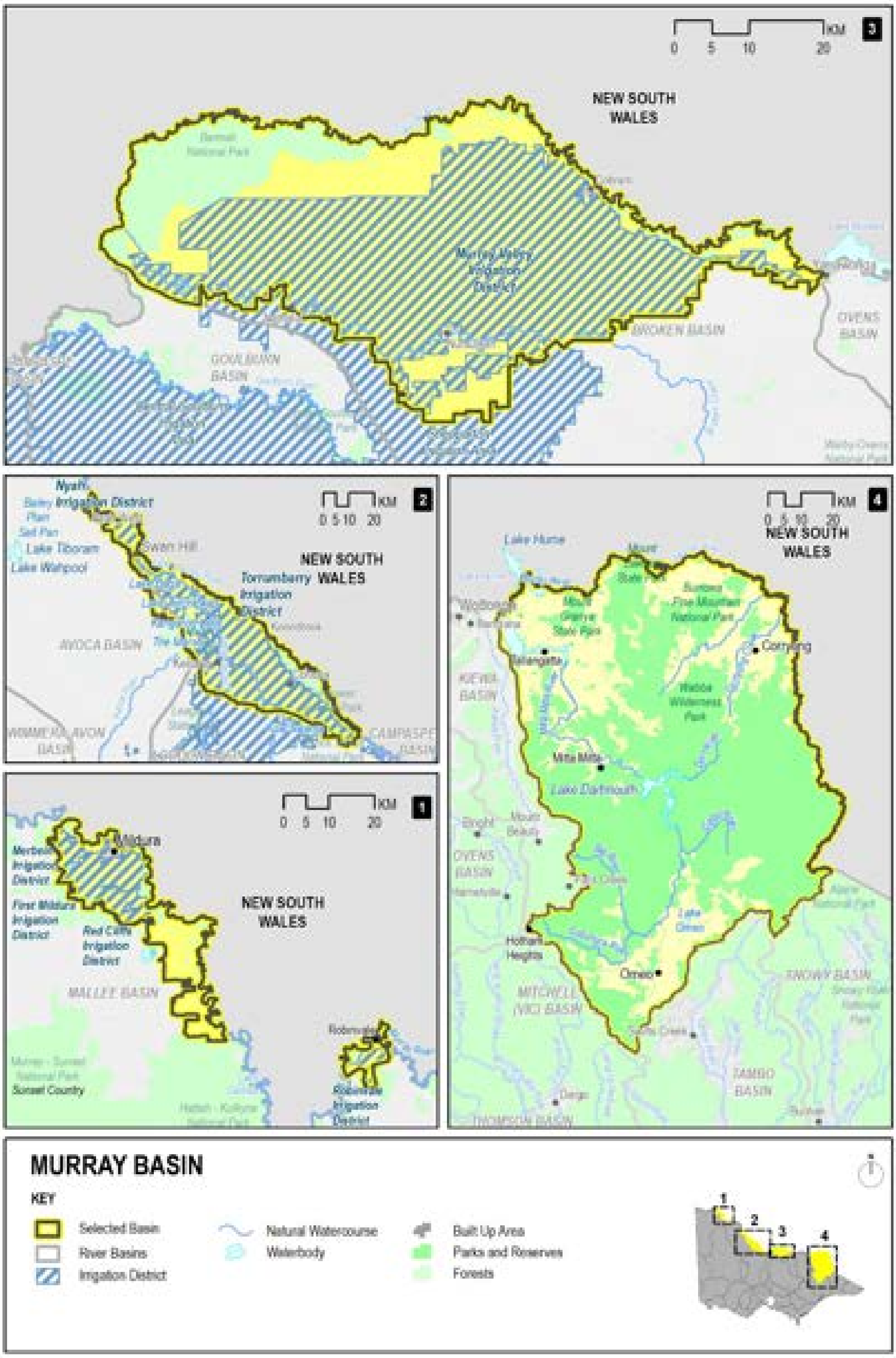
From 2017–18, the method used to estimate the usage, evaporation and harvested volumes from small catchment dams was improved. The key difference is that each dam identified in the GIS data has been individually modelled to better reflect the water balance around the dam based on the climate for that year. Estimated small catchment dam impacts are represented in the basin water balances as three separate components. They are:

- the estimated volume harvested by small catchment dams in each basin, which appears as catchment inflow in the water balance
- the estimated volume that owners extract from dams to supply their needs, which is accounted for as a diversion in the surface water balance
- the estimated volume of evaporation less direct rainfall from the surface of small catchment dams, which is accounted for as a loss in the surface water balance.

6.2 Murray basin

The Murray River forms most of Victoria's border with New South Wales. Victoria shares the volume of water held in the major storages with New South Wales under the Murray–Darling Basin Agreement. For the purposes of this report, the Murray basin includes the Upper Murray basin and areas in Victoria supplied from the Murray River downstream of Lake Hume (Figure 6-2).

Figure 6-2 Map of the Murray basin (Victoria)



6.2.1 Management arrangements

Management of water in the Murray basin is undertaken by various parties, as shown in Table 6-2.

The MDBA operates the Murray River on behalf of the Victorian, New South Wales and South Australian governments in accordance with the water-sharing arrangements set out in the Murray–Darling Basin Agreement. Under the agreement, Victoria shares the waters of the Murray River with New South Wales and South Australia. Under normal conditions, Victoria is entitled to a 50% share of all flows upstream of Doctors Point near Albury–Wodonga (that is, flows to Hume and Dartmouth reservoirs and from the Kiewa River), a 50% share of inflows to the Menindee Lakes storage and all flows entering the Murray from the Ovens, Goulburn, Broken, Campaspe and Loddon rivers. Victoria is also required to supply half of South Australia's monthly entitlement flows from the water available to it.

Goulburn-Murray Water, in its role as resource manager, is responsible for allocating water from Victoria's share of the water supply storages in the Murray basin to entitlement holders in the regulated Victorian Murray system.

Table 6-2 Water resource management responsibilities, Murray basin (Victoria)

Authority	Management responsibilities
Murray–Darling Basin Authority	Operates the River Murray system and efficiently delivers water to users on behalf of all Murray River governments; coordinates waterway management along the Murray River Oversees water resource management in accordance with the 2012 Murray–Darling Basin Plan
Department of Environment, Land, Water and Planning (Victoria)	Coordinates Victoria's input to Murray River system operational and resource management decisions
WaterNSW	Operates Lake Hume, Euston Weir and the Menindee Lakes system on behalf of the MDBA
South Australian Water Corporation	Operates Lake Victoria and several locks on behalf of the MDBA
Goulburn-Murray Water	Operates Lake Dartmouth, Yarrawonga Weir (Lake Mulwala), Torrumbarry Weir and Mildura Weir on behalf of the MDBA Supplies Murray Valley, Torrumbarry, Woorinen, Tresco and Nyah irrigation areas Manages private diversions on the Victorian side of the Murray upstream of Nyah
Lower Murray Water	Supplies Red Cliffs, Robinvale, Merbein and the First Mildura irrigation districts Supplies the Millewa waterworks district, Carwarp and Yelta Manages private diversions on the Victorian side of the Murray downstream of Nyah Supplies towns along the Murray River from Swan Hill to the South Australian border
North East Water	Supplies towns upstream of Lake Mulwala
Goulburn Valley Water	Supplies towns in the Murray Valley Irrigation Area and its surrounds
Coliban Water	Supplies towns in the Torrumbarry Irrigation Area and its surrounds
East Gippsland Water	Supplies Omeo and Dinner Plain
GWMWater	Supplies domestic and stock water to towns and farms in the northern Mallee area
North East Catchment Management Authority	Responsible for waterway and catchment management in the region bounded by the Murray River in the north, the Victorian Alps in the south, the New South Wales border in the east and the Warby Ranges in the west
Mallee Catchment Management Authority	Responsible for waterway and catchment management in an area that runs along the Murray River from Nyah to the South Australian border and south to the Wimmera
Goulburn Broken Catchment Management Authority	Responsible for waterway and catchment management in the region comprising the catchments of the Goulburn and Broken rivers and part of the Murray River valley
North Central Catchment Management Authority	Responsible for waterway and catchment management in the region bordered by the Murray River to the north, the Great Dividing Range and Wombat State Forest to the south and Mt Camel Range to the east.

6.2.2 2020–21 water resources overview

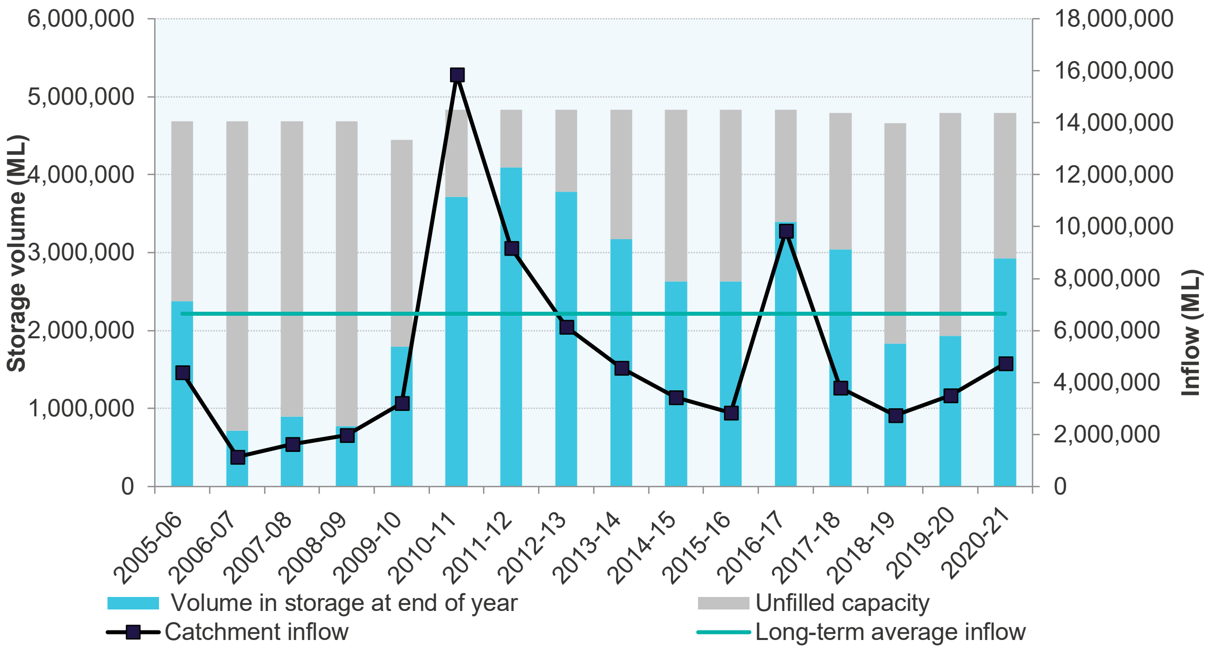
In 2020–21, rainfall was:

- very much below average near Nyah and north of Swan Hill
- below average over Robinvale, south of Mildura and from Swan Hill to Kerang
- average in the basin's central sections (over the Torrumbarry and Murray irrigation districts) and most of the north-east
- above average south of Omeo and in the far east from Omeo to the NSW border.

Catchment inflows to the basin in 2020–21 were 71% of the long-term average annual volume of 6,649,300 ML, greater than in 2019–20 when inflows were 53% of the long-term average.

The volume held in Victoria's share of the major Murray system storages started at 39% of capacity at the beginning of July 2020 and was at 60% of capacity at the end of June 2021. Victoria had access to a share of Menindee Lakes during 2020–21 (from May to June 2021) as storage levels reached more than the 640,000 ML trigger level specified in the Murray–Darling Basin Agreement. When storages levels are low, available water is reserved for New South Wales to supply local needs.

Figure 6-3 Storage volumes and catchment inflows, Murray basin (Victoria)



Seasonal determinations in the regulated Murray system were higher in 2020–21 than in the previous year. Seasonal determinations for high-reliability entitlement began the year with an 8% seasonal determination (on 1 July 2020), increasing to a 55% seasonal determination in October 2020 and reaching a final seasonal determination of 100% on 15 February 2021 compared to a final determination of 66% in April 2020. There was no seasonal determination for low-reliability water shares in 2020–21.

Key aspects of restrictions on licensed diversions from unregulated streams in the Murray basin in 2020–21 were:

- no restrictions in place until November 2020, when the Indigo Creek and Black Dog Creek both had total bans in place
- total bans in five additional streams by February 2021, reaching a peak of seven; this was lower than the peak of 11 streams in January 2020
- removal of all bans by the end of June 2021.

There were no restrictions on urban water use in the Murray basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 1,365,326 ML of water was diverted for consumptive uses — town, domestic and stock, irrigation and commercial supply — and for diversions to wetlands for environmental purposes. This was more than the 1,296,760 ML diverted the previous year.

6.2.2.1 Water for the environment

Environmental watering sites in the Murray basin that depend on water for the environment include:

- the Barmah-Millewa Forest, Gunbower Forest, Hattah Lakes and Kerang and Lower Murray Wetlands, which are located along the Murray River and are internationally significant wetlands listed under the Ramsar Convention; except for the Kerang and Lower Murray Wetlands, these are also The Living Murray icon sites
- the Lindsay, Wallpolla and Mulcra islands (also The Living Murray icon sites), which rely on the freshwater inputs from the Murray River to function ecologically.

In 2020–21, the Murray basin (Victoria) water for the environment comprised:

- *Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999* – Flora and Fauna component, comprising 45,267 ML of high-reliability, 8,523 ML of low-reliability and 49,000 ML of unregulated entitlements held by the VEWH
- *Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999* – Living Murray, comprising 9,589 ML of high-reliability, 101,850 ML of low-reliability and 34,300 ML of unregulated entitlements held by the VEWH on behalf of the MDBA
- *Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999* – Barmah-Millewa Forest Environmental Water Allocation, a significant operational rule embedded in consumptive entitlements comprising 50,000 ML of high-reliability and 25,000 ML of lower security entitlements
- *Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999* – River Murray Increased Flows, comprising Victoria's share of water recovered under the Snowy Water Initiative released from the Snowy Scheme to the River Murray, held by the VEWH

- *Environmental Entitlement (River Murray – NVIRP Stage 1) 2012*, comprising 1,223 ML held by the VEWH, which is mitigation water allocated for the purposes of watering specific environmental sites that have been identified through Goulburn-Murray Water Connections Project environmental approvals processes.
- *Bulk Entitlement (River Murray – Snowy Environmental Reserve) Conversion Order 2004*, comprising 29,794 ML of high-reliability entitlements, held by the VEWH
- 389,298 ML of high-reliability water shares and 41,837 ML of low-reliability water shares held for the environment
- water set aside for minimum flows released by the MDBA as a condition of the Murray–Darling Basin Agreement
- water set aside for the environment through flow-sharing arrangements set out in North East Water's and East Gippsland Water's bulk entitlements from unregulated rivers
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

A total of 691,847 ML of environmental water was delivered in the Victorian Murray system in 2020–21: 636,932 ML of this made its way to the South Australian border.

6.2.3 Water balance

The total volumes of water available and supplied from water resources in the Murray basin in 2020–21 are shown in Table 6-3.

Table 6-3 Water balance, Murray basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	1,801,400	1,836,600
Volume in storage at the end of the year	1	2,803,700	1,801,400
Change in storage		**1,002,300**	**(35,200)**
Inflows			
Catchment inflow	2	4,747,614	3,501,757
Rainfall on major storages	1	94,600	64,900
Net trade from New South Wales	3	168,110	88,010
Spills from New South Wales	3	0	0
Water returned to the Murray River	4	202,649	300,047
Treated wastewater discharged back to river	5	6,330	3,957
Total inflows		**5,219,303**	**3,958,671**
Outflows			
Diversions			
Urban diversions		38,961	40,248
Irrigation district diversions		775,872	749,880
Licensed diversions from regulated streams		470,917	456,936
Licensed diversions from unregulated streams		2,906	3,277
Environmental water diversions		70,877	41,762
Small catchment dams	6	5,794	4,658
Total diversions		***1,365,326***	***1,296,760***
Losses			
Evaporation from major storages	1	185,700	152,300
Net evaporation from small catchment dams	6	2,340	3,125
In-stream infiltration to groundwater, flows to floodplain and evaporation	7	253,237	646,786
Total losses		***441,277***	***802,211***
Water passed to other systems			
Murray River flows to South Australia from Victoria's allocation	8	2,056,300	1,653,200
Ceded to New South Wales	3	74,200	53,500
Spills to New South Wales	3	279,900	188,200
Net trade to New South Wales	3	0	0
Total water passed to other systems		***2,410,400***	***1,894,900***
Total outflows		**4,217,003**	**3,993,871**

6.2.3.1 Notes to the water balance

This water balance for the Murray River system includes only the Victorian portion of the Murray resource.

The volumes presented in the water balance may not be consistent with the MDBA's cap compliance reporting due to different accounting methods.

1. Storage volumes

Major — greater than 1,000 ML — on-stream storages in the Murray basin are included in the water balance. Table 6-4 shows how storage volumes changed during the year. Volumes in off-stream storages are presented for additional information about the resource condition.

Table 6-4 Storage volumes, Murray basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflows less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Lake Dartmouth (Vic. share)	1,928,116	944,800	20,900	29,100	38,400	1,323,400
Lake Hume (Vic. share)	1,502,579	557,800	56,200	85,800	(585,200)	817,400
Lake Victoria (Vic. share)	338,500	298,800	11,700	56,200	216,200	190,600
Menindee Lakes (Vic. share) (1)	865,500	0	5,800	14,600	220,700	472,300
Subtotal	**4,634,695**	**1,801,400**	**94,600**	**185,700**	**(109,900)**	**2,803,700**
Off-stream storages						
Kangaroo Lake	39,200	31,470	3,024	11,924	9,100	31,670
Kow Swamp	51,710	41,559	7,741	30,606	19,070	37,765
Lake Boga	37,000	30,429	2,889	11,405	4,071	25,984
Lake Charm	22,000	20,172	1,619	6,368	3,521	18,944
Lake Cullulleraine	5,270	4,438	447	3,973	3,506	4,418
Subtotal	**155,180**	**128,068**	**15,721**	**64,276**	**39,269**	**118,781**
Total 2020–21	**4,789,875**	**1,929,468**	**110,321**	**249,976**	**(70,631)**	**2,922,481**
Total 2019–20	4,789,875	1,961,804	81,425	208,000	94,238	1,929,468

Note

(1) Victoria's share of Menindee Lakes is reported as 865,500 ML to reflect the volume available when the lakes are at full supply level. However, when the volume in the lakes falls below 480,000 ML, Victoria loses all access to the lakes, and it does not regain access until the storage next reaches 640,000 ML.

2. Catchment inflow

Inflows are calculated based on estimates of inflows to major on-stream storages plus inflows from tributaries.

Catchment inflow is defined as:

- Victoria's share of inflows to Lake Dartmouth, Lake Hume, Lake Victoria and the Menindee Lakes system
- Victoria's share of inflows from the Kiewa River
- flows from the Ovens, Goulburn, Campaspe and Loddon rivers and from Broken Creek into the Murray River.

3. Movements between Victoria and New South Wales

In accordance with the Murray–Darling Basin Agreement and state trading rules, water can move between Victoria and New South Wales shares of the River Murray system through ceding, internal spills and trade.

In 2020–21, Victoria ceded a total of 74,200 ML to New South Wales. This volume was ceded in both Hume Dam and Menindee Lakes (64,900 ML and 9,300 ML, respectively).

Internal spills between Victoria and New South Wales occur when only one state's share of a storage is full and inflows are internally spilled, becoming resources for the state which has the capacity to store them. In 2020–21, there were 279,900 ML of internal spill from Victoria to New South Wales in Lake Victoria.

In 2020–21, there was net trade from New South Wales to Victoria of 168,110 ML. This included trade between environmental water holders as well as non-environment trade.

4. Water returned to the Murray River

This item includes water returned to the Murray River after irrigation and environmental diversions. 20,427 ML was returned to the Murray River following environmental diversions off the waterway. 182,222 ML was returned to the Murray River from the Torrumbarry and Murray Valley irrigation areas at points specified in the River Murray – Goulburn-Murray Water bulk entitlement.

5. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-5 lists the wastewater treatment plants in the Murray basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

Table 6-5 Volume and use of recycled water, Murray basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Bellbridge	C	28	28	100%	0	28	0	0	0	0
Bundalong [(1)]	C	0	0	0%	0	0	0	0	0	0
Cobram	C	130	130	100%	0	130	0	0	0	0
Cohuna [(2)]	n/a	0	0	0%	0	0	0	0	0	0
Corryong	C	94	94	100%	0	94	0	0	0	0
Dartmouth	n/a	6	0	0%	0	0	0	0	6	0
Gunbower / Leitchville	C	24	24	100%	0	24	0	0	0	0
Koondrook	C	98	0	0%	0	0	0	0	98	0
Koorlong	C	2,438	1,894	78%	0	1,894	0	0	544	0
Lake Boga	C	45	0	0%	0	0	0	0	45	0
Merbein	C	140	12	9%	0	12	0	0	128	0
Mildura	C	1,171	561	48%	0	561	0	0	610	0
Murrabit	C	5	0	0%	0	0	0	0	5	0
Nathalia	C	83	83	100%	0	83	0	0	0	0
Numurkah	C	62	62	100%	0	62	0	0	0	0
Nyah / Nyah West	C	58	0	0%	0	0	0	0	58	0
Omeo	C	27	27	100%	0	27	0	0	0	0
Robinvale	C	218	193	89%	0	193	0	0	25	0
Strathmerton [(3)]	C	0	0	0%	0	0	0	0	0	0
Swan Hill	C	1,002	0	0%	0	0	0	0	1,002	0
Tallangatta	C	105	105	100%	0	105	0	0	0	0
Walwa	C	5	5	100%	0	5	0	0	0	0
Wodonga [(4)]	B	4,084	275	7%	172	0	0	103	3,809	0
Yarrawonga	C	538	538	100%	0	538	0	0	0	0
Total 2020–21		**10,361**	**4,031**	**39%**	**172**	**3,756**	**0**	**103**	**6,330**	**0**
Total 2019–20		10,466	4,542	43%	213	4,177	0	152	3,957	1,967

Notes

n/a Data not available

(1) Wastewater treatment plants at Bundalong were operational but did not produce any recycled water output this year.

(2) The Cohuna treatment plant does not have a re-use application. The treated water is stored in onsite lagoons and disposed of by means of evaporation.

(3) The wastewater treatment plant at Strathmerton was operational but did not produce any recycled water output this year.

(4) Baranduda treatment plant transfers all inflows to the Wodonga treatment plant. All re-use volumes from the Baranduda treatment plant are captured as part of the Wodonga treatment plant.

6. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-6 provides information about small catchment dams in the basin.

Table 6-6 Estimated small catchment dam information, Murray basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	12,142	3,909	2,048	5,957
Registered/licensed commercial and irrigation	4,123	1,885	292	2,177
Total 2020–21	**16,265**	**5,794**	**2,340**	**8,134**
Total 2019–20	16,265	4,658	3,125	7,784

7. In-stream infiltration to groundwater, flows to floodplain and evaporation

In-stream losses are the balancing item in this water balance. It is the difference between the total inflows, the known outflows and the net change in storage volume. This volume may not be consistent with the MDBA's accounts due to different accounting methods and due to the MDBA's data only covering the regulated part of the River Murray.

8. Murray River flows to South Australia from Victoria's allocation

This includes the volume of water delivered to South Australia via the Murray River and Lindsay River, including 636,932 ML of water delivered under Victorian entitlements held for the environment.

6.2.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions**: holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Murray – Key compliance points

✓ **There was no net increase in the total entitlement volume from the previous year:**

- 204 ML of high-reliability Murray water shares were surrendered under Goulburn-Murray Water's Connections Project, and another 1.5 ML high-reliability water share was also cancelled during the year.

✓ **The total volume diverted (1,396,909 ML) was within the volume available for the year (2,275,609 ML).**

✓ **No individual bulk entitlement holder took more than the annual volume made available to them.**

✓ **Individual bulk entitlement holders complied with all provisions in their entitlements apart from:**

- ✗ Goulburn-Murray Water exceeded the permitted loss allowance for the Nyah irrigation district by 93 ML.
- ✗ under the *Bulk Entitlement (River Murray – Grampians Wimmera Mallee Water) Order 1999*, no approved metering plan has been implemented for that order.

Entitlements in the Murray basin provide the basis for how water is shared in the basin. Rights to water in the Murray basin are shown in Table 6-7.

Most entitlements to water in the regulated Murray provide the right to carry over unused allocation to the next season. In the Murray basin, these entitlement holders can carry over unused water up to 100% of their entitlement volume. Water held above entitlement volume is also subject to a risk of spill from major storages: no water was written off due to spill events in 2020–21.

Diversions under bulk entitlements are assessed against the Murray–Darling Basin annual cap target for the Murray–Kiewa–Ovens Valley. Since 2012, cap compliance has been reported to the MDBA through the *transition period water take report*. Before this, details of this assessment were published annually in the MDBA's water audit monitoring report.

Table 6-7 Entitlement volumes, Murray basin

Water entitlement – Murray	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (River Murray – Goulburn-Murray Water) Conversion Order 1999		
High-reliability water shares	991,780	986,085
Low-reliability water shares	314,431	314,372
High-reliability supply by agreements	993	993

Low-reliability supply by agreements	409	409
Bulk Entitlement (River Murray – South East Water) Order 2012 (1)	n/a	n/a
Bulk Entitlement (River Murray – City West Water) Order 2012 (1)	n/a	n/a
Bulk Entitlement (River Murray – Yarra Valley Water) Order 2012 (1)	n/a	n/a
Environmental Entitlement (River Murray – NVIRP Stage 1) 2012 (2)	n/a	n/a
Loss provision – irrigation district (3)	161,501	161,501
Loss provision – Victorian Mid-Murray Storages (4)	n/a	n/a
Subtotal: Bulk Entitlement (River Murray – Goulburn-Murray Water) Conversion Order 1999	*1,469,114*	*1,463,361*
Bulk Entitlement (River Murray – Lower Murray Urban and Rural Water – Irrigation) Conversion Order 1999		
High-reliability water shares	289,787	295,686
Low-reliability water shares	7,146	7,205
Millewa Waterworks districts	700	700
Yelta Wargan Waterworks districts	14	14
Provision for statutory domestic and stock rights	532	532
Loss provisions (5)	15,981	15,981
Subtotal: Bulk Entitlement (River Murray – Lower Murray Urban and Rural Water – Irrigation) Conversion Order 1999	*314,160*	*320,118*
Bulk Entitlement (River Murray – Lower Murray Urban and Rural Water – Urban) Conversion Order 1999	30,971	30,971
Bulk Entitlement (River Murray – Grampians Wimmera Mallee Water) Conversion Order 1999	3,486	3,486
Bulk Entitlement (River Murray – North East Water) Conversion Order 1999	14,540	14,540
Bulk Entitlement (River Murray – Goulburn Valley Water) Conversion Order 1999	5,593	5,593
Bulk Entitlement (River Murray – Coliban Water) Conversion Order 1999	6,285	6,285
Bulk Entitlement (Corryong) Conversion Order 2000	680	680
Bulk Entitlement (Cudgewa) Conversion Order 2000	29	29
Bulk Entitlement (Dartmouth) Conversion Order 2000	60	60
Bulk Entitlement (Omeo) Conversion Order 2008	77	77
Bulk Entitlement (Walwa) Conversion Order 2000	61	61
Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999		
High-reliability entitlement	54,856	54,856
Low-reliability entitlement	110,373	110,373
Unregulated entitlement	83,300	83,300
Barmah-Millewa Forest Environmental Water Allocation (BMF EWA) (6)		
Barmah-Millewa Forest Environmental Water Allocation – high-reliability	50,000	50,000
Barmah-Millewa Forest Environmental Water Allocation – lower-security	25,000	25,000
River Murray Increased Flows (RMIF) (7)	n/a	n/a
Subtotal: Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999	*323,528*	*323,528*
Bulk Entitlement (River Murray – Snowy Environmental Reserve) Conversion Order 2004	29,794	29,794
Take and use licences – unregulated surface water	13,788	13,792
Licensed small catchment dams – on-waterway	2,624	2,460
Licensed small catchment dams – off-waterway	13,561	13,725
Total	**2,228,349**	**2,228,559**

Notes

(1) Together, these entitlements provide City West Water, South East Water and Yarra Valley Water with a total annual allocation of water equal to one-third of the phase 3 Murray water savings achieved in the previous year under Goulburn-Murray Water Connections Project stage 1.

(2) This entitlement is held by VEWH for audited mitigation water from the Goulburn-Murray Water Connections Project. This entitlement receives a volume of mitigation water allocation from the previous year as specified in the latest annual audit of Connections Project water recovery. Historically, this entitlement also provided the VEWH with a total annual allocation of water equal to one-third of the phase 3 Murray water recovery achieved in the previous year under the Connections Project stage 1.

(3) These loss allowances represent the total loss allowances as outlined in the bulk entitlement and the volume that applied to the majority of the water year rather than on 30 June of each year. The actual loss allowed may vary year to year based on the rules in the bulk entitlement, actual delivery volumes, carryover or headroom allowance.

(4) The allowance for loss in the Victorian Mid-Murray Storages includes a portion of fixed distribution loss and is adjusted for the net evaporation from the storages (Kow Swamp, Kangaroo Lake, Lake Charm and Lake Boga).

(5) The loss allowance volume includes a 4,800 ML loss allowance for the Millewa waterworks district.

(6) The Barmah-Millewa Forest Environmental Water Allocation includes 50 GL of high-reliability entitlement and 25 GL of lower security entitlement and is matched by equivalent entitlements in New South Wales. Conditions of the entitlement provide for the allocation to be borrowed to support Victorian Murray allocations and specify certain conditions when the allocation must be released.

(7) The River Murray Increased Flows entitlement reflects the water recovered under the Snowy Water Initiative for the health of the Murray River. It provides for up to 70 GL of water being made available in the Snowy Scheme each year, but the volume available in the Murray in a given year depends on the volume of this water released from the Snowy Scheme to the Murray River.

Table 6-8 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

Table 6-8 Available water and take, Murray basin

Water entitlement	Available water (ML)					Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Spillable write-off	Total available water	
River Murray – Goulburn-Murray Water						
Water shares	370,245	959,231	(432,173)	0	897,303	388,010
Supply by agreements	583	993	(29)	0	1,547	628
River Murray – Melbourne retailers (1)	10,984	10,659	(9,795)	0	11,849	0
River Murray – NVIRP stage 1 (2)	1,095	368	(240)	0	1,223	0
Loss allowance – irrigation districts (3)	-	-	-	-	-	83,657
Operating provisions (whole of system) (3)	-	-	-	-	-	41,761
Net diversion: River Murray – Goulburn-Murray Water (4)					*911,922*	*514,056*
River Murray – Lower Murray Urban and Rural Water – Irrigation						
Water shares	73,176	322,539	263,716	0	659,432	534,315
Millewa Waterworks district	150	700	200	0	1,050	1,049
Yelta Wargan Waterworks districts		14	0	0	14	2
Loss allowance – irrigation districts (5)	-	-	-	-	-	10,774
Diversion: River Murray – Lower Murray Water (6)					*660,496*	*546,140*
River Murray – Lower Murray Water (Urban)	6,207	30,971	(9,834)	0	27,344	20,625
River Murray – Wimmera Mallee Water	1,425	3,486	1,415	0	6,326	4,371
River Murray – North East Water (7)	3,183	16,325	(9,006)	0	10,503	9,154
River Murray – Goulburn Valley Water	3,141	5,593	(910)	0	7,824	4,428
River Murray – Coliban Water	3,553	6,285	(23)	0	9,815	4,402
Corryong	-	680	0	-	680	289
Cudgewa	-	29	0	-	29	0
Dartmouth	-	60	0	-	60	0
Omeo	-	77	0	-	77	48
Walwa	-	61	0	-	61	15
River Murray – Flora and Fauna						
High- and low-reliability components (8)	49,303	472,545	(195,570)	0	326,278	273,717
Unregulated entitlement	-	7,012	0	-	7,012	7,012
BMF – EWA (9)	10,000	50,000	183,150	-	243,150	0
RMIF	7,862	25,000	0	-	32,862	7,862
Subtotal: River Murray – Flora and Fauna (10)					*143,402*	*288,591*
River Murray – Snowy Environmental Reserve (11)	2,979	29,794	(31,582)	-	1,192	0
Take and use licences – unregulated surface water	-	13,794	0	-	13,794	2,906
Licensed small catchment dams	-	16,185	0	-	16,185	1,885
Total 2020–21	**543,888**	**1,972,400**	**(240,680)**	**0**	**2,275,609**	**1,396,909**
Total 2019–20	833,654	1,689,543	(763,865)	0	1,759,331	1,243,138

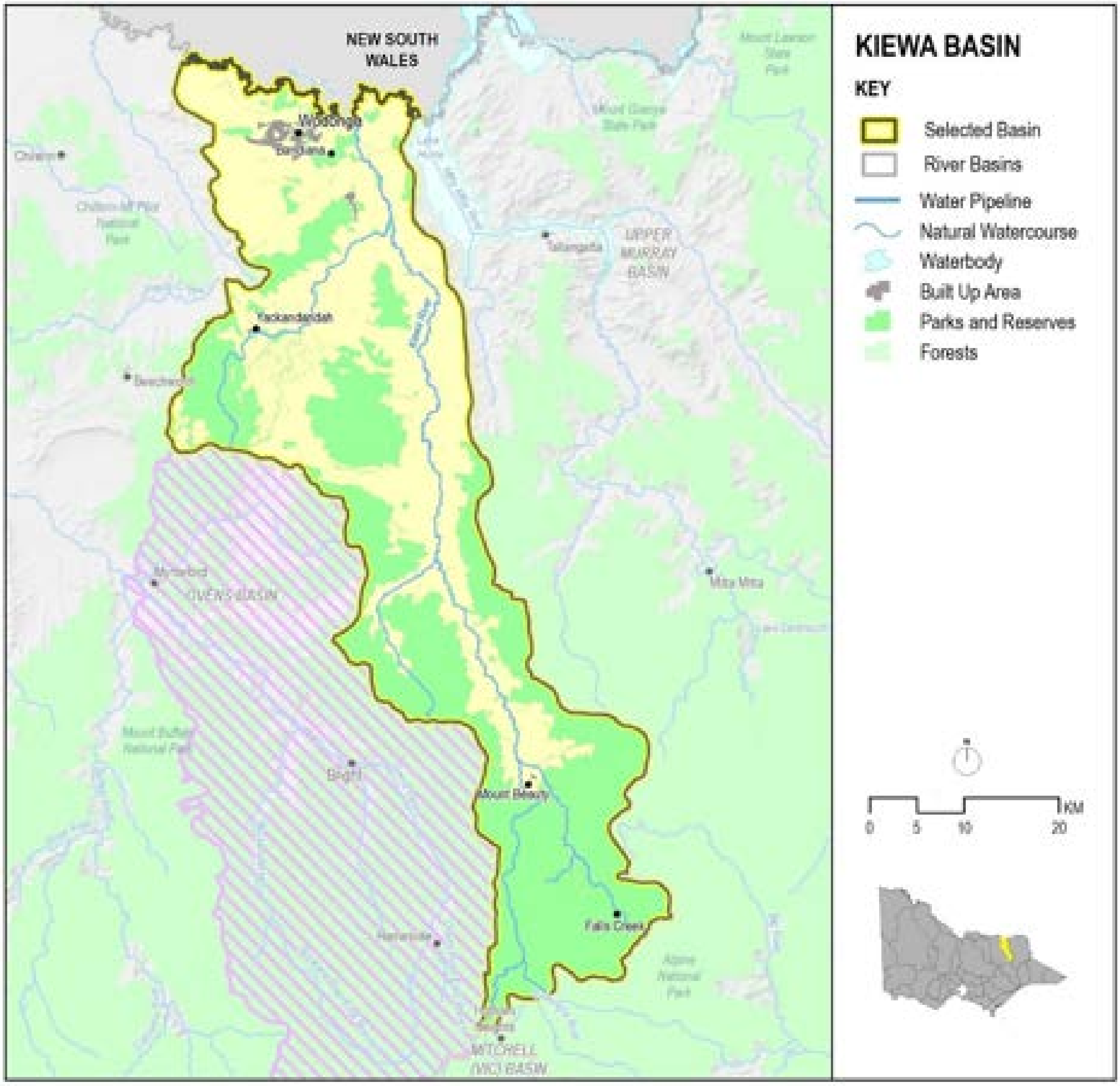
Notes

(1) Melbourne retail water corporations' entitlements are reported in one account, as they each own equal shares of the available allocation.
(2) This entitlement is held by the VEWH, and water use reported can represent both in-stream use and actual diversions from the waterway. No use was reported in 2020–21.
(3) 'Loss allowance – irrigation districts' includes loss incurred in Torrumbarry, Murray Valley, Nyah, Tresco and Woorinen irrigation districts. 'Operating provisions' includes primarily the change in storage and other effects of the Victorian Mid-Murray Storages (Kow Swamp, Lake Charm, Kangaroo Lake and Lake Boga).
(4) The water use reported in this line item represents the net diversion to supply primary entitlements and fulfil other operating requirements under the Goulburn-Murray Water Murray system source bulk entitlement (net of return flow from irrigation).
(5) The loss recorded under the Lower Murray Water irrigation bulk entitlement includes loss in the Millewa waterworks district.
(6) The water use reported in this line item represents the bulk diversion to supply primary entitlements and fulfil other operating requirements under the Lower Murray Urban and Rural Water – Irrigation Murray system source bulk entitlements.
(7) Allocation includes return flows of 1,785 ML credited to North East Water from Wodonga recycled water treatment.
(8) Allocation includes return flows of 417,690 ML credited to the VEWH from deliveries of environmental water. Most of the allocation traded out of this entitlement was traded to South Australia, where it was used to deliver environmental outcomes in the lower Murray River, Lower Lakes and Coorong.
(9) Allocation issued to Victoria's Barmah-Millewa Forest Environmental Water Allocation (BMF EWA) comprised 50,000 ML against the high-reliability entitlement and 0 ML against the low-reliability entitlement. 183,150 ML — while not a trade, it is shown here in the net trade column — represents the balance of the BMF EWA allocation available during 2020–2021 that was borrowed to support Victorian Murray high-reliability water share allocations in accordance with the BMF EWA rules. The borrow amount includes 50,000 ML of additional amount borrowed and 233,150 ML repaid.
(10) Water use reported under this entitlement represents both in-stream use and actual diversions from the waterway. Of the 288,591 ML reported, 70,870 ML represents diversions from the waterway.
(11) Water allocated to this entitlement between 1 February 2020 and 31 January 2021 was traded to the Snowy inter-valley transfer account to offset reductions in releases from the Snowy Scheme as part of the Snowy Water Initiative and to allow equivalent volumes to be released from the Scheme as Snowy River Increased Flows and RMIF to support the environmental health of those rivers.

6.3 Kiewa basin

The Kiewa basin (Figure 6-4) is in northern Victoria. The Kiewa River is about 100 km long; it extends from the Bogong High Plains and drains northward to the Murray River.

Figure 6-4 Map of the Kiewa basin



6.3.1 Management arrangements

Management of water in the Kiewa basin is undertaken by various parties, as shown in Table 6-9.

Outflows from the Kiewa basin are shared on a 50-50 basis between Victoria and New South Wales within the Murray system.

Table 6-9 Water resource management responsibilities, Kiewa basin

Authority	Management responsibilities
Goulburn-Murray Water	Manages private diversions
North East Water	Supplies towns across the basin including Wodonga and Mount Beauty
AGL Hydro	Operates reservoirs in the Kiewa basin for hydropower generation
North East Catchment Management Authority	Responsible for waterway and catchment management in the region bounded by the Murray River in the north, the Victorian Alps in the south, the New South Wales border in the east and the Warby Ranges in the west

6.3.2 2020–21 water resources overview

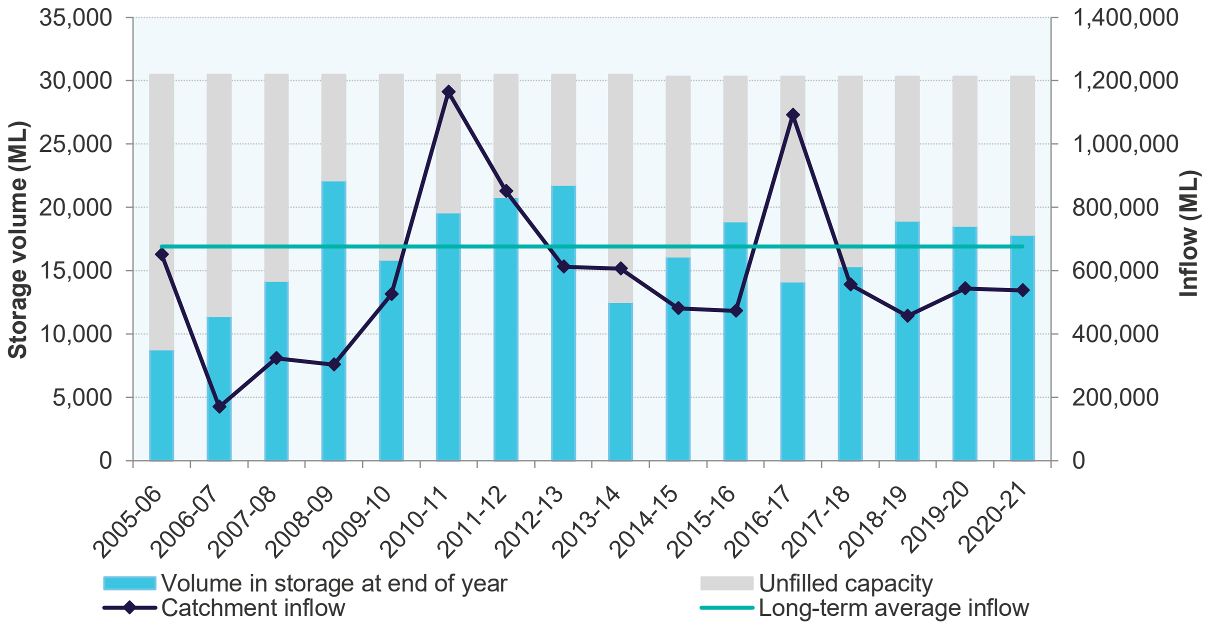
In 2020–21, rainfall was:

- average in most of the basin
- below average in a small area north-east of Bright.

Catchment inflows to the basin in 2020–21 were 80% of the long-term average annual volume of 676,700 ML, the same as 2019–20. The volume of water flowing out of the Kiewa River into the Murray basin represented 93% of the Kiewa basin's total inflows.

Major storages in the basin were at 61% of capacity on 1 July 2020 and 58% of capacity on 30 June 2021.

Figure 6-5 Storage volumes and catchment inflows, Kiewa basin



Key aspects of restrictions on licensed diversions from unregulated streams in the Kiewa basin in 2020–21 were:

- no restrictions in place until December 2020, when the Bright and Basin creeks both had total bans on licensed diversions
- total bans were then put in place on an additional 11 streams by January 2021, reaching a peak of 16 streams by February 2021; this was lower than the peak of 17 streams in December 2019
- all bans were lifted by June 2021
- seven streams remained unrestricted for the whole of 2020–21.

There were no restrictions on urban water use in the Kiewa basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 8,021 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 8,373 ML diverted in the previous year.

6.3.2.1 Water for the environment

Environmental watering sites and environmental values in the Kiewa basin that depend on water for the environment include:

- threatened remnant vegetation and Murray cod in the reaches of the West Kiewa River and lower Kiewa River
- nationally significant Alpine wetlands, known as the Alpine sphagnum bogs and associated fens.

Water from the Kiewa basin also flows into the Murray basin, helping to maintain environmental assets in that basin.

In 2020–21, water for the environment in the Kiewa basin comprised:

- water set aside for the environment:
  - through flow-sharing arrangements
  - through the operation of passing flow conditions on consumptive bulk entitlements held by North East Water and AGL Hydro Ltd

- through the operation of passing flow conditions on licensed diversions
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

6.3.3 Water balance

The total volumes of water available and supplied from water resources in the Kiewa basin in 2020–21 are shown in Table 6-10.

Table 6-10 Water balance, Kiewa basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	18,112	18,570
Volume in storage at the end of the year	1	17,208	18,112
Change in storage		**(904)**	**(458)**
Inflows			
Catchment inflow	2	538,368	543,893
Rainfall on major storages	1	0	0
Treated wastewater discharged back to river	3	285	331
Total inflows		**538,653**	**544,224**
Outflows			
Diversions			
Urban diversions		457	525
Licensed diversions from unregulated streams		4,051	4,827
Transfer to the Ovens basin	4	584	584
Small catchment dams	5	2,929	2,436
Total diversions		***8,021***	***8,373***
Losses			
Evaporation from major storages	1	0	0
Net evaporation from small catchment dams	5	1,320	1,528
In-stream infiltration to groundwater, flows to floodplain and evaporation		31,082	30,877
Total losses		***32,402***	***32,405***
Water passed at outlet of basin			
Kiewa basin outflow to Murray River – Victorian share		249,567	251,952
Kiewa basin outflow to Murray River – New South Wales' share		249,567	251,952
Total water passed at outlet of basin		***499,134***	***503,904***
Total outflows		**539,557**	**544,682**

6.3.3.1 Notes to the water balance

1. Storage volumes

Major — greater than 1,000 ML — on-stream storages in the Kiewa basin are included in the water balance. Table 6-11 shows how storage volumes changed during the year. Volumes in off-stream storages are presented for additional information about the resource condition.

An estimate of rainfall and evaporation for storages in the Kiewa basin has not been made, as data for these sites is not available.

Table 6-11 Storage volumes, Kiewa basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflows less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Lake Guy	1,416	666	n/a	n/a	(178)	489
Rocky Valley Lake	28,294	17,445	n/a	n/a	(726)	16,719
Subtotal	**29,710**	**18,112**	n/a	**n/a**	**(904)**	**17,208**
Off-stream storages						
Clover Pondage	255	95	n/a	n/a	170	265
Pretty Valley basin	355	355	n/a	n/a	0	355
Subtotal	**610**	**450**	n/a	**n/a**	**170**	**620**
Total 2020–21	**30,320**	**18,562**	**n/a**	**n/a**	**(734)**	**17,828**
Total 2019–20	30,320	18,974	n/a	n/a	(413)	18,562

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, the known inflows and the net change in storage volume.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-12 lists the wastewater treatment plants in the Kiewa basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

The treated wastewater volume of 285 ML returned to the river includes the amount discharged to the environment from wastewater treatment plants as well as an amount of 93 ML returned from the Falls Creek Alpine Resort to Rocky Valley Creek.

Table 6-12 Volume and use of recycled water, Kiewa basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Dinner Plain	C	95	95	100%	0	95	0	0	0	0
Mount Beauty	B	195	3	2%	3	0	0	0	192	0
Yackandandah	C	103	103	100%	0	103	0	0	0	0
Total 2020–21		**393**	**201**	**51%**	**3**	**198**	**0**	**0**	**192**	**0**
Total 2019–20		369	174	47%	5	169	0	0	195	0

4. Transfer to the Ovens basin

The 584 ML transfer represents water that is transferred to the Ovens basin to be supplied to urban customers in Beechworth.

5. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-13 provides information about small catchment dams in the basin.

Table 6-13 Estimated small catchment dam information, Kiewa basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	6,397	1,703	1,048	2,751
Registered/licensed commercial and irrigation	4,528	1,226	272	1,498
Total 2020–21	**10,925**	**2,929**	**1,320**	**4,249**
Total 2019–20	10,925	2,437	1,527	3,964

6.3.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Kiewa – Key compliance points
✓ **There was no net increase in the total entitlement volume from the previous year.**
✓ **The total volume diverted (6,318 ML) was within the volume available for the year (20,396 ML).**
✓ **No individual bulk entitlement holder took more than the annual volume made available to them.**
✓ **Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlements in the Kiewa basin provide the basis for how water is shared in the basin. Rights to water in the Kiewa basin are set out in Table 6-14.

Diversions under bulk entitlements are assessed against the Murray–Darling Basin annual cap target for the Murray–Kiewa–Ovens valley. Since 2012, cap compliance has been reported to the MDBA through the *transition period water take report*. Before this, details of this assessment were published annually in the MDBA's water audit monitoring report. Carryover provisions are not available for entitlement holders in the Kiewa basin.

Table 6-14 Entitlement volumes, Kiewa basin

Water entitlement – Kiewa	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Beechworth) Conversion Order 2001 (1)	1,100	1,100
Bulk Entitlement (Kiewa – Hydro) Conversion Order 1997 (2)	n/a	n/a
Bulk Entitlement (Kiewa – Tangambalanga) Conversion Order 2000	179	179
Bulk Entitlement (Mount Beauty – Tawonga) Conversion Order 1997	718	718
Bulk Entitlement (Yackandandah) Conversion Order 2001	209	209
Take and use licences – unregulated surface water (3)	13,659	13,662
Licensed small catchment dams – on-waterway	1,850	1,850
Licensed small catchment dams – off-waterway	2,679	2,679
Total	**20,393**	**20,396**

Notes

(1) The Beechworth bulk entitlement can source water from both the Kiewa and the Ovens basins, but the majority of the water is sourced from the Kiewa basin. Beechworth is in the Ovens basin, so any water sourced from the Kiewa basin under this entitlement is transferred to the Ovens basin for use.

(2) This bulk entitlement held by AGL Hydro Ltd is for non-consumptive uses. All water diverted under this entitlement must be returned to the waterway. A specified volume is not applicable.

(3) The volume of unregulated surface water entitlements includes licences for in-stream diversions. In the Kiewa basin, there are 11 ML of in-stream licence.

Table 6-15 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

Table 6-15 Available water and take, Kiewa basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Beechworth	-	1,100	0	1,100	584
Kiewa – Hydro (1)	-	-	-	-	-
Kiewa – Tangambalanga	-	179	0	179	0
Mount Beauty – Tawonga	-	718	0	718	299
Yackandandah	-	209	0	209	158
Take and use licences – unregulated surface water	-	13,662	0	13,662	4,051
Licensed small catchment dams	-	4,528	0	4,528	1,226
Total 2020–21	**-**	**20,396**	**0**	**20,396**	**6,318**
Total 2019–20	-	20,407	0	20,407	6,930

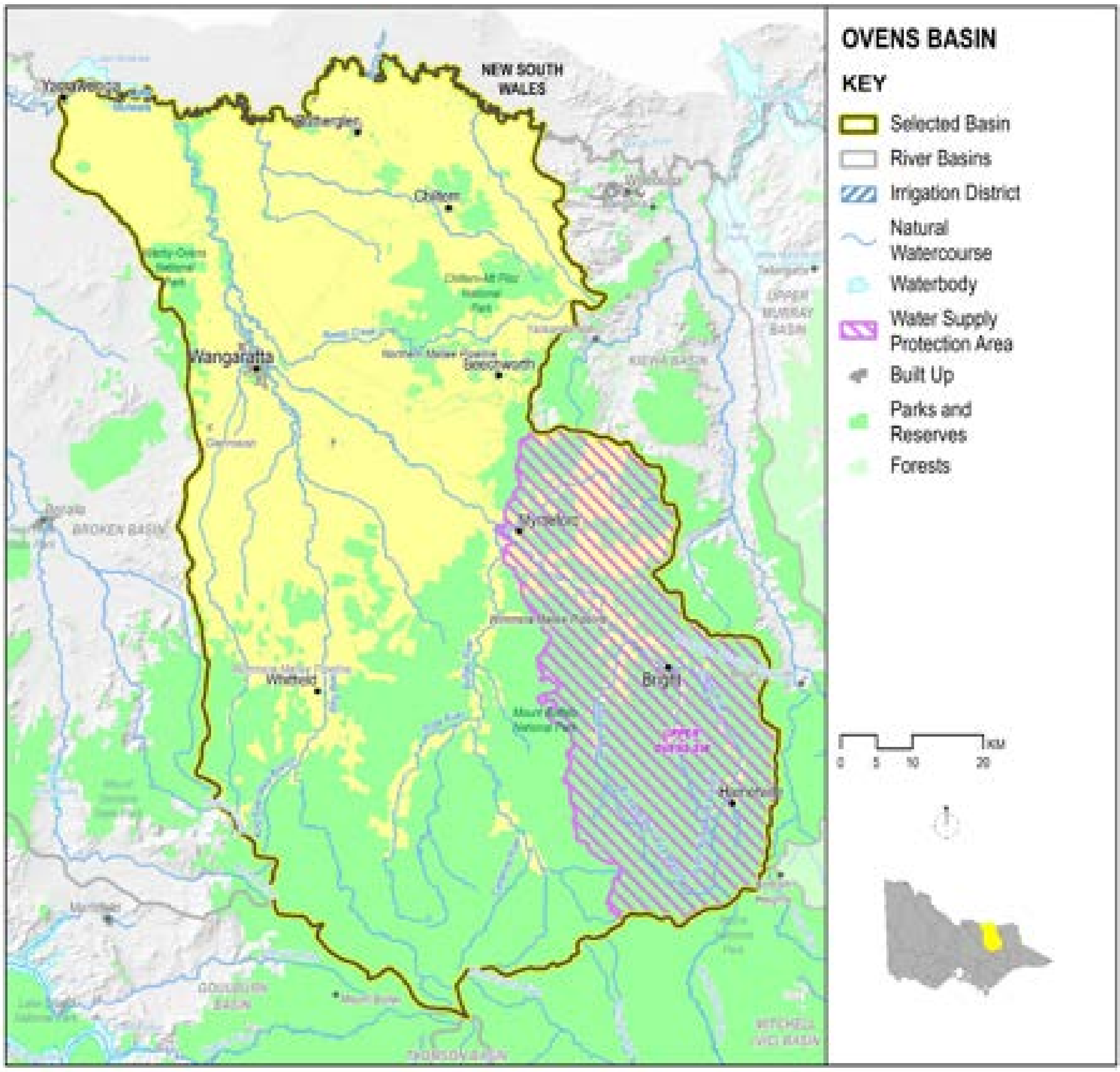
Note

(1) This bulk entitlement held by AGL Hydro Ltd is for non-consumptive uses. All water diverted under this entitlement must be returned to the waterway; therefore, no volumes are reported as diversions for the purposes of this table.

6.4 Ovens basin

The Ovens basin (Figure 6-6) is in north-east Victoria. It covers an area that extends from the Murray River in the north to the Great Dividing Range in the south, and it is bordered by the Broken basin in the west and the Kiewa basin in the east.

Figure 6-6 Map of the Ovens basin



6.4.1 Management arrangements

Management of water in the Ovens basin is undertaken by various parties, as shown in Table 6-16.

Table 6-16 Water resource management responsibilities, Ovens basin

Authority	Management responsibilities
Goulburn-Murray Water	Supplies primary entitlements in the regulated Ovens and King systems Manages licensed diversions Operates Lake Buffalo and Lake William Hovell
North East Water	Supplies towns including Wangaratta, Bright, Myrtleford, Beechworth and Chiltern
North East Catchment Management Authority	Responsible for waterway and catchment management in the region bounded by the Murray River in the north, the Victorian Alps in the south, the New South Wales border in the east and the Warby Ranges in the west

6.4.2 2020–21 water resources overview

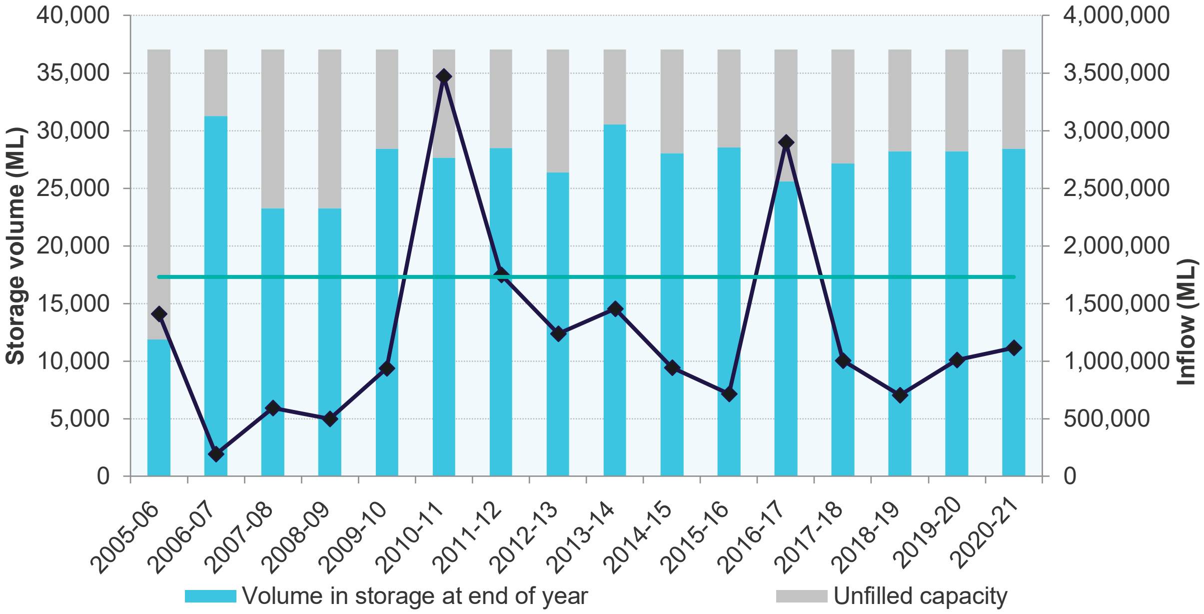
In 2020–21, rainfall was:

- average in most of the basin
- below average in the centre of the basin, in an area covering Whitfield to Myrtleford and Bright.

Catchment inflows to the basin in 2020–21 were 64% of the long-term average annual volume of 1,729,300 ML, greater than in 2019–20, when inflows were 58% of the long-term average. The volume of water flowing out of the Ovens basin into the Murray River represented 96% of the Ovens basin's catchment inflows.

Major storages in the basin were at 76% of capacity on 1 July 2020 and slightly higher (at 77% of capacity) on 30 June 2021.

Figure 6-7 Storage volumes and catchment inflows, Ovens basin



Key aspects of restrictions on licensed diversions from unregulated streams in the Ovens basin in 2020–21 were:

- no restrictions in place until December 2020, when a total ban was put in place on Hodgsons Creek
- a peak of seven restricted streams by January 2021, lower than the peak of 20 in January 2020
- all restrictions were lifted by the end of July 2021.

There were no restrictions on urban water use in the Ovens basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 23,606 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 25,955 ML diverted in the previous year.

6.4.2.1 Water for the environment

Environmental watering sites and environmental values in the Ovens basin that depend on water for the environment include:

- the lower Ovens River (which contains heritage and iconic reaches), which is an important environmental asset that depends on water in the Ovens basin
- the lower Ovens wetlands including Mullimur Wetland, which support freshwater catfish, egrets, herons, cormorants, bitterns and treecreepers and a large variety of aquatic vegetation
- the Buffalo River and King River, which are important sites for large fish species during their breeding cycle: trout cod are found as far up the King River as Whitfield.

Water from the Ovens basin also flows into the Murray basin, helping to maintain environmental assets in that basin.

In 2020–21, water for the environment in the Ovens basin comprised:

- water set aside for the environment:
  - and other downstream uses through the operation of passing flows conditions on consumptive bulk entitlements held by Goulburn-Murray Water in the regulated rivers
  - through the operation of passing flow conditions on licensed diversions, including those set out in the *Upper Ovens River WSPA Water Management Plan*
  - through flow-sharing arrangements set out in North East Water's bulk entitlements in the unregulated rivers
- 123 ML of high-reliability water shares held for the environment

- 36 ML of water allocation transferred to the VEWH for delivery in the Ovens system for environmental and Aboriginal outcomes
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

In 2020–21, 159 ML of environmental water was delivered in-stream in the Ovens basin.

6.4.3 Water balance

The total volumes of water available and supplied from water resources in the Ovens basin in 2020–21 are shown in Table 6-17.

Table 6-17 Water balance, Ovens basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	28,172	28,183
Volume in storage at the end of the year	1	28,439	28,172
Change in storage		**267**	**(11)**
Inflows			
Catchment inflow	2	1,112,732	1,007,608
Rainfall on major storages	1	3,892	3,689
Transfer from Kiewa basin	3	584	584
Treated wastewater discharged back to river	4	1,921	1,453
Total inflows		**1,119,130**	**1,013,334**
Outflows			
Diversions			
Urban diversions		5,189	5,418
Licensed diversions from regulated streams		6,909	10,474
Licensed diversions from unregulated streams		4,326	4,348
Environmental water diversions		0	20
Small catchment dams	5	7,183	5,715
Total diversions		***23,606***	***25,975***
Losses			
Evaporation from major storages	1	3,762	3,951
Net evaporation from small catchment dams	5	3,925	3,420
In-stream infiltration to groundwater, flows to floodplain and evaporation		14,426	21,510
Total losses		***22,113***	***28,881***
Water passed at outlet of basin			
Ovens basin outflow to Murray River		1,073,144	958,488
Total water passed at outlet of basin		***1,073,144***	***958,488***
Total outflows		**1,118,863**	**1,013,345**

6.4.3.1 Notes to the water balance

1. Storage volumes

Major — greater than 1,000 ML — on-stream storages in the Ovens basin are included in the water balance. Table 6-18 shows how storage volumes changed during the year.

Table 6-18 Storage volumes, Ovens basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflows less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Lake Buffalo	23,340	14,175	2,690	2,983	700	14,581
Lake William Hovell	13,690	13,998	1,202	779	(563)	13,858
Total 2020–21	**37,030**	**28,172**	**3,892**	**3,762**	**137**	**28,439**
Total 2019–20	37,030	28,183	3,689	3,951	252	28,172

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, the known inflows and the net change in storage volume.

3. Transfer from Kiewa basin

The 584 ML transfer represents water that is transferred from the Kiewa basin before being supplied to urban customers in Beechworth.

4. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-19 lists the wastewater treatment plants in the Ovens basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

Table 6-19 Volume and use of recycled water, Ovens basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Beechworth	C	372	94	25%	0	94	0	0	278	0
Bright / Porepunkah	C	517	19	4%	19	0	0	0	498	0
Chiltern	C	21	21	100%	0	21	0	0	0	0
Glenrowan	C	28	28	100%	0	28	0	0	0	0
Moyhu	C	9	9	100%	0	9	0	0	0	0
Myrtleford	n/a	394	0	0%	0	0	0	0	394	0
Rutherglen / Wahgunyah	C	91	91	100%	39	52	0	0	0	0
Wangaratta	C	1,378	627	46%	6	621	0	0	751	0
Wangaratta Trade Waste	n/a	0	0	0%	0	0	0	0	0	0
Total 2020–21		**2,810**	**889**	**32%**	**64**	**825**	**0**	**0**	**1,921**	**0**
Total 2019–20		2,609	1,156	44%	59	1,097	0	0	1,453	0

n/a Data not available

5. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-20 provides information about small catchment dams in the basin.

Table 6-20 Estimated small catchment dam information, Ovens basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	26,417	4,779	3,294	8,073
Registered/licensed commercial and irrigation	10,919	2,404	631	3,035
Total 2020–21	**37,336**	**7,183**	**3,925**	**11,108**
Total 2019–20	37,336	5,715	3,420	9,135

6.4.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Ovens – Key compliance points	
ü	**There was no net increase in the total entitlement volume from the previous year.**
ü	**The total volume diverted (18,402 ML) was within the volume available for the year (64,195 ML).**
ü	**No individual bulk entitlement holder took more than the annual volume made available to them.**
ü	**Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlements in the Ovens basin provide the basis for how water is shared in the basin. Rights to water in the Ovens basin are set out in Table 6-21.

Diversions under bulk entitlements are assessed against the Murray–Darling Basin annual cap target for the Murray–Kiewa–Ovens valley. Since 2012, cap compliance has been reported to the MDBA through the *transition period water take report*. Before this, details of this assessment were published annually in the MDBA's water audit monitoring report.

Table 6-21 Entitlement volumes, Ovens basin

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Ovens System – Goulburn-Murray Water) Conversion Order 2004 (1)		
High-reliability water shares	26,164	26,164
Spill-reliability water shares	12,521	12,525
Bulk Entitlement (Ovens System – Moyhu, Oxley and Wangaratta – North East Water) Conversion Order 2004	7,832	7,832
Subtotal: Bulk Entitlement (Ovens System – Goulburn-Murray Water) Conversion Order 2004	*46,517*	*46,521*
Bulk Entitlement (Bright) Conversion Order 2000	870	870
Bulk Entitlement (Chiltern) Conversion Order 2000	180	180
Bulk Entitlement (Glenrowan) Conversion Order 1999	90	90
Bulk Entitlement (Harrietville) Conversion Order 1999	91	91
Bulk Entitlement (Myrtleford) Conversion Order 2001 (2)	1,470	1,470
Bulk Entitlement (Springhurst) Conversion Order 1999	36	36
Bulk Entitlement (Whitfield) Conversion Order 1999	34	34
Take and use licences – unregulated surface water (3)	13,796	13,809
Licensed small catchment dams – on-waterway	3,474	3,410
Licensed small catchment dams – off-waterway	7,445	7,509
Total	**74,003**	**74,020**

Notes

(1) Under this bulk entitlement, Goulburn-Murray Water operates Lake Buffalo and Lake William Hovell to supply water share holders in the regulated part of the Ovens system and to supply water to North East Water's Ovens system bulk entitlement for Moyhu, Oxley and Wangaratta.

(2) This entitlement specifies that up to 1,470 ML can be diverted in any one year. The maximum volume that can be taken over any two-year period is 2,424 ML (1,212 ML annual average).

(3) The volume of unregulated surface water entitlements includes licences for in-stream diversions. In the Ovens basin, there are 21 ML of in-stream licence.

Table 6-22 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

Table 6-22 Available water and take, Ovens basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Ovens system – Goulburn-Murray Water					
Water shares (1)	-	28,682	0	28,682	7,068
Ovens system – Moyhu, Oxley and Wangaratta	-	7,832	0	7,832	3,120
Diversion: Ovens system – Goulburn-Murray Water (2)				*36,514*	*10,187*
Bright	-	870	0	870	865
Chiltern (3)	-	180	0	180	0
Glenrowan (4)	-	90	0	90	8
Harrietville	-	91	0	91	71
Myrtleford	-	1,212	0	1,212	542
Springhurst	-	36	0	36	0

Whitfield	-	34	0	34	0
Take and use licences – unregulated surface water [(5)]	-	13,809	333	14,141	4,326
Licensed small catchment dams [(5)]	-	10,983	44	11,027	2,404
Total 2020–21	**-**	**63,819**	**376**	**64,195**	**18,402**
Total 2019–20	-	64,441	117	64,558	21,714

Notes

(1) Water use reported includes 159 ML of environmental in-stream use. The 159 ML is not reflected in the water balance in Table 6-17 as it does not reflect an actual diversion from the waterway.

(2) The water use reported in this line item represents the bulk diversion to supply primary entitlements under the Ovens system source bulk entitlement. It includes water delivered in-stream for environmental purposes (159 ML).

(3) North East Water has not diverted any water under this bulk entitlement since February 2008, when Chiltern was connected to the Wodonga supply system.

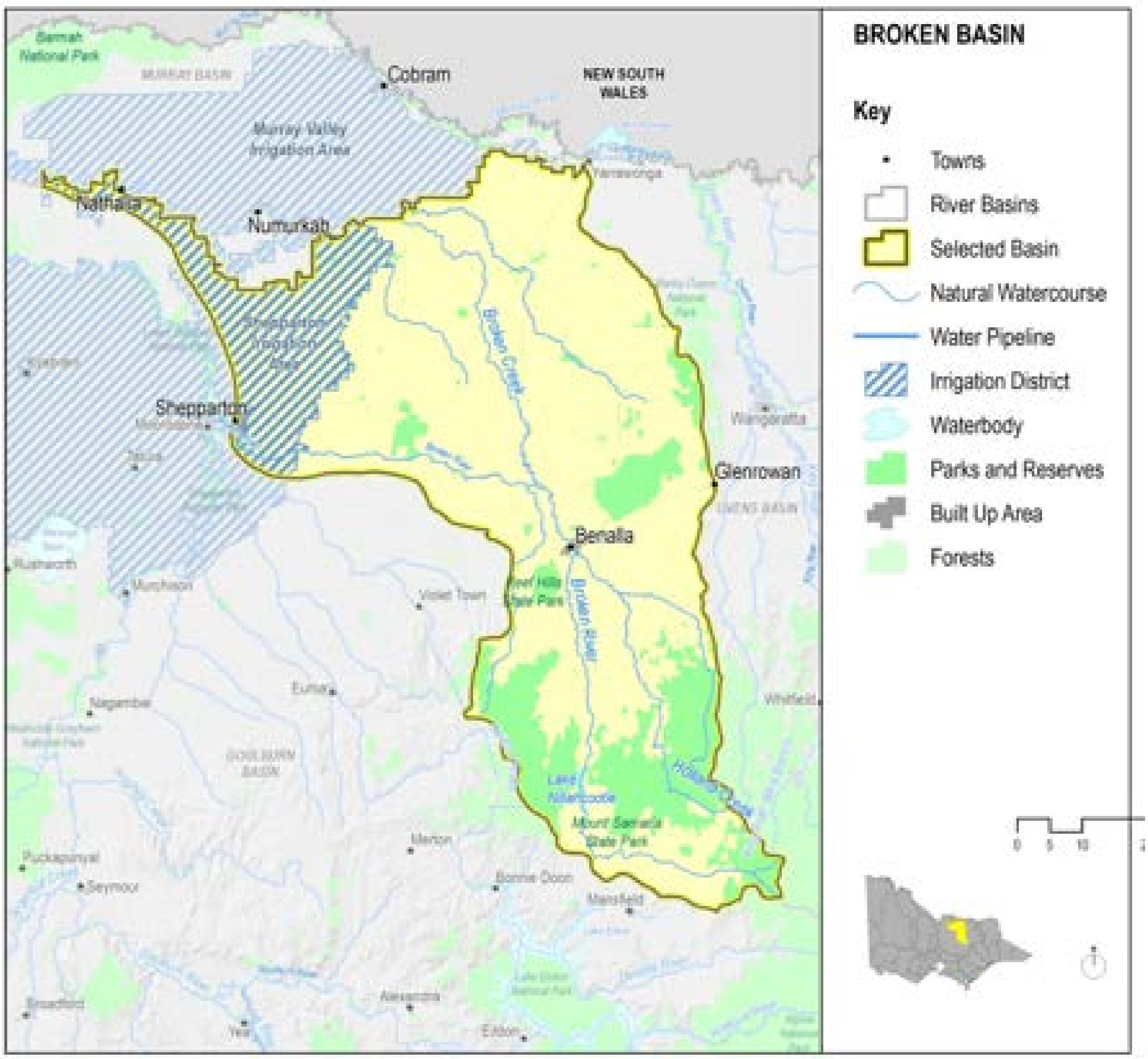
(4) Glenrowan receives urban supply from the Wangaratta system. North East Water diverted 8 ML under the Glenrowan bulk entitlement in 2020–21 to supply water to an irrigation customer via a supply by agreement.

(5) Net trade encompasses temporary and permanent trades in and out of the Ovens basin. The net value of 333 represents water traded out to Ovens basin licensed dams (44 ML) as well as in from groundwater take and use licences (377 ML). Groundwater and surface water are highly connected in the Upper Ovens WSPA, and trade is allowed between them.

6.5 Broken basin

The Broken basin (Figure 6-8) is in northern Victoria. It includes the Broken River, which flows into the Goulburn River at Shepparton, and Broken Creek, which flows into the Murray River at Barmah. For the purposes of these water accounts, the Broken basin excludes the Murray Valley Irrigation Area, which is included in the Murray basin.

Figure 6-8 Map of the Broken basin



6.5.1 Management arrangements

Management of water in the Broken basin is undertaken by various parties, as shown in Table 6-23.

Table 6-23 Water resource management responsibilities, Broken basin

Authority	Management responsibilities
Goulburn-Murray Water	Supplies primary entitlements for the Broken River and the Tungamah domestic and stock supply system Manages licensed diversions Provides bulk water supplies to Goulburn Valley Water and North East Water Operates Lake Nillahcootie and weirs on Broken River
North East Water	Supplies towns across most of the Broken basin including Benalla Operates the Loombah and McCall-Say reservoirs
Goulburn Valley Water	Supplies towns in the west of the basin including Shepparton, Nathalia and Dookie (sourced from Goulburn and Murray basins)
Goulburn Broken Catchment Management Authority	Responsible for waterway and catchment management in the region comprising the catchments of the Goulburn and Broken rivers and part of the Murray River valley

6.5.2 2020–21 water resources overview

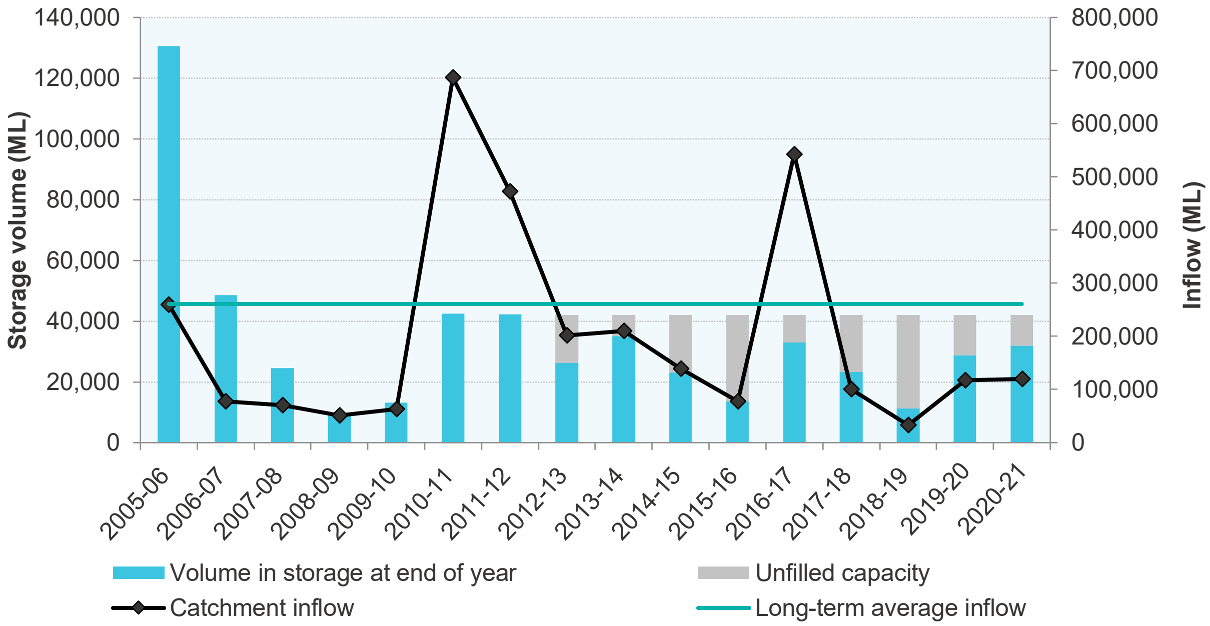
In 2020–21, rainfall was:

- average in the north of the basin
- below average in most of the middle and south of the basin, from Benalla to Mansfield
- average in the south-west of the basin, from Reed Hills State Park to Mount Samaria State Park.

Catchment inflows to the basin in 2020–21 were 46% of the long-term average annual volume of 260,800 ML, similar to 2019–20, when inflows were 45% of the long-term average.

Major storages in the basin were at 68% of capacity on 1 July 2020 and higher (at 76% of capacity) on 30 June 2021.

Figure 6-9 Storage volumes and catchment inflows, Broken basin



Note
Unfilled capacity is not shown on the graph before 2010–11: before then, Lake Mokoan was included as a storage in the Broken basin. Lake Mokoan was decommissioned in 2010, and water supply from this storage ceased, so it is no longer included in the total storage capacity for the Broken basin.

Seasonal determinations in the regulated Broken system were higher in 2020–21 than in the previous year. Seasonal determinations for high-reliability entitlement began the year with a 17% seasonal determination on 1 July 2020, increasing to a 92% seasonal determination by October 2020 and reaching a final seasonal determination of 100% on 15 October 2020 compared to a final 2% seasonal determination on 16 March 2020. Low-reliability water shares also received a seasonal determination of 100% on 15 October 2020.

Key aspects of restrictions on licensed diversions from unregulated streams in the Broken basin in 2020–21 were:

- a total ban on Boosey Creek for the whole of 2020–21
- total bans on Hollands, Ryans, Lima and Lima East creeks from January 2021 until the end of April 2021, when these bans were lifted.

There were no restrictions on urban water use in the Broken basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 11,535 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was more than the 8,863 ML diverted in the previous year.

6.5.2.1 Water for the environment

Environmental watering sites and environmental values in the Broken basin that depend on water for the environment include:

- Murray cod, trout cod and significant areas of intact riparian and floodplain vegetation
- Broken River, upper Broken Creek, lower Broken Creek and wetlands, which contain native fish habitat and a wetland of national significance.

Water from the Broken basin also flows into the Goulburn and Murray basins, helping to maintain internationally significant environmental assets in those basins.

In 2020–21, water for the environment in the Broken basin comprised:

- water set aside for the environment through the operation of passing flows conditions:
  - on consumptive bulk entitlements held by North East Water and Goulburn-Murray Water
  - on licensed diversions
- 624 ML of high-reliability water shares and 23 ML of low-reliability water shares held for the environment
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

A total of 1,235 ML of environmental water was delivered in the Broken basin in 2020–21. The volume is considered to be an off-stream diversion as it is typically lost via evaporation and seepage along upper Broken Creek, and so there is no way to effectively measure throughflow to lower Broken Creek.

6.5.3 Water balance

The total volumes of water available and supplied from water resources in the Broken basin in 2020–21 are shown in Table 6-24.

Table 6-24 Water balance, Broken basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	28,664	11,206
Volume in storage at the end of the year	1	31,855	28,664
Change in storage		**3,191**	**17,458**
Inflows			
Catchment inflow	2	119,914	117,935
Rainfall on major storages	1	3,956	2,518
Treated wastewater discharged back to river	3	0	0
Total inflows		**123,870**	**120,452**
Outflows			
Diversions			
Urban diversions		1,586	1,642
Licensed diversions from regulated streams		6,053	3,523
Licensed diversions from unregulated streams		527	645
Environmental water diversions		1,235	597
Small catchment dams	4	3,369	3,053
Total diversions		***12,770***	***9,460***
Losses			
Evaporation from major storages	1	4,705	3,135
Net evaporation from small catchment dams	4	2,487	2,219
In-stream infiltration to groundwater, flows to floodplain and evaporation		11,191	10,763
Total losses		***18,383***	***16,117***
Water passed at outlet of basin			
Broken River at Gowangardie to Goulburn basin		88,097	76,464
Boosey Creek at Tungamah to Murray basin		627	0
Broken Creek at Katamatite to Murray basin		802	953
Total water passed at outlet of basin		***89,526***	***77,417***
Total outflows		**120,679**	**102,994**

6.5.3.1 Notes to the water balance

1. Storage volumes

Major — greater than 1,000 ML — on-stream storages in the Broken basin are included in the water balance. Table 6-25 shows how storage volumes changed during the year.

Table 6-25 Storage volumes, Broken basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflows less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Lake Nillahcootie	40,400	26,917	3,669	3,921	3,728	30,393
Loombah McCall-Say	1,747	1,747	287	784	211	1,461
Total 2020–21	**42,147**	**28,664**	**3,956**	**4,705**	**3,940**	**31,855**
Total 2019–20	42,147	11,206	2,518	3,135	18,076	28,664

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, the known inflows and the net change in storage volume.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin.

Table 6-26 lists the wastewater treatment plants in the Broken basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

Table 6-26 Volume and use of recycled water, Broken basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to the sea / other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Benalla	C	467	467	100%	0	467	0	0	0	0
Tungamah	C	6	6	100%	0	6	0	0	0	0
Total 2020–21		**473**	**473**	**100%**	**0**	**473**	**0**	**0**	**0**	**0**
Total 2019–20		390	390	100%	0	390	0	0	0	0

4. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-27 provides information about small catchment dams in the basin.

Table 6-27 Estimated small catchment dam information, Broken basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	16,858	1,995	1,996	3,991
Registered/licensed commercial and irrigation	8,796	1,374	491	1,865
Total 2020–21	**25,654**	**3,369**	**2,487**	**5,856**
Total 2019–20	25,654	3,054	2,218	5,272

6.5.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Broken – Key compliance points

- ✓ **There was no net increase in the total entitlement volume from the previous year.**
- ✓ **The total volume diverted (10,775 ML) was within the volume available for the year (31,606 ML).**
- ✓ **No individual bulk entitlement holder took more than the annual volume made available to them.**
- ✓ **Individual bulk entitlement holders complied with all provisions in their entitlements apart from:**
  - ✗ under the Broken System – Goulburn-Murray Water bulk entitlement, losses for upper Broken Creek were 1,085 ML above the annual allowance of 1,850 ML under regulated conditions. Goulburn-Murray Water was working with DELWP and had identified actions aiming to rectify ongoing issues with the upper Broken Creek loss allowance; the accuracy of the offtake measurement was being improved.

Entitlements in the Broken basin provide the basis for how water is shared in the basin. Rights to water in the Broken basin are set out in Table 6-28.

Entitlements to water in the regulated part of the Broken basin provide for the right to carry over unused allocation to the next season. These entitlement holders can carry over unused water up to 50% of their entitlement volume.

Diversions under bulk entitlements in the Broken basin are assessed against the Murray–Darling Basin annual cap target for the Goulburn–Broken–Loddon valley. The Basin Plan introduced a new water accounting and compliance framework based on sustainable diversion limits that began on 1 July 2019. From 2012 to 2019, cap compliance was reported to the MDBA through annual *transition period water take reports*. Following the formal commencement of the sustainable diversion limit (SDL) accounting framework, compliance under the SDL limits is reported separately to water take reports. SDL compliance will be reported through the *sustainable diversion limits compliance report* for each water year.

Table 6-28 Entitlement volumes, Broken basin

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Broken System Goulburn-Murray Water) Conversion Order 2004 (1)		
High-reliability water shares	17,623	17,623
Low-reliability water shares	3,336	3,336
Bulk Entitlement (Broken System – Tungamah Devenish and St James – North East Water) Conversion Order 2004	135	135
Broken supplement to Lower Goulburn and Murray (2)	n/a	n/a
Loss provision	1,850	1,850
Subtotal: Bulk Entitlement (Broken System Goulburn-Murray Water) Conversion Order 2004	**22,944**	*22,944*
Bulk Entitlement (Loombah McCall-Say) Conversion Order 2001	2,324	2,324
Take and use licences – unregulated surface water (3)	1,395	1,397
Licensed small catchment dams – on-waterway	1,308	1,308
Licensed small catchment dams – off-waterway	7,489	7,489
Total	**35,460**	**35,462**

Notes

(1) Under this bulk entitlement, Goulburn-Murray Water operates Lake Nillahcootie to supply water share holders in the regulated part of the Broken system and to supply water to North East Water's bulk entitlement for Tungamah, Devenish and St James.
(2) Supplementary supply to the lower Goulburn and Murray systems is provided when low-reliability allocations have reached 100% and surplus water remains in the Broken system. A specified volume is not applicable.
(3) The volume of unregulated surface water entitlements includes licences for in-stream diversions. There are 2 ML of in-stream licence in the Broken basin.

Table 6-29 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

Table 6-29 Available water and take, Broken basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Broken System Goulburn-Murray Water					
Water shares (1)	1,840	19,097	(3,833)	17,103	4,354
Tungamah, Devenish and St James (2)	64	71	0	135	0
Broken supplement to Lower Goulburn and Murray	-	0	-	0	0
Loss allowance (3)	-	1,850	-	1,850	2,935
Diversion: Broken System Goulburn-Murray Water (4)				*19,088*	*7,289*
Loombah McCall-Say (Benalla)	-	2,324	0	2,324	1,586
Take and use licences – unregulated surface water	-	1,397	0	1,397	527
Licensed small catchment dams	-	8,796	0	8,796	1,374
Total 2020–21	**1,904**	**33,535**	**(3,833)**	**31,606**	**10,775**
Total 2019–20	3,156	14,912	510	18,577	7,594

Notes

(1) Water use reported includes 1,235 ML of environmental diversion.

(2) North East Water transferred its offtake for this bulk entitlement to upstream of Benalla Weir in October 2009, but it does not have the infrastructure in place to supply water under this entitlement. In 2020–21, Tungamah, Devenish and St James continued to be supplied with water via a pipeline from Yarrawonga in the Murray system.

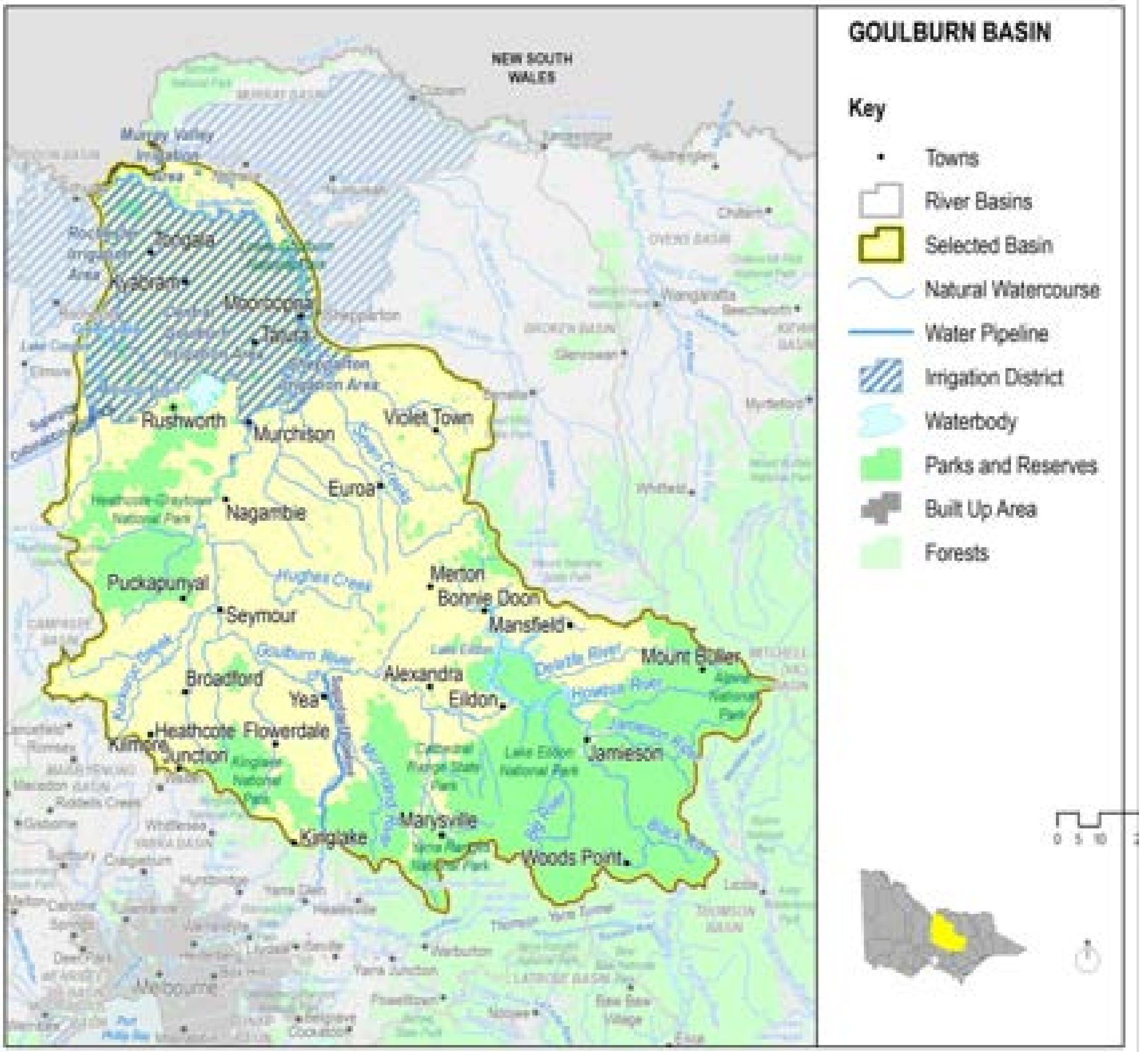
(3) Goulburn-Murray Water has an annual average loss allowance of 1,850 ML. In 2020–21, Goulburn-Murray Water reported that during regulated conditions, losses from Broken Creek were 1,085 ML over the loss allowance.

(4) The water use reported in this line item represents the bulk diversion during regulated conditions to supply primary entitlements under the Broken system source bulk entitlement. It includes environment deliveries in-stream (597 ML).

6.6 Goulburn basin

The Goulburn basin (Figure 6-10) is in northern Victoria. It extends from the Great Dividing Range near Woods Point in the south-east to the Murray River near Echuca in the north-west.

Figure 6-10 Map of the Goulburn basin



6.6.1 Management arrangements

Management of water in the Goulburn basin is undertaken by various parties, as shown in Table 6-30.

Table 6-30 Water resource management responsibilities, Goulburn basin

Authority	Management responsibilities
Goulburn-Murray Water	Supplies Central Goulburn Irrigation District, Rochester Irrigation Area and Shepparton Irrigation Area Manages surface water diversions Delivers bulk supplies to many of Goulburn Valley Water's towns and some of Coliban Water's towns Operates lakes Eildon and Nagambie and the Waranga basin
Goulburn Valley Water	Supplies towns in the Goulburn basin including Shepparton, Alexandra and Seymour
Coliban Water	Can supply towns in the Loddon and Campaspe basins from the Goulburn basin including Bendigo
Melbourne Water	Operates the Silver–Wallaby diversion system to Melbourne
GWMWater	Supplies Quambatook
Goulburn Broken Catchment Management Authority	Responsible for waterway and catchment management in the whole of the Goulburn basin

6.6.2 2020–21 water resources overview

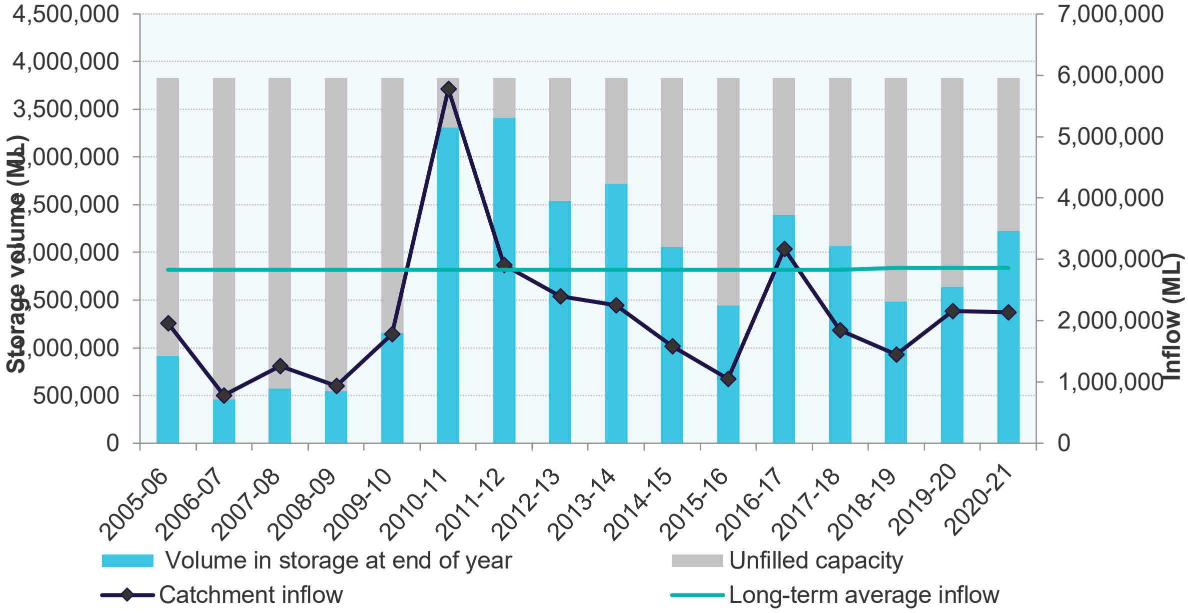
In 2020–21, rainfall was:

- average in most of the basin
- below average in the south-east of the basin, between Eildon and Mansfield
- above average in the far south-east of the basin, in an area near Woods Point
- below average near Murchison.

Catchment inflows to the basin in 2020–21 were 75% of the long-term average annual volume of 2,859,000 ML, the same as in the previous year.

Major storages in the basin were at 49% of capacity on 1 July 2020 and higher (at 58% of capacity) on 30 June 2021.

Figure 6-11 Storage volumes and catchment inflows, Goulburn basin



Allocations for 2020–21 in the Goulburn system were higher than in the previous year. The first seasonal determination for high-reliability water shares of 35% for the Goulburn basin was announced on 1 July 2020, increasing to 77% by October 2020 and reaching a final determination of 100% by November 2020 compared to a final determination of 80% in April 2019. There was no seasonal determination allocation for low-reliability water shares in 2020–21.

Key aspects of restrictions on licensed diversions from unregulated streams in the Goulburn basin in 2020–21 were:

- total bans on Sunday Creek from November 2020 to May 2021
- total bans on Faithfulls Creek and Sevens Creek from January to May 2021
- total bans on Delatite River and its tributaries in March 2021
- total bans on Hughes Creek from March to May 2021
- total bans reached a peak of five in March, less than the eight in January 2020
- all bans were lifted by June, and there were no restrictions on 16 streams during 2020–21.

There were no restrictions on urban water use in the Goulburn basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 765,792 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 811,831 ML diverted in the previous year.

6.6.2.1 Water for the environment

Environmental watering sites and environmental values in the Goulburn basin that depend on water for the environment include:

- wetlands of national significance, significant areas of intact riparian and floodplains vegetation and endangered flora and fauna species including trout cod and Murray cod

- the lower Goulburn River floodplain (downstream of Goulburn Weir), which is listed as a wetland of national significance and is a native fish habitat and floodplain national park
- Reedy Swamp, a regionally significant wetland that is part of the Lower Goulburn National Park and which contains drought refuge and significant habitat for colonial nesting birds.

Water from the Goulburn basin also flows into the Murray, Campaspe and Loddon basins, helping to maintain internationally significant environmental assets (such as Gunbower Forest and the Hattah Lakes in the Murray basin).

In 2020–21, water sourced from the Goulburn basin for the environment comprised:

- the *Environmental Entitlement (Goulburn System – Living Murray) 2007*, comprising 39,625 ML of high-reliability and 156,980 ML of low-reliability entitlements held by the VEWH
- the *Goulburn River Environmental Entitlement 2010*, comprising 26,555 ML of high-reliability and 5,792 ML of low-reliability entitlements held by the VEWH
- the *Environmental Entitlement (Goulburn System – NVIRP Stage 1) 2012*, comprising 1,682 ML held by the VEWH, which is mitigation water allocated for the purposes of watering specific environmental sites that have been identified through the Goulburn-Murray Water Connections Project environmental approvals processes.
- the *Bulk Entitlement (Goulburn System – Snowy Environment Reserve) Order 2004*, comprising 30,252 ML of high-reliability and 8,156 ML of low-reliability entitlements
- up to 7,490 ML of water each year, as part of the *Bulk Entitlement (Loddon River – Environmental Water Reserve) Order 2005*
- 332,437 ML of high-reliability water shares and 60,319 ML of low-reliability water shares held for the environment
- water set aside for the environment through the operation of passing flow conditions:
  - on consumptive bulk entitlements (regulated and unregulated systems) held by Goulburn Valley Water and Goulburn-Murray Water
  - on licensed diversions
- the *Silver and Wallaby Creeks Environmental Entitlement 2006*, which provides passing flow rules on Silver and Wallaby creeks
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

A total of 270,016 ML of environmental water was sourced from the Goulburn basin in 2020–21. 10,635 ML of this was diverted off-stream, and the remaining 259,381 ML was delivered in-stream in the Goulburn River.

6.6.3 Water balance

The total volumes of water available and supplied from water resources in the Goulburn basin in 2020–21 are shown in Table 6-31.

Table 6-31 Water balance, Goulburn basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	1,641,535	1,285,943
Volume in storage at the end of the year	1	1,964,215	1,641,535
Change in storage		**322,680**	**355,592**
Inflows			
Catchment inflow	2	2,134,641	2,155,436
Rainfall on major storages	1	81,514	68,735
Inflow from Broken River at Gowangardie		88,097	76,464
Inflow from Loddon via the Loddon supplement		0	0
Return flow from irrigation		0	0
Transfer from Campaspe via Waranga Western Channel		0	0
Treated wastewater discharged back to river	3	2,047	1,199
Total inflows		**2,306,298**	**2,301,835**
Outflows			
Diversions			
Urban diversions		26,200	27,291
Irrigation district diversions		697,092	749,379
Licensed diversions from regulated streams		17,599	13,187
Licensed diversions from unregulated streams		5,302	5,376

Transfer from Silver and Wallaby creeks to Yarra basin		2,604	808
Transfers to Melbourne via North–South pipeline	4	12	11
Environmental water diversions	5	10,635	9,048
Small catchment dams	6	16,983	15,779
Total diversions		***776,427***	***820,879***
Losses			
Evaporation from major storages	1	88,671	71,511
Net evaporation from small catchment dams	6	10,150	8,562
In-stream infiltration to groundwater, flows to floodplain and evaporation		109,589	86,240
Total losses		***208,410***	***166,313***
Water passed at outlet of basin			
Goulburn River to Campaspe River via Waranga Western Channel		205	3,487
Goulburn River outflow to Murray River		945,902	906,684
Goulburn River outflow to Murray River via Broken Creek		52,675	48,881
Total water passed at outlet of basin		**998,782**	***959,052***
Total outflows		**1,983,618**	**1,946,243**

6.6.3.1 Notes to the water balance

1. Storage volumes

Major — greater than 1,000 ML — on-stream storages in the Goulburn basin are included in the water balance. Table 6-32 shows how storage volumes changed during the year. Volumes in off-stream storages are presented for additional information about the resource condition. Rainfall and evaporation have not been estimated for Greens Lake.

Table 6-32 Storage volumes, Goulburn basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflows less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Goulburn Weir	25,500	20,457	4,807	10,721	7,328	21,871
Lake Eildon	3,334,158	1,619,953	76,458	77,751	322,046	1,940,707
Sunday Creek Reservoir	1,650	1,125	249	199	462	1,638
Subtotal	**3,361,308**	**1,641,535**	**81,514**	**88,671**	**329,836**	**1,964,215**
Off-stream storages						
Greens Lake	32,500	10,536	n/a	n/a	(4,019)	6,517
Waranga Basin	432,360	370,329	22,119	55,717	(82,921)	253,810
Subtotal	**464,860**	**380,865**	**22,119**	**55,717**	**(86,940)**	**260,327**
Total 2020–21	**3,826,168**	**2,022,401**	**103,633**	**144,388**	**242,896**	**2,224,542**
Total 2019–20	3,826,168	1,485,977	93,291	126,442	569,574	2,022,401

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, the known inflows and the net change in storage volume.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-33 lists the wastewater treatment plants in the Goulburn basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

In addition to the recycled water reported below, 123 ML was returned from the Mount Buller Resort to Black Dog Creek and other waterways during the water year.

Table 6-33 Volume and use of recycled water, Goulburn basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Alexandra	B	212	197	93%	182	15	0	0	15	0
Avenel	C	28	28	100%	0	28	0	0	0	0
Bonnie Doon	C	32	32	100%	0	32	0	0	0	0
Broadford	C	311	109	35%	0	109	0	0	202	0
Eildon	B	148	107	72%	107	0	0	0	41	0
Euroa	C	121	121	100%	60	61	0	0	0	0
Girgarre (1)	C	0	0	0%	0	0	0	0	0	0
Kilmore	C	608	405	67%	109	296	0	0	203	0
Kyabram / Merrigum	C	400	400	100%	0	400	0	0	0	0
Mansfield	C	318	201	63%	63	138	0	0	117	0
Marysville	C	146	146	100%	33	113	0	0	0	0
Mooroopna	C	1,075	1,075	100%	0	1,075	0	0	0	0
Murchison (1)	C	0	0	0%	0	0	0	0	0	0
Nagambie	C	150	150	100%	0	150	0	0	0	0
Seymour	C	534	325	61%	71	254	0	0	209	0
Shepparton	C	3,084	2,102	68%	0	2,102	0	0	982	0
Stanhope / Rushworth	C	63	63	100%	0	63	0	0	0	0
Tatura	C	908	908	100%	0	908	0	0	0	0
Tongala	C	303	176	58%	0	176	0	0	127	0
Upper Delatite	C	43	43	100%	0	43	0	0	0	0
Violet Town	C	1	1	100%	0	1	0	0	0	0
Yea	C	119	91	76%	43	48	0	0	28	0
Total 2020–21		**8,604**	**6,680**	**78%**	**668**	**6,012**	**0**	**0**	**1,924**	**0**
Total 2019–20		8,025	6,981	87%	657	6,324	0	0	1,044	0

Note
(1) Wastewater treatment plants at Girgarre and Murchison were operational but did not produce any recycled water output this year.

4. Transfers to Melbourne via North–South pipeline

12 ML of usage was recorded against Yarra Valley Water's Goulburn system bulk entitlement. This water was used to maintain the operational capacity of the North–South Pipeline and keep the pipeline charged for firefighting purposes.

5. Environmental water diversions

Water sourced from the Goulburn basin under the Loddon River Environmental Reserve bulk entitlement is included as an environmental diversion from the Goulburn basin (7,638 ML).

6. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-34 provides information about small catchment dams in the basin.

Table 6-34 Estimated small catchment dam information, Goulburn basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	51,221	11,017	8,548	19,565
Registered/licensed commercial and irrigation	22,621	5,966	1,602	7,568
Total 2020–21	**73,842**	**16,983**	**10,150**	**27,133**
Total 2019–20	73,842	15,780	8,561	24,341

6.6.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Goulburn – Key compliance points

✓ **There was no net increase in the total entitlement volume from the previous year:**

- 1,111 ML of high-reliability and 533 ML of low-reliability Goulburn water shares were issued for the conversion of equivalent-volume high- and low-reliability Goulburn supply by agreements; the total change in water share volume was also affected by the cancellation of 52 ML of high-reliability water share. These changes were associated with the Mitiamo Pipeline Project and the establishment of the Mitiamo Waterworks District.

✓ **The total volume diverted (1,017,148 ML) was within the volume available for the year (1,792,497 ML).**

✓ **No individual bulk entitlement holder took more than the annual volume made available to them.**

✓ **Individual bulk entitlement holders complied with all provisions in their entitlements apart from:**

✗ no approved metering plan had been implemented for the *Bulk Entitlement (Quambatook – Grampians Wimmera Mallee Water) Order 2006*.

Entitlements in the Goulburn basin provide the basis for how water is shared in the basin. Rights to water in the Goulburn basin are set out in Table 6-35.

Melbourne Water holds a bulk entitlement to divert surface water from Silver and Wallaby creeks. This entitlement is one of four that contribute to the Greater Yarra system – Thomson River Pool, which primarily supplies Melbourne and supports regional urban water corporations Barwon Water, Western Water, South Gippsland Water and Westernport Water (Table 6-104 and Table 6-105).

Entitlements (except some waterworks districts entitlements) to water in the regulated system of the Goulburn basin provide for the right to carry over unused allocation to the next season. In the Goulburn basin, holders of these entitlements can carry over unused water up to 100% of their entitlement volume. Water held above entitlement volume is subject to a risk of spill. There were no spill events in 2020–21 affecting customers' spillable water accounts.

The VEWH holds *Bulk Entitlement (Goulburn System – Snowy Environmental Reserve) Order 2004* in trust for the Snowy River. Allocation to the entitlement is traded from the VEWH's account to the Snowy Scheme so it can be subsequently released from the Snowy Scheme to support the health of the Snowy and Murray rivers. Table 4-5 has information about this entitlement.

Diversions under bulk entitlements are assessed against the Murray–Darling Basin annual cap target for the Goulburn–Broken–Loddon valley. Since 2012, cap compliance has been reported to the MDBA through the *transition period water take report*. Before this, details of this assessment were published annually in the MDBA's water audit monitoring report.

Table 6-35 Entitlement volumes, Goulburn basin

Water entitlement – Goulburn	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Eildon – Goulburn Weir) Conversion Order 1995 (1)		
High-reliability water shares	1,084,915	1,083,856
Low-reliability water shares	469,630	469,097
High-reliability supply by agreements	3,310	4,421
Low-reliability supply by agreements	1,292	1,825
Waterworks districts (2)	2,291	2,289
Bulk Entitlement (Quambatook – Grampians Wimmera Mallee Water) Order 2006	100	100
BE (Goulburn Channel System – CW) Order 2012	2,420	2,420
BE (Goulburn River – GVW) Order 2012	26,299	26,299
BE (Goulburn Channel System – GVW) Order 2012	7,191	7,191
Goulburn system – Melbourne metropolitan retailers		
Bulk Entitlement (Goulburn System – City West Water) Order 2012 (3)	n/a	n/a

Bulk Entitlement (Goulburn System – South East Water) Order 2012 (3)	n/a	n/a
Bulk Entitlement (Goulburn System – Yarra Valley Water) Order 2012 (3)	n/a	n/a
Subtotal: Goulburn system – Melbourne metropolitan retailers	n/a	*n/a*
Environmental Entitlement (Goulburn System – Living Murray) 2007		
Living Murray – high-reliability entitlement	39,625	39,625
Living Murray – low-reliability entitlement	156,980	156,980
Subtotal: Environmental Entitlement (Goulburn System – Living Murray) 2007	**196,605**	*196,605*
Environmental Entitlement (Goulburn System – NVIRP Stage 1) 2012 (4)	n/a	n/a
Bulk Entitlement (Goulburn System – Snowy Environmental Reserve) Order 2004		
Snowy high-reliability entitlement	30,252	30,252
Snowy low-reliability entitlement	8,156	8,156
Subtotal: Bulk Entitlement (Goulburn System – Snowy Environmental Reserve) Order 2004	**38,408**	*38,408*
Goulburn River Environmental Entitlement 2010		
Goulburn River Environmental Entitlement – high-reliability	26,555	26,555
Goulburn River Environmental Entitlement – low-reliability	5,792	5,792
Subtotal: Goulburn River Environmental Entitlement 2010	**32,347**	*32,347*
Goulburn supplement to Broken Creek (5)	40,000	40,000
Goulburn supplement to Little Lake Boort (5)	300	300
Goulburn supplement for Loddon environmental (5)	7,490	7,490
Goulburn water quality reserve (5)	30,000	30,000
Goulburn exchange rate trade commitment	99,649	99,649
Loss provision – irrigation district (6)	239,208	239,208
Subtotal: Bulk Entitlement (Eildon – Goulburn Weir) Conversion Order 1995	**2,281,454**	*2,281,504*
Bulk Entitlement (Broadford, Kilmore and Wallan) Conversion and Augmentation Order 2003 (7)	2,875	2,875
Bulk Entitlement (Buxton) Conversion Order 1995	110	110
Bulk Entitlement (Euroa System) Conversion Order 2001	1,990	1,990
Bulk Entitlement (Longwood) Conversion Order 1995	120	120
Bulk Entitlement (Mansfield) Conversion Order 1995	1,300	1,300
Bulk Entitlement (Marysville) Conversion Order 1995	462	462
Bulk Entitlement (Pyalong) Conversion Order 1997	75	75
Bulk Entitlement (Strathbogie) Conversion Order 2012	23	23
Bulk Entitlement (Thornton) Conversion Order 1995	120	120
Bulk Entitlement (Upper Delatite) Conversion Order 1995	235	235
Bulk Entitlement (Violet Town) Conversion Order 1997	20	20
Bulk Entitlement (Woods Point) Conversion Order 1995	30	30
Bulk Entitlement (Yea) Conversion Order 1997	438	438
Bulk Entitlement (Rubicon – Southern Hydro Ltd) Conversion Order 1997 (8)	n/a	n/a
Bulk Entitlement (Silver and Wallaby Creeks – Melbourne Water) Order 2014 (9)	22,000	22,000
Silver and Wallaby Creeks Environmental Entitlement 2006 (10)	n/a	n/a
Take and use licences – unregulated surface water	15,767	15,772
Licensed small catchment dams – on-waterway	8,406	8,408
Licensed small catchment dams – off-waterway	14,215	14,224
Total	**2,349,641**	**2,349,707**

Notes

(1) Under Goulburn-Murray Water's Eildon – Goulburn Weir bulk entitlement, the water corporation operates the Goulburn system to supply Goulburn system water share holders; bulk entitlements held by Coliban Water, Goulburn Valley Water and GWMWater for towns supplied from irrigation districts; and entitlements held by the Melbourne metropolitan retail water corporations and the VEWH.

(2) This includes the volume of water to supply water allowance holders in the Normanville, Tungamah, East Loddon (South), East Loddon (North) and West Loddon waterworks districts. It excludes the specified volume of loss allowance in these districts as well as the volume of water required to supply GWMWater's and Coliban Water's bulk entitlements via these districts.

(3) Together, these entitlements provide City West Water, South East Water and Yarra Valley Water with a total annual allocation of water equal to one-third of the phase 3 Goulburn water savings achieved in the previous year under the Goulburn-Murray Water Connections Project stage 1; a specified volume has not been included.

(4) This entitlement is held by the VEWH for audited mitigation water from the Goulburn-Murray Water Connections Project. This entitlement receives a volume of mitigation water allocation from the previous year as specified in the latest annual audit of the Connections Project's water recovery. Historically, this entitlement also provided the VEWH with a total annual allocation of water equal to one-third of the phase 3 Goulburn water recovery achieved in the previous year under the Connections Project stage 1.

(5) These are additional supplies (or supplements) the Goulburn system is required to provide to the Broken Creek and Loddon systems and for water quality in the Goulburn system. Schedule 3 of Goulburn-Murray Water's Eildon – Goulburn Weir bulk entitlement sets out the conditions for these supplies to be provided. The Goulburn supplement for Loddon environmental is supplied to the VEWH under VEWH's *Bulk Entitlement (Loddon River – Environmental Reserve) Order 2005,* where it is labelled the 'Wimmera Mallee Pipeline savings entitlement'.

(6) This represents the maximum loss allowance for irrigation districts (Central Goulburn, Rochester, Loddon Valley and Shepparton) as outlined in the bulk entitlement including loss allowances in waterworks districts (Normanville, East Loddon (South), East Loddon (North) and

Tungamah). Note that this is the volume that applied to the majority of the water year rather than on 30 June of each year. The actual loss allowed will vary year to year, based on the rules in the bulk entitlement, actual delivery volumes, carryover or headroom allowance.
(7) This entitlement specifies that up to 2,875 ML can be diverted in any one year. The maximum volume that can be taken over any 10-year period is 22,380 ML (2,238 ML annual average).
(8) The Rubicon–Hydro bulk entitlement held by AGL Hydro Ltd is for non-consumptive purposes, and therefore a specified volume has not been included. Water diverted under this entitlement is returned to the watercourse.
(9) Melbourne Water holds a 22,000 ML bulk entitlement on Silver and Wallaby creeks. Compliance with a three-year diversion limit of 66,000 ML is assessed using a three-year rolling total diversion. This water is used to supply primary entitlement holders (City West Water, South East Water, Yarra Valley Water, Barwon Water, Western Water, South Gippsland Water and Westernport Water) with entitlement to the Greater Yarra system – Thomson River Pool, which sources water from the Yarra River, Thomson River, Tarago River, Silver Creek and Wallaby Creek.
(10) The *Silver and Wallaby Creeks Environmental Entitlement 2006* specifies the volume of environmental (passing) flows required to be released for Silver Creek and Wallaby Creek, so a specified volume has not been included.

Table 6-36 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

Table 6-36 Available water and take, Goulburn basin

Water entitlement	Available water (ML)					Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Spillable write-off	Total available water	
Eildon – Goulburn Weir						
Water shares	387,715	1,083,856	(128,102)	0	1,343,469	596,540
Supply by agreements	2,197	4,421	(1,539)	0	5,079	2,842
Waterworks districts (1)	-	2,320	0	-	2,320	1,301
Quambatook – GWMWater	90	100	(15)	0	175	86
Goulburn channel system – CW	259	2,420	0	0	2,679	989
Goulburn River and Eildon – GVW (2)	1,873	26,587	(3,602)	0	24,858	16,261
Goulburn channel system – GVW	2,415	7,191	(3,100)	0	6,506	4,802
Goulburn system – Melbourne retailers	19,822	12,861	(10,535)	0	22,147	12
Environmental Entitlement Goulburn system – Living Murray (3)	32,251	39,625	10,080	0	81,956	47,954
Goulburn System – NVIRP Stage 1 (3)	1,328	426	1,414	0	3,168	1,486
Goulburn system – Snowy Environmental Reserve	3,630	30,252	(33,882)	0	()	0
Goulburn River environmental entitlement (3)	24,270	40,192	168,105	0	232,567	212,938
Loss allowance – irrigation district (4)	-	-	-	-	-	101,841
Downstream commitments and waterway losses (5)	-	-	-	-	-	12,211
Diversion: Eildon – Goulburn Weir (6)						*999,264*
Broadford, Kilmore and Wallan	-	2,238	0	-	2,238	1,870
Buxton	-	110	0	-	110	0
Euroa system	-	1,990	0	-	1,990	749
Longwood	-	120	0	-	120	57
Mansfield	-	1,300	0	-	1,300	805
Marysville	-	462	0	-	462	166
Pyalong	-	75	0	-	75	22
Strathbogie	-	23	0	-	23	7
Thornton	-	120	0	-	120	0
Upper Delatite	-	235	0	-	235	99
Violet Town	-	20	0	-	20	0
Woods Point	-	30	0	-	30	6
Yea	-	438	0	-	438	233
Rubicon – Hydro Ltd	-	-	-	-	-	-
Silver and Wallaby creeks – Melbourne Water	-	22,000	0	-	22,000	2,604
Silver and Wallaby Creeks Environmental Entitlement	-	-	-	-	-	-
Take and use licences – unregulated surface water	-	15,788	0	-	15,788	5,302
Licensed small catchment dams	-	22,623	0	-	22,623	5,965
Total 2020–21	**475,849**	**1,317,823**	**(1,176)**	**0**	**1,792,497**	**1,017,148**
Total 2019–20	416,201	1,117,366	(156,202)	0	1,377,365	1,226,518

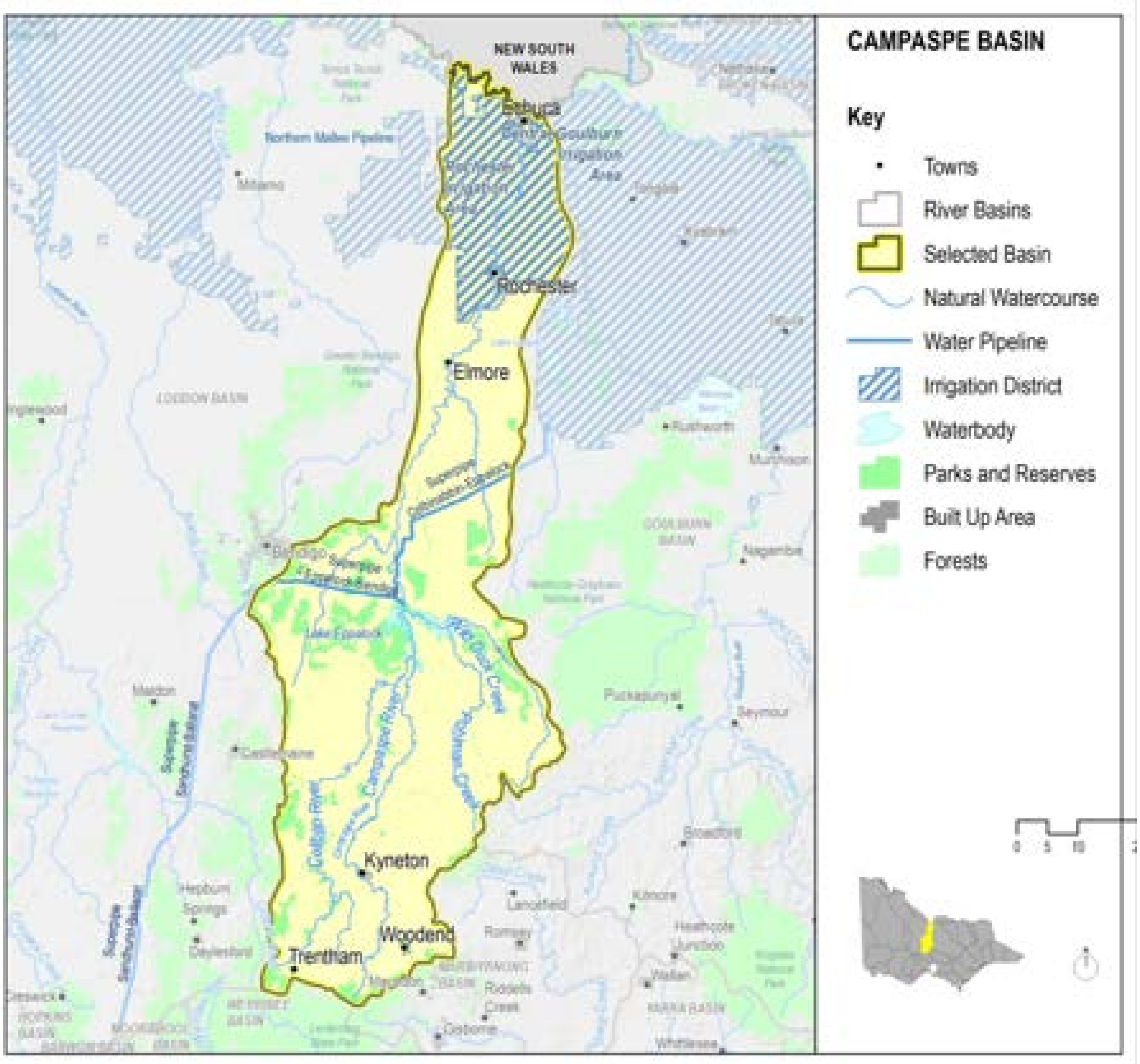
Notes

(1) Reported volumes relate to water allowance holders. Water available under Coliban Water's and GWMWater's bulk entitlements in the waterworks districts are excluded from this line item (and reported against those bulk entitlements).
(2) The volume of allocation issued includes return flows of 288 ML, credited to Goulburn Valley Water for return flows from Goulburn-Murray Water customers.
(3) Water use reported under these entitlements represents both in-stream use and actual diversions from the waterway. Of the 262,378 ML reported, 2,997 ML represents diversions from the waterway.
(4) This represents the actual losses incurred in 2020–21 in the Central Goulburn, Rochester, Loddon Valley and Shepparton irrigation areas and the Normanville, East Loddon (South), East Loddon (North) and Tungamah waterworks districts.
(5) This reflects the use of water to manage the system including the net transfer of water to off-stream storages — Waranga Basin and Greens Lake — as well as water supplied to the Campaspe, Loddon and Murray rivers during the water year.
(6) The water use reported in this line item represents the bulk diversion to supply primary entitlements and fulfil other operating requirements under the Goulburn system source bulk entitlement. It includes environmental deliveries in-stream (259,381 ML) as well as environmental diversions off-stream (2,997 ML).

6.7 Campaspe basin

The Campaspe basin (Figure 6-12) is in north-central Victoria. It extends 150 km south from the Murray River to the Great Dividing Range and is 45 km across at its widest point.

Figure 6-12 Map of the Campaspe basin



6.7.1 Management arrangements

Management of water in the Campaspe basin is undertaken by various parties, as shown in Table 6-37.

Table 6-37 Water resource management responsibilities, Campaspe basin

Authority	Management responsibilities
Goulburn-Murray Water	Supplies Rochester Irrigation District and Campaspe area Manages licensed diversions Provides bulk water supply to Coliban Water Operates Lake Eppalock
Coliban Water	Provides irrigation and domestic and stock supplies off the Coliban Main Channel Supplies urban water for most of the Campaspe basin including Echuca, Rochester and Kyneton Operates Upper Coliban, Lauriston and Malmsbury reservoirs
Western Water	Supplies urban water for Woodend at the southern end of the basin
North Central Catchment Management Authority	Responsible for waterway and catchment management in the whole of the Campaspe basin

6.7.2 2020–21 water resources overview

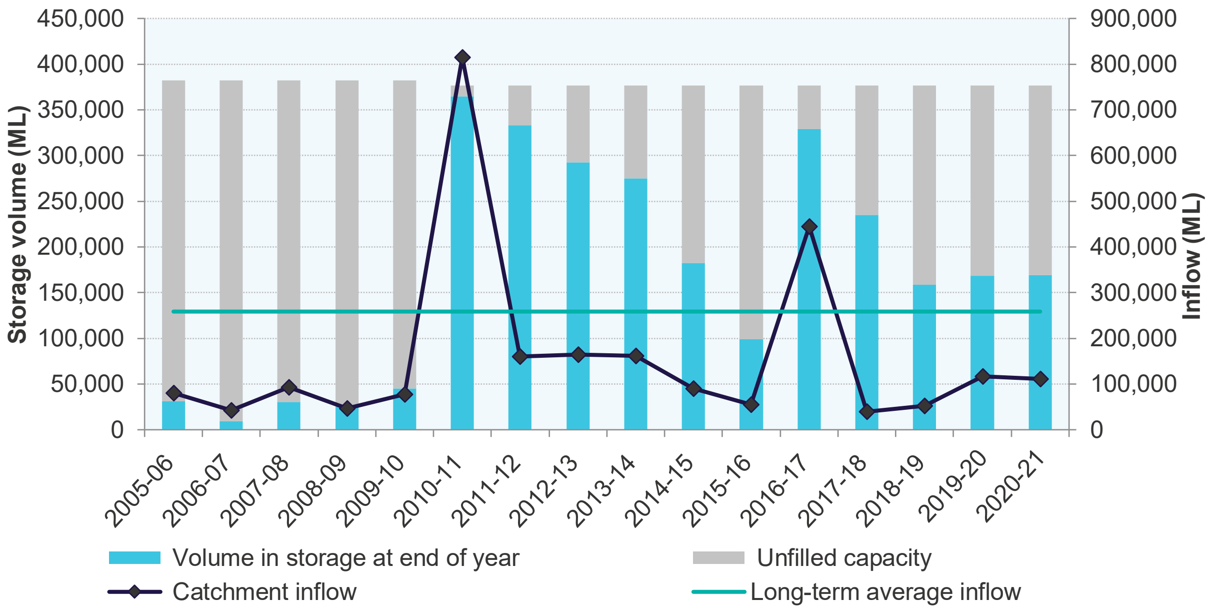
In 2020–21, rainfall was:

- average in most of the basin
- above average in a small area south of the basin near Trentham and Woodend.

Catchment inflows to the basin in 2020–21 were 43% of the long-term average of 258,600 ML, slightly less than in 2019–20, when inflows were 45% of the long-term average.

Major storages in the basin were at 45% of capacity on 1 July 2020 and were at the same level (at 45% of capacity) on 30 June 2021.

Figure 6-13 Storage volumes and catchment inflows, Campaspe basin



Seasonal determinations were higher in 2020–21 than in the previous year in the Campaspe system. The first seasonal determination for high-reliability water shares was announced on 1 July 2020 at 31%, then rose to 68% on 2 September and reached a final allocation of 100% on 15 October 2021. There was no seasonal determination for low-reliability water shares in 2020–21. Coliban Water opened the water season with a 100% allocation for its rural customers.

Key aspects of restrictions on licensed diversions from unregulated streams in the Campaspe basin in 2020–21 were:

- total bans in place for Cornella Creek and Wanalta Creek for the whole year; diversions from Stony Creek were banned for ten months, with unrestricted diversions in September and October 2020
- total bans in place for another seven streams from November, reaching a peak of 17 streams by January 2021
- most bans were lifted by June or July 2021
- there were no restrictions in place for Coliban River, Meadow Valley Creek, Mia Mia Creek and Native Gully Creek for the entirety of 2020–21.

There were no restrictions on urban water use in the Campaspe basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 39,398 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 39,890 ML diverted in the previous year.

6.7.2.1 Water for the environment

Environmental watering sites and environmental values in the Campaspe basin that depend on water for the environment include endangered flora and fauna species including Murray cod and painted snipe, and communities of threatened riparian vegetation.

Water from the Campaspe basin also feeds into the Murray basin, helping to maintain internationally significant environmental assets (such as Gunbower Forest and Kerang Wetlands) in that basin.

In 2020–21, water for the environment in the Campaspe basin comprised:

- the *Campaspe River Environmental Entitlement 2013,* comprising 20,652 ML of high-reliability and 2,966 ML of low-reliability entitlements held by the VEWH

- the *Environmental Entitlement (Campaspe River – Living Murray Initiative) 2007*, comprising 126 ML of high-reliability and 5,048 ML of low-reliability entitlements held by the VEWH
- 6,594 ML of high-reliability water shares and 395 ML of low-reliability water shares held for the environment
- water set aside for the environment through the operation of passing flow conditions:
  - on consumptive bulk entitlements held by Coliban Water, Western Water and Goulburn-Murray Water
  - on licensed diversions
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

In 2020–21, a total of 25,090 ML of environmental water was delivered in-stream in the Campaspe basin.

6.7.3 Water balance

The total volumes of water available and supplied from water resources in the Campaspe basin in 2020–21 are shown in Table 6-38.

Table 6-38 Water balance, Campaspe basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	168,366	158,491
Volume in storage at the end of the year	1	168,862	168,366
Change in storage		**496**	**9,875**
Inflows			
Catchment inflow	2	111,328	117,033
Rainfall on major storages	1	13,233	11,230
Transfer from Waranga Western Channel to Lake Eppalock		0	0
Transfer to Campaspe basin from Waranga Western Channel		149	3,487
Treated wastewater discharged back to river	3	610	756
Total inflows		**125,319**	**132,506**
Outflows			
Diversions			
Urban diversions		17,869	17,675
Diversion for Coliban Water rural entitlements		5,624	9,332
Licensed diversions from regulated streams		7,104	4,028
Licensed diversions from unregulated streams		404	508
Small catchment dams	4	8,397	8,094
Transfer from Campaspe basin to Western Waranga Channel		0	0
Transfer from Campaspe basin to White Swan Reservoir		0	253
Total diversions		**39,398**	***39,890***
Losses			
Evaporation from major storages	1	24,992	22,723
Net evaporation from small catchment dams	4	4,793	5,172
In-stream infiltration to groundwater, flows to floodplain and evaporation		4,816	6,843
Total losses		***34,600***	***34,738***
Water passed at outlet of basin			
Campaspe River outflows to Murray River	5	50,825	48,003
Total water passed at outlet of basin		***50,825***	***48,003***
Total outflows		**124,823**	**122,631**

6.7.3.1 *Notes to the water balance*

1. Storage volumes

Major — greater than 1,000 ML — on-stream storages in the Campaspe basin are included in the water balance. Table 6-39 shows how storage volumes changed during the year. Rainfall and evaporation estimates cannot be made for Campaspe Weir.

Table 6-39 Storage volumes, Campaspe basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflows less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Campaspe Weir	2,624	2,700	n/a	n/a	0	2,700
Lake Eppalock	304,651	115,198	7,993	17,934	4,154	109,411
Lauriston Reservoir	19,790	16,480	1,351	1,835	2,224	18,220
Malmsbury Reservoir	12,034	2,364	1,090	1,627	1,325	3,152
Upper Coliban Reservoir	37,770	31,624	2,799	3,596	4,552	35,379
Total 2020–21	**376,869**	**168,366**	**13,233**	**24,992**	**12,255**	**168,862**
Total 2019–20	376,869	158,491	11,230	22,723	21,367	168,366

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, the known inflows and the net change in storage volume.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-40 lists the wastewater treatment plants in the Campaspe basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

Table 6-40 Volume and use of recycled water, Campaspe basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to the sea / other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Axedale	B	19	19	100%	19	0	0	0	0	0
Echuca [(1)]	B	1,158	1,158	100%	0	1,158	0	0	0	0
Elmore [(2)]	C	0	0	0%	0	0	0	0	0	0
Heathcote	C	98	98	100%	98	0	0	0	0	0
Kyneton	B, C	812	440	54%	72	367	0	1	372	0
Lockington [(2)]	C	0	0	0%	0	0	0	0	0	0
Woodend	C	329	91	28%	27	64	0	0	238	0
Total 2020–21		**2,416**	**1,806**	**75%**	**216**	**1,589**	**0**	**1**	**610**	**0**
Total 2019–20		2,218	1,458	66%	366	1,092	0	0	756	4

Notes

(1) Water produced from the Echuca and Rochester treatment plants is stored in the same storage lagoon. The re-use volumes for both treatment plants are accounted for under Echuca.

(2) The Elmore and Lockington treatment plants produce Class C recycled water, which is used for onsite irrigation as required. Recycled water produced from these plants was not used during 2020–21.

4. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-41 provides information about small catchment dams in the basin.

Table 6-41 Estimated small catchment dam information, Campaspe basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	29,753	6,669	4,393	11,062
Registered/licensed commercial and irrigation	6,485	1,728	400	2,127
Total 2020–21	**36,237**	**8,397**	**4,793**	**13,189**
Total 2019–20	36,237	8,093	5,172	13,265

5. Campaspe River outflows to Murray River

This volume is the gauged flow from the Campaspe River to the Murray River, measured at Rochester downstream of Waranga Western Channel.

6.7.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Campaspe – Key compliance points
✓ **There was no net increase in the total entitlement volume from the previous year.**
✓ **The total volume diverted (57,758 ML) was within the volume available for the year (110,624 ML).**
✓ **No individual bulk entitlement holder took more than the annual volume made available to them.**
✓ **Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlements in the Campaspe basin provide the basis for how water is shared in the basin. Rights to water in the Campaspe basin are set out in Table 6-42.

Entitlements to water in regulated systems in the Campaspe basin provide for the right to carry over unused allocation to the next season. In the Campaspe basin, these entitlement holders can carry over unused water up to 100% of their entitlement volume; any unused water above this amount is written off as an end-of-season forfeiture. Water held above entitlement volume is also subject to a risk of spill.

Diversions under these bulk entitlements are assessed against the Murray–Darling Basin cap target for the Campaspe valley. Since 2012, cap compliance has been reported to the MDBA through the *transition period water take report*. Before this, details of this assessment were published annually in the MDBA's water audit monitoring report.

Table 6-42 Entitlement volumes, Campaspe basin

Water entitlement – Campaspe	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Campaspe System – Goulburn-Murray Water) Conversion Order 2000 (1)		
High-reliability water shares	23,465	23,465
Low-reliability water shares	19,175	19,175
Bulk Entitlement (Axedale Goornong and Rochester) Conversion Order 1999 (2)	349	349
Environmental Entitlement (Campaspe River – Living Murray Initiative) 2007		
Campaspe River TLM – high-reliability	126	126
Campaspe River TLM – low-reliability	5,048	5,048
Subtotal: Environmental Entitlement (Campaspe River – Living Murray Initiative) 2007	**5,174**	**5,174**
Campaspe River Environmental Entitlement 2013		
Campaspe River Environmental Entitlement – high-reliability	18,996	18,996
Campaspe River Environmental Entitlement – fixed reliability	1,656	1,656
Campaspe River Environmental Entitlement – low-reliability water shares	2,966	2,966
Subtotal: Campaspe River Environmental Entitlement 2013	**23,618**	**23,618**
Campaspe exchange rate trade commitment	368	368
Provision for system operation (3)	11,441	11,441
Subtotal: Bulk Entitlement (Campaspe System – Goulburn-Murray Water) Conversion Order 2000	**83,590**	**83,590**
Bulk Entitlement (Campaspe System – Coliban Water) Conversion Order 1999 (4)	50,260	50,260
Bulk Entitlement (Trentham) Conversion Order 2012 (5)	120	120
Bulk Entitlement (Woodend) Conversion Order 2004	470	470
Take and use licences – unregulated surface water	978	962
Licensed small catchment dams – on-waterway	1,863	1,863
Licensed small catchment dams – off-waterway	4,621	4,659
Total	**141,902**	**141,924**

Notes

(1) Under this bulk entitlement, Goulburn-Murray Water releases water from Lake Eppalock to supply water share holders in the Campaspe system, to supply Coliban Water's Axedale, Goornong and Rochester bulk entitlement, and to supply the VEWH's environmental entitlement. The water that Goulburn-Murray Water may take is limited to an average annual volume of 83,590 ML over any consecutive 10-year period.
(2) Coliban Water may take, under its Axedale, Goornong and Rochester bulk entitlement, a maximum annual volume of 215 ML for Axedale and Goornong and an average of 134 ML per annum over any consecutive 10-year period for Rochester.
(3) This volume includes an allowance for volume supplied to the Goulburn system via the Campaspe supplement.
(4) Under this bulk entitlement, Coliban Water releases water from Lake Eppalock, Lauriston Reservoir, Malmsbury Reservoir and Upper Coliban Reservoir to supply rural and urban commitments. The water that Coliban Water may take is limited to an average annual volume of 50,260 ML over any consecutive three-year period. There was 15,742 ML of take and use entitlement volume on 30 June 2020 (for rural customers).
(5) Coliban Water can take, under the Trentham bulk entitlement, an average of 120 ML per year over a three-year period.

Table 6-43 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

Table 6-43 Available water and take, Campaspe basin

Water entitlement	Available water (ML)					Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Spillable write-off	Total available water	
Campaspe system – Goulburn-Murray Water (1)						
Water shares	10,151	23,465	(10,492)	0	23,125	7,104
Axedale, Goornong and Rochester	33	349	(295)	0	87	72
Campaspe River – Living Murray Initiative (2)	101	126	0	0	227	194
Campaspe River Environmental Entitlement (2)	4,750	20,652	3,429	0	28,831	24,836
Operating provisions (whole of system) (3)	-	-	-	-	0	0
Diversion: Campaspe system – Goulburn-Murray Water (4)					*52,270*	*32,206*
Campaspe system – Coliban Water (1) (5)	-	50,260	0	-	50,260	23,008
Trentham (6)	-	120	0	-	120	140
Woodend	-	470	0	-	470	273
Take and use licences – unregulated surface water	-	979	(3)	-	976	404
Licensed small catchment dams	-	6,525	3	-	6,528	1,728
Total 2020–21	**15,035**	**102,946**	**(7,358)**	**0**	**110,624**	**57,758**
Total 2019–20	20,782	94,421	(12,980)	0	102,223	53,647

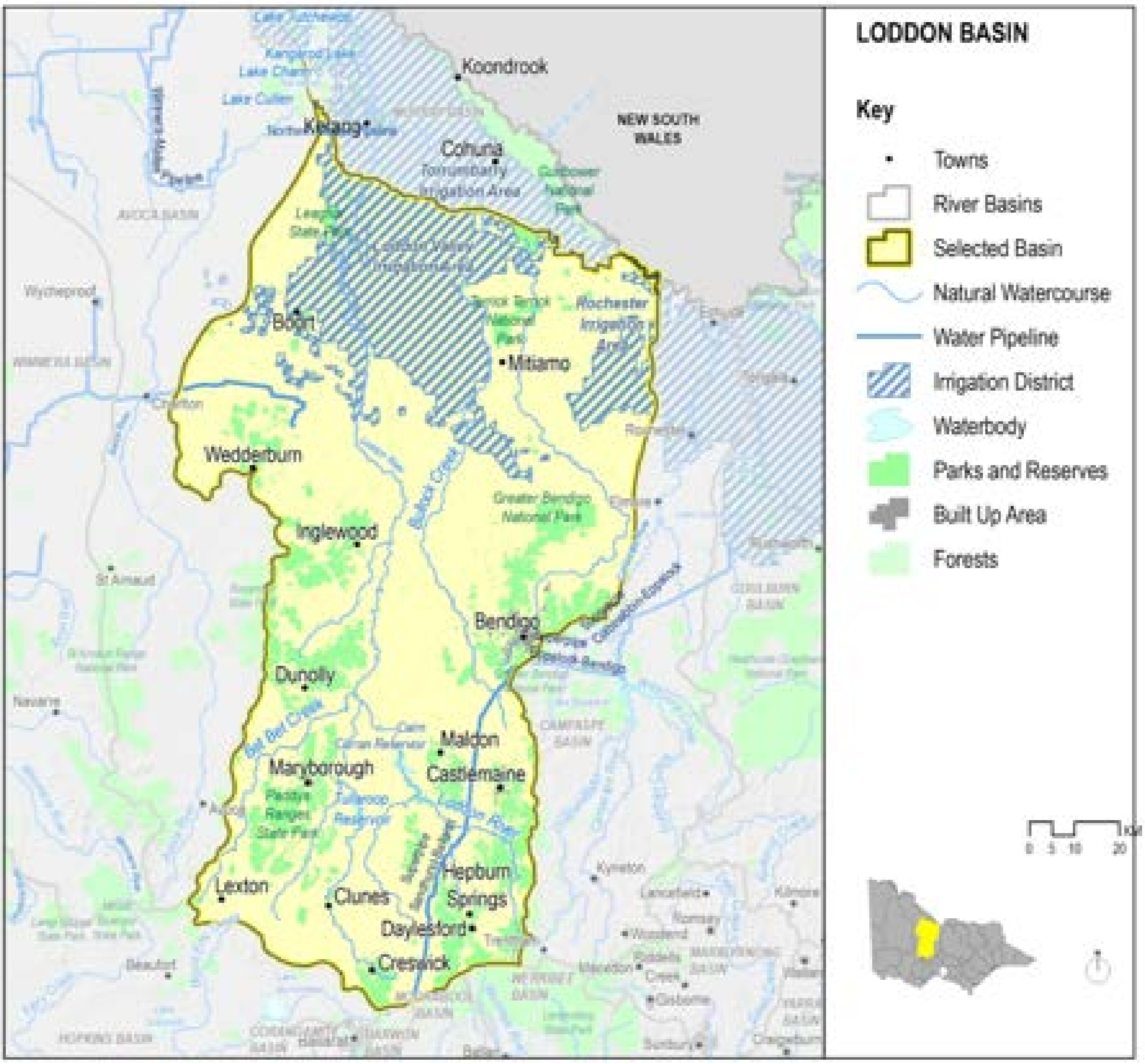
Notes

(1) The water available to Goulburn-Murray Water and Coliban Water includes an inflow and storage capacity share of Lake Eppalock. In any year, available inflows will vary; entitlement holders may have water available from the previous year in their storage share, but the maximum annual amount that can be taken is shown here.
(2) The water use reported under these two entitlements is in-stream use. It is not included as a diversion for the purposes of the Campaspe basin water balance in Table 6-38.
(3) The water taken under the operating provision refers to system losses and water made available to the Goulburn system via the Goulburn supplement. As there are no irrigation areas or districts in the Campaspe system, there is zero loss: the volume of diversion and delivery are the same. In 2020–21, the supplement provided to the Goulburn system was 0 ML.
(4) The water taken reported in this line item represents the bulk diversion to supply primary entitlements and fulfil other operating requirements under the Campaspe system source bulk entitlement. It includes environment deliveries in-stream (25,030 ML).
(5) Water taken under the Campaspe system – Coliban Water entitlement is the volume taken from the waterway for urban and rural supply. The volume includes amounts lost within the system.
(6) Under the Trentham bulk entitlement, Coliban Water may take an average of 120 ML per year over a three-year period. The current three-year rolling average is 119 ML, so the 2020–21 use of 140 ML does not constitute overuse against available water.

6.8 Loddon basin

The Loddon basin (Figure 6-14) is in northern Victoria and includes the Loddon River, Bullock Creek and Bendigo Creek. The basin is crossed by the Waranga Western Channel, which provides water to users in the Loddon basin from the Goulburn basin (that is, to the Loddon Valley Irrigation Area). The southern part of the basin supplies the Bullarook water shares for irrigators along Birch and Bullarook creeks. For the purposes of the Loddon water balance, the Loddon basin excludes the Torrumbarry Irrigation Area (which is supplied mostly from the Murray River) and the Loddon Valley Irrigation Area.

Figure 6-14 Map of the Loddon basin



6.8.1 Management arrangements

Management of water in the Loddon basin is undertaken by various parties, as shown in Table 6-44.

Table 6-44 Water resource management responsibilities, Loddon basin

Authority	Management responsibilities
Goulburn-Murray Water	Supplies the Loddon Valley Irrigation Area and domestic and stock supplies in Normanville, East Loddon (South), East Loddon (North) and West Loddon waterworks districts sourced from the Goulburn basin Manages licensed diversions Provides bulk supply to Coliban Water for towns supplied from the Loddon, Campaspe and Goulburn systems including Pyramid Hill, Boort and Bendigo Operates major reservoirs including Cairn Curran, Laanecoorie, Tullaroop, Hepburn Lagoon and Newlyn reservoirs
GWMWater	Provides bulk supply to Coliban Water for towns supplied from the Wimmera Mallee system (Borung, Korong Vale, Wedderburn and Wychitella)
Central Highlands Water	Supplies towns in the southern part of the Loddon basin including Maryborough, Daylesford, Creswick and Clunes

Lower Murray Water	Supplies the town of Kerang in the northern part of the Loddon basin from supplies taken from the Murray River
Coliban Water	Supplies towns in the eastern and northern parts of the Loddon basin including Bendigo, Castlemaine, Wedderburn, Mitiamo, Pyramid Hill and Boort
North Central Catchment Management Authority	Responsible for waterway and catchment management in the whole of the Loddon basin

6.8.2 2020–21 water resources overview

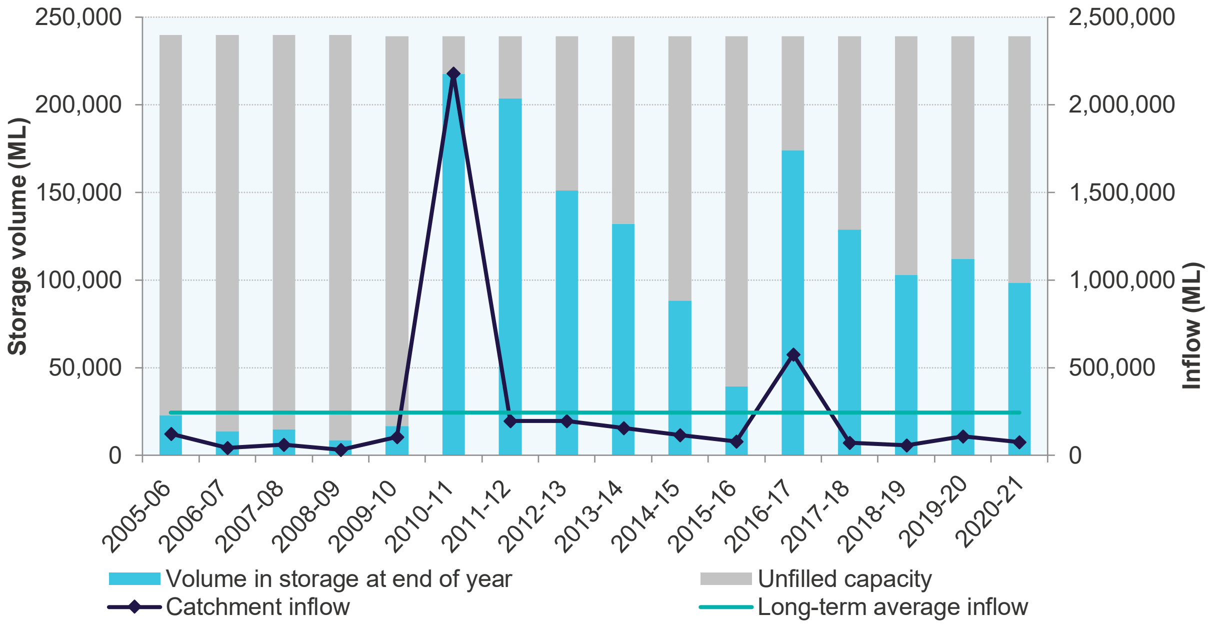
In 2020–21, rainfall was:

- average in most of the basin
- above average in the west near Dunolly and Lexton and in the south-west near Creswick
- below average in the far north-west, west of Leaghur State Park.

Catchment inflows to the basin in 2020–21 were 30% of the long-term average annual volume of 243,400 ML, lower than in 2019–20, when inflows were 44% of the long-term average.

Major storages in the basin were at 46% of capacity on 1 July 2020 and lower (at 40% of capacity) on 30 June 2021.

Figure 6-15 Storage volumes and catchment inflows, Loddon basin



Seasonal determinations were higher in 2020–21 than in the previous year in the Loddon system. On 1 July 2020, the opening determination for high-reliability water shares was announced at 35% allocation. This increased to 77% by 15 October 2020 and reached a final allocation of 100% by 16 November 2020. No seasonal determinations were made for low-reliability water shares during the year. The Bullarook system began the year with a 0% seasonal determination for high-reliability water shares, increasing to 5% in August 2020 and reaching 100% by September 2020. Low-reliability water shares did not receive a determination until 1 September 2020, when a 100% seasonal determination was announced.

Key aspects of restrictions on licensed diversions from unregulated streams in the Loddon basin in 2020–21 were:

- total bans in place for seven streams from July 2020. Most of these bans were lifted by the end of May 2021. Bans on Back Creek (Loddon) and Coghills Creek were lifted for September and October 2020 but returned from December 2020 until the end of May 2021
- total bans in place for ten streams from November 2020 and an additional 20 from December 2021
- a peak of 32 streams had total bans in place by January 2021, higher than the 29 in March 2020.

Most of these bans were lifted by the end of May 2021, and there were no restrictions on eight streams for the entirety of 2020–21.

There were no restrictions on urban water use in the Loddon basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 25,778 ML of water was diverted from the Loddon basin for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was more than the 26,284 ML diverted in the previous year.

6.8.2.1 Water for the environment

Environmental watering sites and environmental values in the Loddon basin that depend on water for the environment include:

- endangered flora and fauna species including Murray cod and painted snipe and communities of threatened riparian vegetation
- Third Reedy Lake, where water for the environment supports critically endangered southern purple spotted gudgeons
- Tullaroop Creek and Serpentine Creek, which have a population of regionally significant river blackfish.

Water from the Loddon basin also flows into the Murray basin, helping to maintain internationally significant Ramsar-listed environmental assets including the Kerang Wetlands, which support over 150 flora species and over 50 waterbird species including the endangered freckled duck and little bittern.

In 2020–21, water for the environment sourced from the Loddon basin comprised:

- the *Bulk Entitlement (Loddon River – Environmental Water Reserve) Order 2005*, which includes 3,480 ML of high-reliability, 2,024 ML of low-reliability and 7,490 ML of provisional-reliability entitlements, passing flows and river-freshening flows
- The *Environmental Entitlement (Birch Creek – Bullarook System) 2009*, which includes passing flows and 100 ML of water in Newlyn Reservoir when high-reliability water shares are greater than 20% in the Bullarook system at the start of December
- 3,826 ML of high-reliability water shares and 527 ML of low-reliability water shares held for the environment
- water set aside for the environment through the operation of passing flow conditions:
  - on consumptive bulk entitlements held by Central Highlands Water and Goulburn-Murray Water
  - on licensed diversions
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

A total of 17,489 ML of environmental water was used in the Loddon basin in 2020–21: 10,017 ML of this was diverted off-stream, and the remaining 7,472 ML was delivered in-stream. 7,638 ML of the diversion was supplied from the Goulburn system to Lake Meran, Lake Yando and Loddon Weir, so it is reported as a diversion from the Goulburn system water balance. Only 2,379 ML was diverted from the Loddon system.

6.8.3 Water balance

The total volumes of water available and supplied from water resources in the Loddon basin in 2020–21 are shown in Table 6-45.

Table 6-45 Water balance, Loddon basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	107,974	98,211
Volume in storage at the end of the year	1	94,503	107,974
Change in storage		**(13,471)**	**9,763**
Inflows			
Catchment inflow	2	74,217	107,751
Rainfall on major storages	1	9,677	9,973
Treated wastewater discharged back to river	3	7,641	6,440
Total inflows		**91,535**	**124,165**
Outflows			
Diversions			
Urban diversions		2,799	3,030
Licensed diversions and irrigation diversions from regulated streams		8,798	8,542
Transfer to Goulburn basin (through Loddon supplement)	4	0	0
Licensed diversions from unregulated streams		4,566	4,974
Environmental water diversions		2,379	1,662
Small catchment dams	5	9,615	9,738
Total diversions		***28,157***	***27,946***
Losses			
Evaporation from major storages	1	19,876	23,927

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Net evaporation from small catchment dams	5	5,947	6,547
In-stream infiltration to groundwater, flows to floodplain and evaporation		15,436	15,528
Total losses		***41,259***	***46,002***
Water passed at outlet of basin			
Loddon River outflow to Murray River (Appin South)		27,295	35,214
Wandella Creek at Fairley		0	20
Mount Hope Creek at Mitiamo		5,752	4,820
Bullock Creek, Calivil Creek and Nine Mile Creek		2,543	399
Total water passed at outlet of basin		***35,590***	***40,453***
Total outflows		**105,006**	**114,401**

6.8.3.1 Notes to the water balance

1. Storage volumes

Major — greater than 1,000 ML — on-stream storages in the Loddon basin are included in the water balance.

Table 6-46 shows how storage volumes changed during the year. Volumes in off-stream storages are presented for additional information about the resource condition.

Table 6-46 Storage volumes, Loddon basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflows less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Cairn Curran Reservoir	147,130	57,829	4,941	11,177	6,181	57,774
Hepburn Lagoon	2,424	1,568	874	1,119	541	1,864
Laanecoorie Reservoir	8,000	2,960	891	1,368	843	3,326
Newlyn Reservoir	3,012	1,717	535	695	1,010	2,567
Tullaroop Reservoir	72,950	43,901	2,436	5,517	(11,847)	28,973
Subtotal	**233,516**	**107,974**	**9,677**	**19,876**	**(3,272)**	**94,503**
Off-stream storages						
Evansford Reservoir	1,346	818	117	207	339	1,067
Sandhurst Reservoir	2,595	2,180	150	256	(108)	1,966
Spring Gully Reservoir	1,680	1,017	173	224	78	1,044
Subtotal	**5,621**	**4,015**	**440**	**687**	**309**	**4,077**
Total 2020–21	**239,137**	**111,989**	**10,117**	**20,563**	**(2,963)**	**98,580**
Total 2019–20	239,137	102,998	10,434	24,651	23,208	111,989

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, the known inflows and the net change in storage volume.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-47 lists the wastewater treatment plants in the Loddon basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

Table 6-47 Volume and use of recycled water, Loddon basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Bendigo [1]	A,B,C	7,049	1,331	19%	955	376	0	0	5,718	0
Boort	C	15	15	100%	0	15	0	0	0	0
Bridgewater / Inglewood	C	0	0	0%	0	0	0	0	0	0
Castlemaine	B	1,478	109	7%	109	0	0	0	1,369	0
Clunes	C	33	33	100%	0	33	0	0	0	0
Daylesford	C	345	345	100%	6	339	0	0	0	0
Dunolly	C	5	5	100%	0	5	0	0	0	0
Kerang	C	554	0	0%	0	0	0	0	554	0
Maryborough	C	451	451	100%	77	374	0	0	0	0
Pyramid Hill [2]	C	0	0	0%	0	0	0	0	0	0
Waubra	C	6	6	100%	0	6	0	0	0	0
Wedderburn	C	16	16	100%	0	16	0	0	0	0
Total 2020–21		**9,952**	**2,311**	**23%**	**1,147**	**1,164**	**0**	**0**	**7,641**	**0**
Total 2019–20		8,996	2,016	22%	876	1,140	0	0	6,440	540

Notes

(1) At the Bendigo treatment plant, 307 ML of the 'Volume of treated wastewater produced' represents effluent received from the New Moon Mine water treatment plant, which is discharged to the Bendigo Creek via the Bendigo treatment plant discharge point.

(2) Recycled water produced from the Pyramid Hill treatment plant was not used during 2020–21.

4. Transfer to Goulburn basin (through Loddon supplement)

The Loddon supplement to the Goulburn provides supplementary supply to the Goulburn system from the Waranga Western Channel west of Loddon River via Serpentine Creek, in accordance with arrangements set out in *Bulk Entitlement (Loddon System – Goulburn-Murray Water) Conversion Order 2005*. As such, the volume is reported in this water balance as a transfer to the Goulburn basin. No such transfer occurred in 2020–21.

5. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-48 provides information about small catchment dams in the basin.

Table 6-48 Estimated small catchment dam information, Loddon basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	42,579	6,204	5,072	11,276
Registered/licensed commercial and irrigation	17,063	3,411	875	4,286
Total 2020–21	**59,642**	**9,615**	**5,947**	**15,562**
Total 2019–20	59,642	9,737	6,547	16,284

6.8.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Loddon – Key compliance points
✓ **There was a net increase of 28 ML in the total entitlement volume from the previous year.** • The net increase came about due to: ○ a 34 ML increase in licensed small catchment dams (issued for a data error, with a corresponding decrease in the Campaspe basin) ○ a 4 ML cancellation of unregulated take and use licences ○ a 2 ML cancellation of a high-reliability water share.
✓ **The total volume diverted (36,177 ML) was within the volume available for the year (75,049 ML).**
✓ **No individual bulk entitlement holder took more than the annual volume made available to them.**
✓ **Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlements in the Loddon basin provide the basis for how water is shared in the basin. Rights to water in the Loddon basin are set out in Table 6-49.

Entitlements to water in regulated systems in the Loddon basin provide for the right to carry over unused allocation to the next season. In the Loddon basin, these entitlement holders can carry over unused water up to 50% of their entitlement volume. Any unused water above this amount is written off.

Diversions under bulk entitlements are assessed against the Murray–Darling Basin annual cap target for the Goulburn–Broken–Loddon Valley. Since 2012, cap compliance has been reported to the MDBA through the *transition period water take report*. Before this, details of this assessment were published annually in the MDBA's water audit monitoring report.

Table 6-49 Entitlement volumes, Loddon basin

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Loddon System – Goulburn-Murray Water) Conversion Order 2005 (1)		
High-reliability water shares – Loddon	21,389	21,391
Low-reliability water shares – Loddon	8,079	8,079
Bulk Entitlement (Loddon River – Environmental Reserve) Order 2005		
Loddon wetland entitlement	2,000	2,000
Loddon system – East Loddon Waterworks District modernisation savings entitlement	1,480	1,480
Loddon system – Wimmera Mallee Pipeline savings entitlement (2)	7,490	7,490
Loddon environmental low-reliability entitlement	2,024	2,024
Subtotal: Bulk Entitlement (Loddon River – Environmental Reserve) Order 2005	**12,994**	**12,994**
Bulk Entitlement (Loddon System – Part Maryborough – Central Highlands Water) Conversion Order 2005 (3)	1,200	1,200
Bulk Entitlement (Loddon System – Coliban Water) Conversion Order 2005	820	820
Loddon supplement to the Goulburn (2) (4)	n/a	n/a
Subtotal: Bulk Entitlement (Loddon System – Goulburn-Murray Water) Conversion Order 2005	**44,482**	**44,484**
Bulk Entitlement (Bullarook system – Goulburn-Murray Water) Conversion Order 2009 (5)		
High-reliability water shares – Bullarook	758	758
Low-reliability water shares – Bullarook	381	381
Bulk Entitlement (Bullarook System – Central Highlands Water) Conversion Order 2009	500	500
Environmental Entitlement (Birch Creek – Bullarook System) 2009	100	100
Subtotal: Bulk Entitlement (Bullarook system – Goulburn-Murray Water) Conversion Order 2009	**1,739**	**1,739**
Bulk Entitlement (Creswick) Conversion Order 2004	500	500
Bulk Entitlement (Daylesford – Hepburn Springs) Conversion Order 2004	916	916
Bulk Entitlement (Evansford-Talbot System–Part Maryborough–Central Highlands Water) Conversion Order 2006 (3)	3,000	3,000
Bulk Entitlement (Lexton) Conversion Order 2004	45	45
Take and use licences – unregulated surface water (6)	15,892	15,896
Licensed small catchment dams – on-waterway	6,430	6,195
Licensed small catchment dams – off-waterway	10,632	10,833
Total	**83,636**	**83,608**

Notes

(1) Under this bulk entitlement, Goulburn-Murray Water operates Cairn Curran Reservoir, Tullaroop Reservoir, Laanecoorie Reservoir and Loddon Weir to supply water share holders in the Loddon system and to supply the Loddon system bulk entitlements held by Central Highlands Water, Coliban Water and the VEWH.

(2) These entitlements can be supplied from the Loddon system or the Goulburn system by Goulburn-Murray Water. The rules defining the supply are described in the Bulk Entitlement (Eildon – Goulburn Weir) Conversion Order 1995. The volume is also included in the Goulburn basin as components of the Eildon – Goulburn Weir bulk entitlement called the 'Goulburn supplement for Loddon environmental entitlement' and 'Goulburn supplement for Loddon System'.
(3) The entitlement volume associated with the Loddon System – Part Maryborough – Central Highlands Water bulk entitlement (1,200 ML) is transferred to the Evansford-Talbot system and taken under the Evansford-Talbot System–Part Maryborough–Central Highlands Water bulk entitlement (3,000 ML).
(4) The Loddon supplement to the Goulburn provides for Loddon system water to be supplied to the Goulburn system from the Waranga Western Channel west of Loddon River via Serpentine Creek. Goulburn-Murray Water's bulk entitlement specifies that after ensuring all Loddon system high-reliability entitlements can be satisfied in the current year and are provided for in the following year and sufficient water is held in storage, additional resources in the Loddon system can be used to supplement the Goulburn system. These provisions were not met during 2020–21, and no supplement was made available to the Goulburn system.
(5) Under this bulk entitlement, Goulburn-Murray Water operates Newlyn Reservoir and Hepburns Lagoon to supply water share holders in the Bullarook system and to supply the Bullarook system bulk entitlements held by Central Highlands Water and the VEWH.
(6) The volume of unregulated surface water entitlements includes licences for in-stream diversions. There are 35 ML of in-stream licence in the Loddon basin.

Table 6-50 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

Table 6-50 Available water and take, Loddon basin

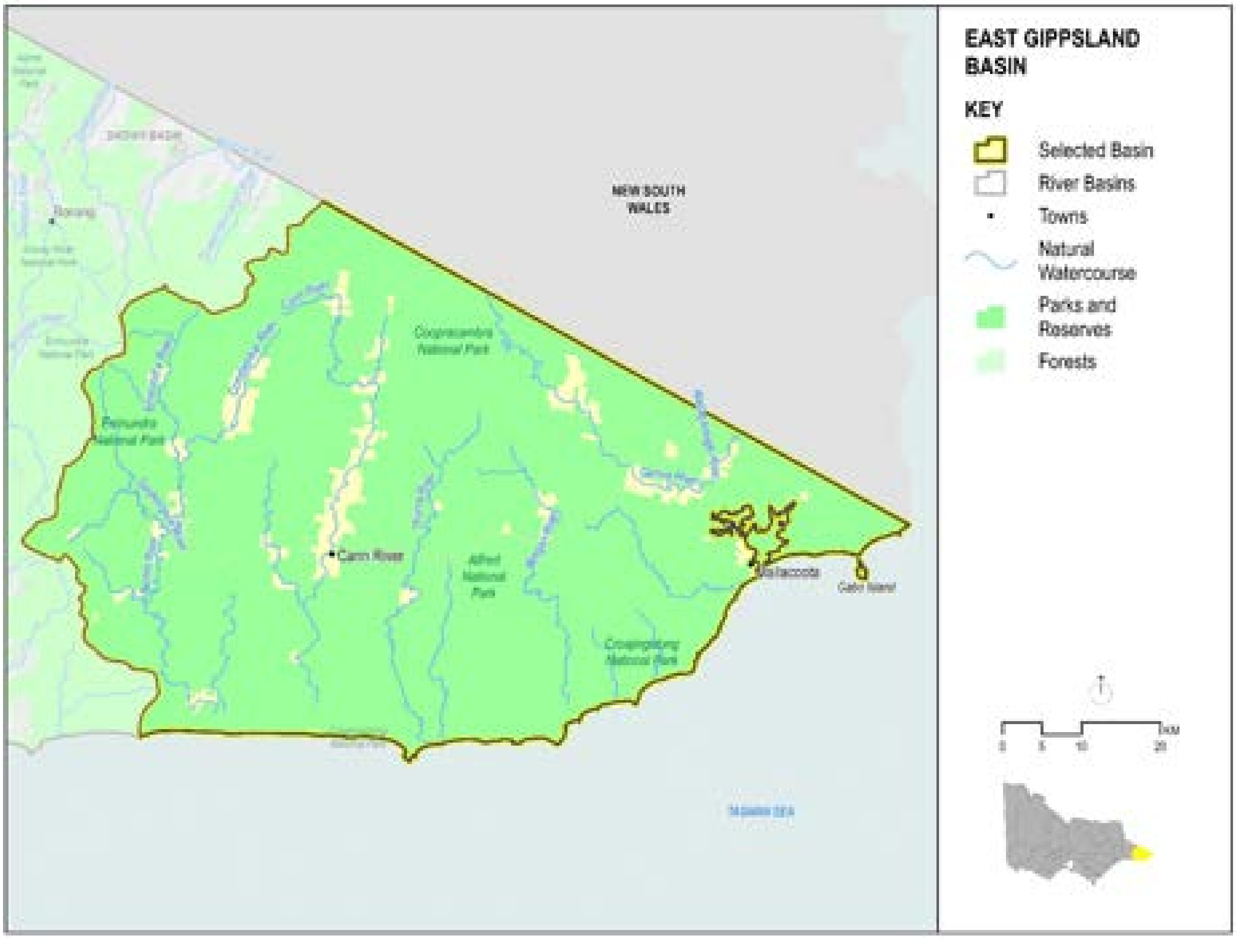
Water entitlement	Available water (ML): Opening carryover	Allocation issued	Net trade in / (out)	Total available water	Water taken (ML)
Loddon System – Goulburn-Murray Water					
Water shares – Loddon	4,098	18,814	(9,748)	13,164	5,373
Loddon River – Environmental Reserve (1)	2,000	11,118	5,070	18,188	16,188
Loddon System – Part Maryborough – Central Highlands Water (2)	900	1,200	(820)	1,280	414
Loddon System – Coliban Water	58	762	(678)	142	133
Loddon supplement to the Goulburn (3)	-	-	-	0	0
Operating provisions (whole of system) (4)	-	2,841	-	2,841	2,841
Diversion: Loddon system – Goulburn-Murray Water (5)				*35,615*	*24,949*
Bullarook System – Goulburn-Murray Water					
Water shares – Bullarook	281	856	0	1,138	584
Bullarook System – Central Highlands Water	238	263	0	500	183
Environmental Entitlement Birch Creek – Bullarook System (6)	100	100	0	200	0
Diversion: Bullarook system – Goulburn-Murray Water (7)				*1,838*	*767*
Creswick	-	500	0	500	479
Daylesford – Hepburn Springs	-	916	0	916	599
Evansford-Talbot System–Part Maryborough–Central Highlands Water (2)	-	3,000	0	3,000	1,405
Lexton	-	45	0	45	0
Take and use licences – unregulated surface water	-	16,072	(7)	16,065	4,566
Licensed small catchment dams	-	17,063	7	17,070	3,411
Total 2020–21	**7,675**	**73,549**	**(6,175)**	**75,049**	**36,177**
Total 2019–20	7,686	70,058	(11,354)	66,390	31,259

Notes
(1) The water taken under this entitlement reported here reflects the volume of water delivered under the components of the entitlement listed in Table 6-49. River-freshening flows of 828 ML and passing flows of 472 ML were also delivered under this entitlement, and they are not included in this table. Part of this entitlement can be supplied from the Goulburn system to the Boort wetlands and Loddon Weir; 7,638 ML was taken in 2020–21 under this component of the entitlement and is reported as a diversion in the Goulburn basin water balance. In the portion supplied from the Loddon basin, 2,379 ML of the water taken was diverted off-stream.
(2) The water taken under the Loddon System – Part Maryborough – Central Highlands Water bulk entitlement (414 ML) is transferred to the Evansford-Talbot system for supply to Maryborough. This water is then delivered to Maryborough under the Evansford-Talbot System – Part Maryborough – Central Highlands Water entitlement. This means that of the 1,405 ML supplied to Maryborough, 414 ML was supplied from the declared Loddon system.
(3) The Loddon supplement to the Goulburn supplies Loddon system water to the Goulburn system, providing for entitlement holders with Goulburn water shares. As such, the volume is reported as a transfer to the Goulburn basin. During 2020–21, there were no transfers from the Loddon system to the Goulburn system under this entitlement.
(4) This reflects the use of water to manage the Loddon system. It equals the amount diverted to Serpentine Creek and not used by customers.
(5) The water use reported in this line item represents the bulk diversion to supply primary entitlements and fulfil other operating requirements under the Loddon system source bulk entitlement. It includes environment deliveries in-stream (6,172 ML).
(6) Allocation is only made to this entitlement when high-reliability water shares are greater than 20% in the Bullarook system at the start of December.
(7) The water taken reported in this line item represents the bulk diversion to supply primary entitlements under the Bullarook system source bulk entitlement.

6.9 East Gippsland basin

The East Gippsland basin (Figure 6-16) is the easternmost basin in Victoria. The headwaters of the Genoa River originate in New South Wales and flow through Victoria before reaching the ocean near Mallacoota. Other rivers in the basin include the Betka, Wingan, Thurra, Cann and Bemm rivers.

Figure 6-16 Map of the East Gippsland basin



6.9.1 Management arrangements

Management of water in the East Gippsland basin is undertaken by various parties, as shown in Table 6-51.

Table 6-51 Water resource management responsibilities, East Gippsland basin

Authority	Management responsibilities
Southern Rural Water	Manages licensed diversions
East Gippsland Water	Supplies urban water to towns including Mallacoota, Cann River and Bemm River
East Gippsland Catchment Management Authority	Responsible for waterway and catchment management in the entire East Gippsland basin

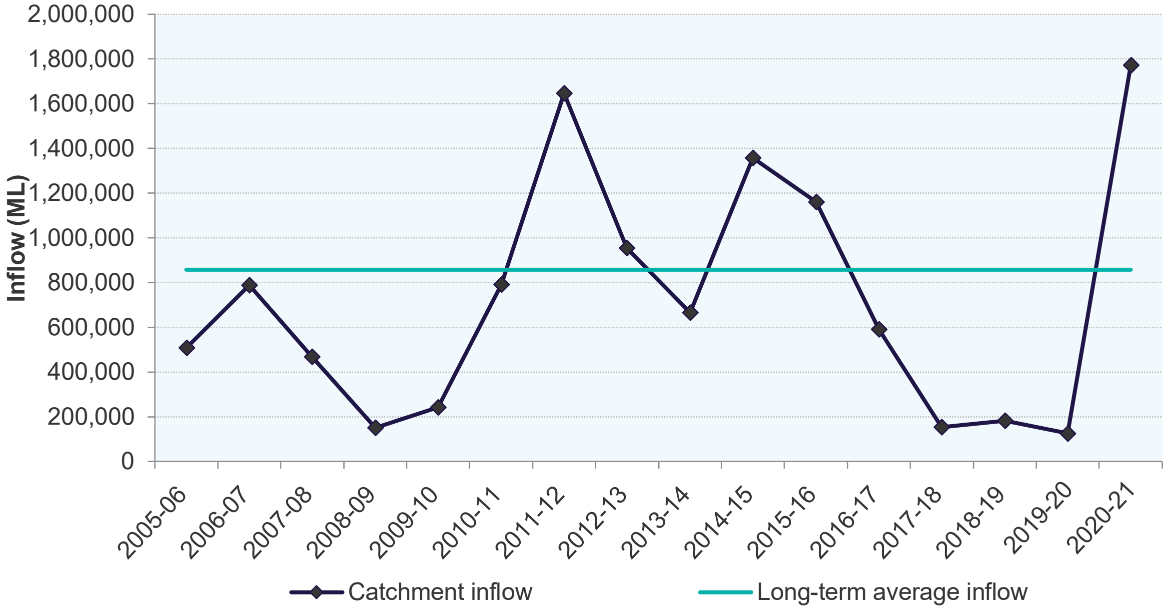
6.9.2 2020–21 water resources overview

In 2020–21, rainfall was:

- very much above average in the far east of the basin, from Cann River to the NSW border
- above average in the basin's lower western corner, from Cann River to the Snowy basin.

Catchment inflows to the basin in 2020–21 were 207% of the long-term annual average of 857,700 ML, much higher than in 2019–20, when inflows were 15% of the long-term average. Consumptive use in the basin is generally very low compared to water availability, and almost 100% of total inflows passed to Bass Strait in 2020–21.

Figure 6-17 Catchment inflows, East Gippsland basin



There were no restrictions placed on licensed diversions from unregulated streams in the East Gippsland basin for the entirety of 2020–21 compared to one in the previous year.

There were no restrictions on urban water use in the East Gippsland basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 683 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was more than the 361 ML diverted in the previous year.

6.9.2.1 Water for the environment

Environmental watering sites and environmental values in the East Gippsland basin that depend on water for the environment include:

- the Bemm, Cann and Genoa rivers, which all feed into high-value wetlands
- Sydenham, Tamboon and Mallacoota inlets (all nationally significant wetlands)
- pristine estuaries, heritage river reaches and the swamp skink, Australian grayling, Australian bass, tangle orchid and eastern curlew.

In 2020–21, water for the environment in the East Gippsland basin comprised:

- water set aside for the environment through:
  - flow-sharing arrangements set out in bulk entitlements held by East Gippsland Water
  - the operation of passing flow conditions on licensed diversions
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

6.9.3 Water balance

The total volumes of water available and supplied from water resources in the East Gippsland basin in 2020–21 are shown in Table 6-52.

Table 6-52 Water balance, East Gippsland basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	-	-
Volume in storage at the end of the year	1	-	-
Change in storage		**-**	**-**
Inflows			
Catchment inflow	2	1,773,084	125,854
Rainfall on major storages	1	-	-
Treated wastewater discharged back to river	3	0	0
Total inflows		**1,773,084**	**125,854**

Outflows			
Diversions			
Urban diversions		111	86
Licensed diversions from unregulated streams		9	64
Small catchment dams	4	563	211
Total diversions		***683***	***361***
Losses			
Evaporation from major storages	1	-	-
Net evaporation from small catchment dams	4	(20)	171
In-stream infiltration to groundwater, flows to floodplain and evaporation	5	-	-
Total losses		***(20)***	***171***
Water passed at outlet of basin			
River outflows to the ocean		1,772,421	125,322
Total water passed at outlet of basin		***1,772,421***	***125,322***
Total outflows		**1,773,084**	**125,854**

6.9.3.1 Notes to the water balance

1. Storage volumes

There are no major — greater than 1,000 ML — storages in the East Gippsland basin.

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows and the known inflows.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-53 lists the wastewater treatment plants in the East Gippsland basin. In 2020–21, no water was discharged to the environment in the East Gippsland basin.

Table 6-53 Volume and use of recycled water, East Gippsland basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Bemm River	n/a	8	8	100%	0	8	0	0	0	0
Cann River	n/a	21	21	100%	0	21	0	0	0	0
Mallacoota	C	56	56	100%	0	56	0	0	0	0
Total 2020–21		**85**	**85**	**100%**	**0**	**85**	**0**	**0**	**0**	**0**
Total 2019–20		30	30	100%	0	30	0	0	0	0

n/a Data not available

4. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-54 provides information about small catchment dams in the basin.

2020–21 was wetter than 2019–20, so the net evaporation — evaporation from the dam's surface minus direct rainfall — is negative, implying that rainfall was greater than evaporation.

Table 6-54 Estimated small catchment dam information, East Gippsland basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	1,094	478	(19)	458
Registered/licensed commercial and irrigation	176	86	(1)	85
Total 2020–21	**1,270**	**564**	**(20)**	**543**
Total 2019–20	1,271	211	171	382

5. In-stream infiltration to groundwater, flows to floodplain and evaporation

An assessment of in-stream infiltration to groundwater, flows to floodplain and evaporation is not made in the East Gippsland basin as no suitable models are available, and the distribution of streamflow gauges across the basin makes it difficult to estimate in-stream losses (see chapter 6.1.5.3).

6.9.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

East Gippsland – Key compliance points
✓ **There was no net increase in the total entitlement volume from the previous year.**
✓ **The total volume diverted (206 ML) was within the volume available for the year (1,455 ML).**
✓ **No individual bulk entitlement holder took more than the annual volume made available to them.**
✓ **Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlements in the East Gippsland basin provide the basis for how water is shared in the basin. Rights to water in the East Gippsland basin are set out in Table 6-55.

Table 6-55 Entitlement volumes, East Gippsland basin

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Bemm River) Conversion Order 1997	100	100
Bulk Entitlement (Cann River) Conversion Order 1997	192	192
Bulk Entitlement (Mallacoota) Conversion Order 1997	330	330
Take and use licences – unregulated surface water	657	657
Licensed small catchment dams – off-waterway	176	176
Total	**1,455**	**1,455**

Table 6-56 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

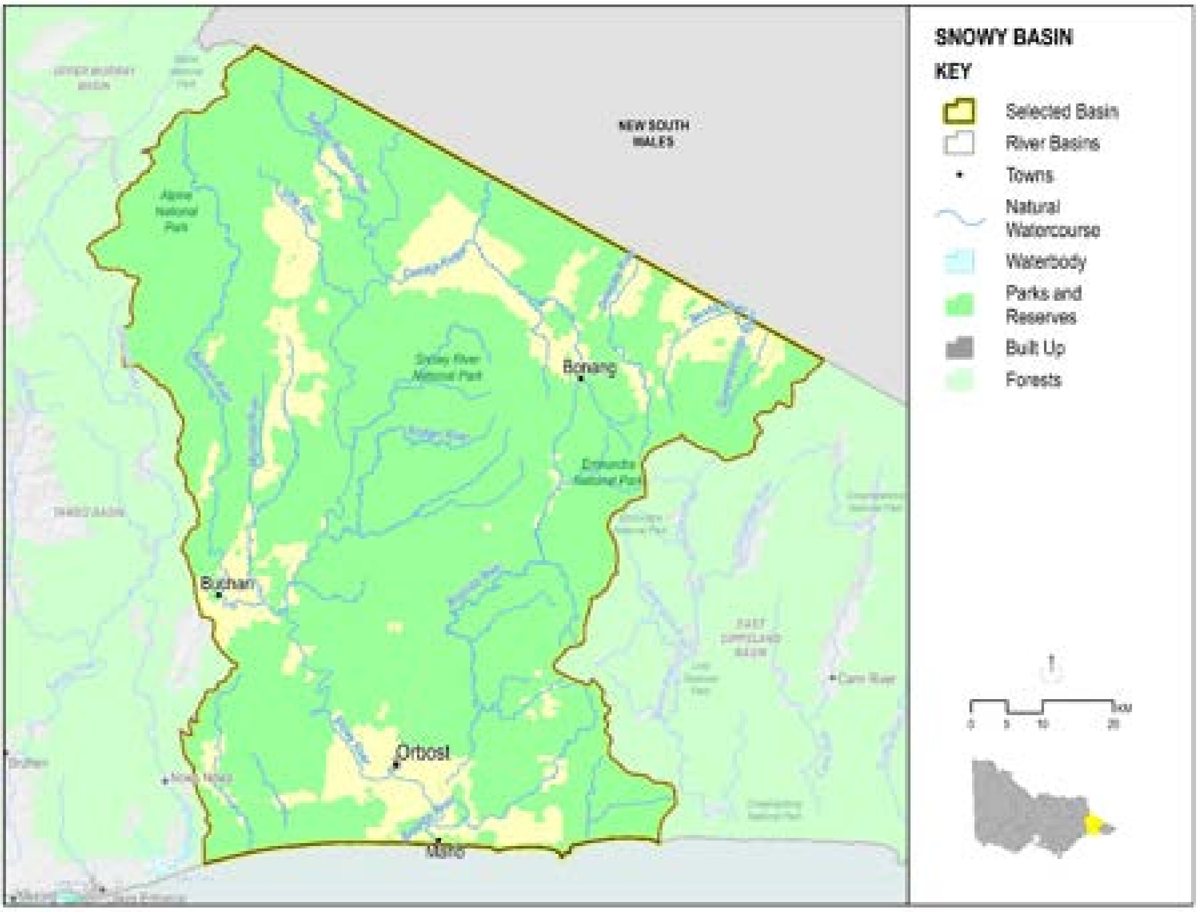
Table 6-56 Available water and take, East Gippsland basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Bemm River	-	100	0	100	14
Cann River	-	192	0	192	28
Mallacoota	-	330	0	330	70
Take and use licences – unregulated surface water	-	657	0	657	9
Licensed small catchment dams	-	176	0	176	86
Total 2020–21	**-**	**1,455**	**0**	**1,455**	**206**
Total 2019–20	-	1,455	0	1,455	179

6.10 Snowy basin

Victoria's Snowy basin (Figure 6-18) is in east Gippsland. The Snowy River originates in New South Wales and is part of the Snowy Mountains Hydro-Electric Scheme, which connects it to the Murray and Murrumbidgee rivers. Major tributaries within the Victorian basin include the Deddick River, Buchan River and Brodribb River, which join the Snowy River before it flows into Bass Strait at Marlo. As these accounts provide a record of water availability and use across Victoria, this chapter only considers the portion of the Snowy basin located in Victoria.

Figure 6-18 Map of the Snowy basin



6.10.1 Management arrangements

Management of water in the Victorian portion of the Snowy basin is undertaken by various parties, as shown in Table 6-57. In the New South Wales portion of the Snowy basin, Snowy Hydro Limited releases water under a licence issued by that state's Department of Planning, Industry and Environment.

Table 6-57 Water resource management responsibilities, Snowy basin

Authority	Management responsibilities
Southern Rural Water	Manages surface water licensed diversions
East Gippsland Water	Supplies towns including Buchan, Orbost and Marlo
East Gippsland Catchment Management Authority	Responsible for waterway and catchment management in the whole of the Victorian Snowy basin

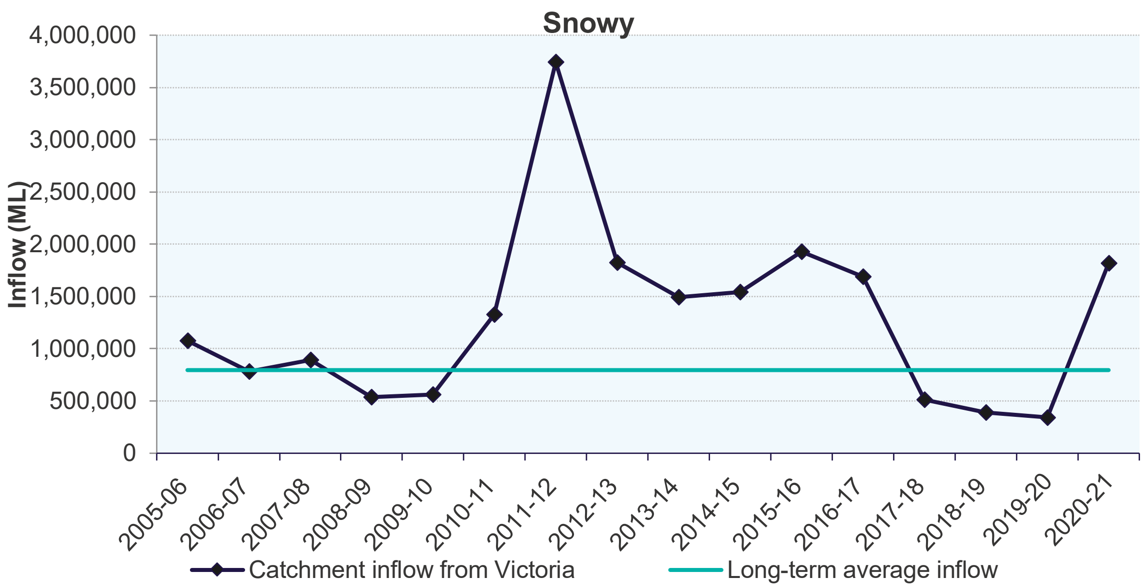
6.10.2 2020–21 water resources overview

In 2020–21, rainfall was:

- above average in most of the basin
- very much above average in the far east, from Bonang to the NSW border and south of Alpine National Park, and in a small area in the south-west of the basin near Buchan.

Catchment inflows to the basin in 2020–21 were 228% of the long-term annual average of 795,600 ML, much greater than in 2019–20, when inflows were 43% of the long-term average.

Figure 6-19 Catchment inflows, Snowy basin



There were no restrictions placed on licensed diversions from unregulated streams in the Snowy basin for the entirety of 2020–21, the same as in the previous year.

There were no restrictions on urban water use in the Snowy basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 2,218 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 2,754 ML diverted in the previous year.

6.10.2.1 Water for the environment

Environmental watering sites and environmental values in the Snowy basin that depend on water for the environment include:

- Australian grayling populations, heritage river reaches, the Ewings Marsh wetlands complex and the Snowy River daisy
- freshwater species (such as river blackfish and Australian grayling) found in the upper reaches and tributaries of the Snowy River
- the lower reaches of the Snowy River, which support species including estuary perch and Australian bass that move between saltwater and freshwater systems
- estuarine and saltwater species (such as flathead, mulloway and black bream) in the estuary
- the nationally important floodplain wetlands of the Snowy River near Marlo, which provide feeding and breeding areas for wetland and migratory birds.

In 2020–21, water for the environment in the Snowy basin comprised:

- water set aside for the environment through the operation of passing flow conditions:
  - on the water licence issued to Snowy Hydro
  - on consumptive bulk entitlements held by East Gippsland Water
  - on licensed diversions
- water recovered for the environment as part of the Snowy Water Inquiry and released by Snowy Hydro in accordance with conditions of its water licence
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

A total of 91,700 ML of environmental water was delivered from the Snowy Mountains Hydro-Electric Scheme to the Snowy River between 1 April 2020 and 31 May 2021, which was the 2020–21 water year as defined under the Snowy Water Licence. This water was released downstream of Jindabyne Dam and Mowamba Weir in New South Wales, and it included 9,000 ML of passing flows and 82,700 ML of water recovered as part of the Snowy Water Initiative. There is more information about the management of environmental water recovered under the Snowy Water Initiative in chapter 4.1.3.

6.10.3 Water balance

The total volumes of water available and supplied from water resources in the Snowy basin in 2020–21 are shown in Table 6-58. As these accounts provide a record of water availability and use across Victoria, this balance only considers the Victorian portion of the Snowy basin.

Table 6-58 Water balance, Snowy basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	-	-
Volume in storage at the end of the year	1	-	-
Change in storage		**-**	**-**
Inflows			
Catchment inflow from Victoria	2	1,815,274	343,275
Catchment inflow from New South Wales	2	523,808	133,832
Rainfall on major storages	1	-	-
Treated wastewater discharged back to river	3	0	0
Total inflows		**2,339,082**	**477,107**
Outflows			
Diversions			
Urban diversions		645	717
Licensed diversions from unregulated streams		403	1,254
Small catchment dams	4	1,169	783
Total diversions		***2,218***	***2,754***
Losses			
Evaporation from major storages	1	-	-
Net evaporation from small catchment dams	4	296	916
In-stream infiltration to groundwater, flows to floodplain and evaporation	5	-	-
Total losses		***296***	***916***
Water passed at outlet of basin			
River outflows to the ocean		2,336,568	473,437
Total water passed at outlet of basin		***2,336,568***	***473,437***
Total outflows		**2,339,082**	**477,107**

6.10.3.1 Notes to the water balance

1. Storage volumes

There are no major — greater than 1,000 ML — storages in the Victorian portion of the Snowy basin.

2. Catchment inflow

Catchment inflow from Victoria is the balancing item in this water balance. It is the difference between the total outflows and the known inflows.

Catchment inflow from New South Wales is recorded as the volume flowing from the Snowy River at Burnt Hut Crossing (at gauge 222013).

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-59 lists the wastewater treatment plants in the Snowy basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance, but in 2020–21 there were no such discharges into the Snowy basin's waterways. In 2020–21, 100% of the water produced in treatment plants in the Snowy basin was recycled and used for agricultural applications.

Table 6-59 Volume and use of recycled water, Snowy basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML) Urban and industrial	Agriculture	Beneficial allocation	Within plant process	Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
Orbost	C	271	271	100%	0	271	0	0	0	0
Total 2020–21		**271**	**271**	**100%**	**0**	**271**	**0**	**0**	**0**	**0**
Total 2019–20		231	231	100%	0	231	0	0	0	0

4. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-60 provides information about small catchment dams in the basin.

Table 6-60 Estimated small catchment dam information, Snowy basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	2,840	799	262	1,061
Registered/licensed commercial and irrigation	1,590	370	34	404
Total 2020–21	**4,430**	**1,169**	**296**	**1,465**
Total 2019–20	4,430	784	915	1,700

5. In-stream infiltration to groundwater, flows to floodplain and evaporation

An assessment of in-stream infiltration to groundwater, flows to floodplain and evaporation is not made in the Snowy basin as there are no suitable models available, and the distribution of streamflow gauges across the basin makes it difficult to estimate in-stream losses (see chapter 6.1.5.3).

6.10.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Snowy – Key compliance points

- ✓ **There was no net increase in the total entitlement volume from the previous year.**
- ✓ **The total volume diverted (1,419 ML) was within the volume available for the year (7,710 ML).**
- ✓ **No individual bulk entitlement holder took more than the annual volume made available to them.**
- ✓ **Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlements in the Snowy basin provide the basis for how water is shared in the basin. Rights to water in the Snowy basin are set out in Table 6-61.

Table 6-61 Entitlement volumes, Snowy basin

Water entitlement – Snowy	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Buchan) Conversion Order 1997	170	170
Bulk Entitlement (Orbost System) Conversion Order 1997	2,031	2,031
Take and use licences – unregulated surface water	3,919	3,919
Licensed small catchment dams – on-waterway	30	30
Licensed small catchment dams – off-waterway	1,560	1,560
Total	**7,710**	**7,710**

Table 6-62 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

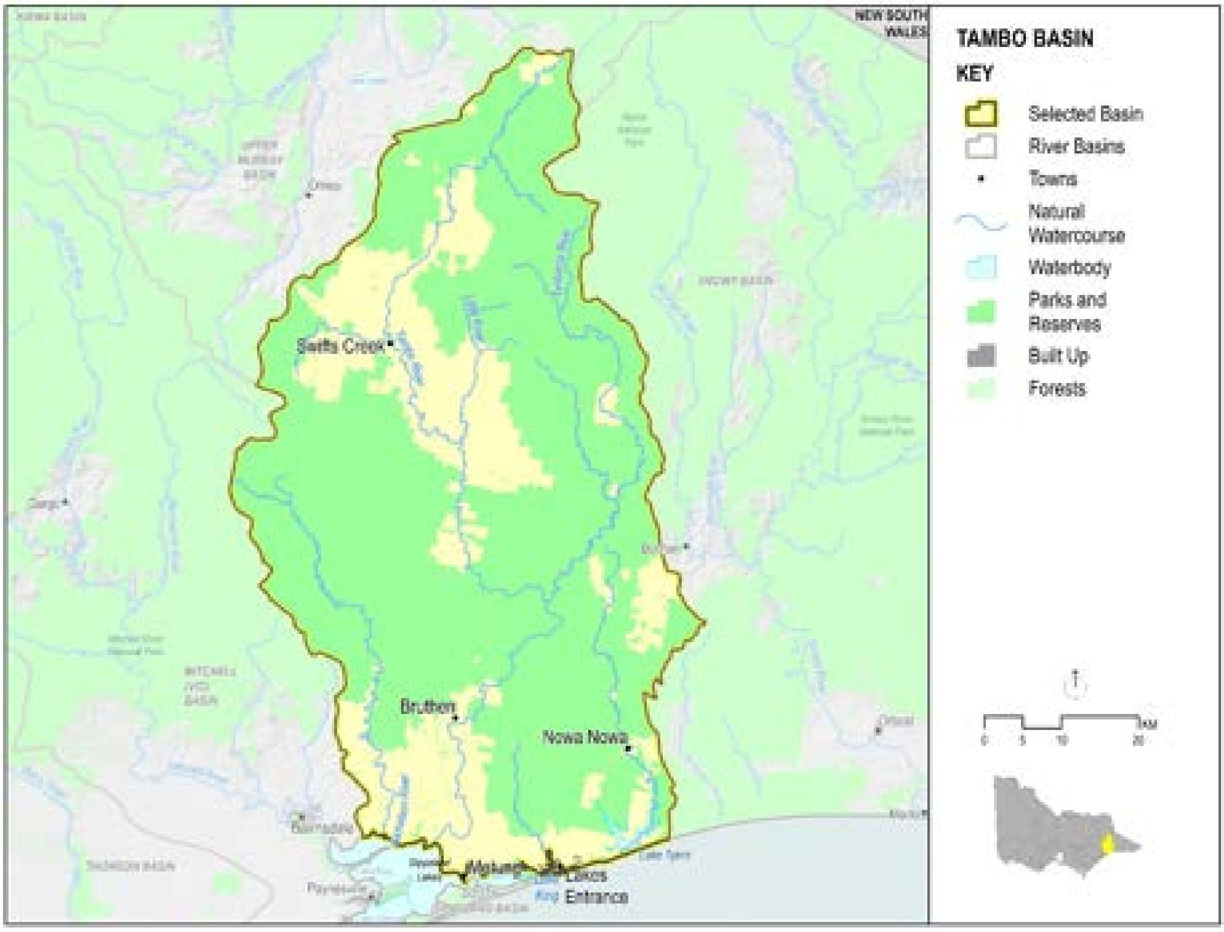
Table 6-62 Available water and take, Snowy basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Buchan	-	170	0	170	16
Orbost System	-	2,031	0	2,031	629
Take and use licences – unregulated surface water	-	3,919	0	3,919	403
Licensed small catchment dams	-	1,590	0	1,590	370
Total 2020–21	**-**	**7,710**	**0**	**7,710**	**1,419**
Total 2019–20	-	7,710	0	7,710	2,216

6.11 Tambo basin

The Tambo basin (Figure 6-20) is in south-east Victoria. The basin contains the Tambo River and the Nicholson River, which flow into the Gippsland Lakes.

Figure 6-20 Map of the Tambo basin



6.11.1 Management arrangements

Management of water in the Tambo basin is undertaken by various parties, as shown in Table 6-63.

Table 6-63 Water resource management responsibilities, Tambo basin

Authority	Management responsibilities
Southern Rural Water	Manages licensed diversions
East Gippsland Water	Supplies Swifts Creek; towns including Lakes Entrance, Bruthen and Nowa Nowa are supplied from neighbouring basins
East Gippsland Catchment Management Authority	Responsible for waterway and catchment management in the whole of the Tambo basin

6.11.2 2021–21 water resources overview

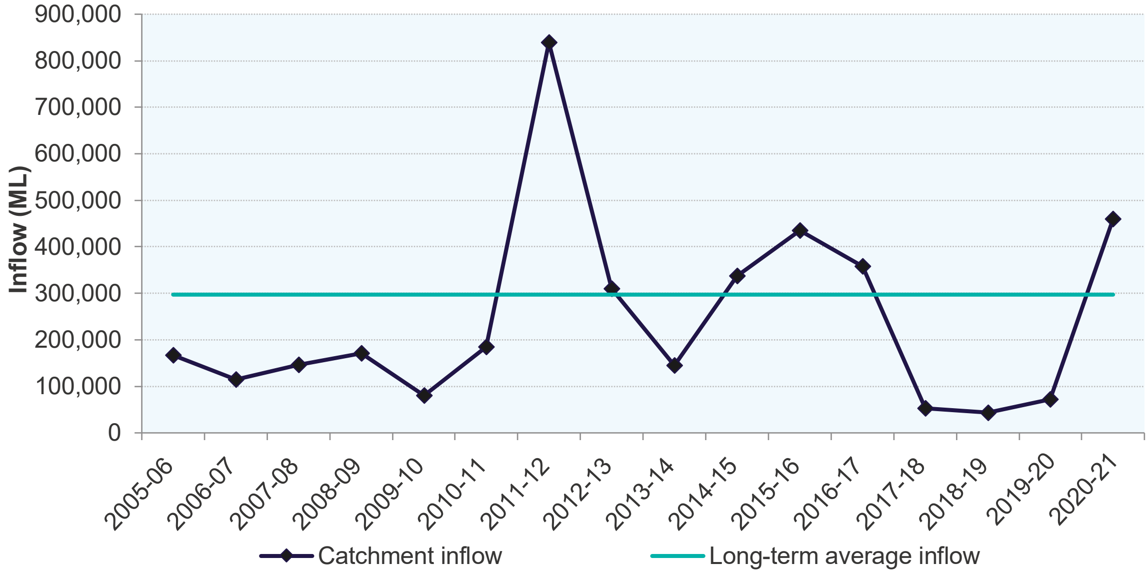
In 2020–21, rainfall was:

- above average in most of the basin
- very much above average in the far east of the basin, near Bonang
- average in the north-west, in a small area west of Swifts Creeks.

Catchment inflows to the basin in 2020–21 were 155% of the long-term average annual volume of 297,200 ML, much greater than in 2019–20 when inflows were 24% of the long-term average.

Diversions in the Tambo basin are minor compared to the total water resource. Swifts Creek is the only town supplied by the Tambo basin, while larger towns (such as Lakes Entrance and Bruthen) are supplied by the Bairnsdale water system (sourcing water from the Mitchell basin). Overall, about 99% of the basin inflows passed through to the Gippsland Lakes in 2020–21.

Figure 6-21 Catchment inflows, Tambo basin



There were no restrictions placed on licensed diversions from unregulated streams in the Tambo basin for the entirety of 2020–21 compared to two in the previous year.

There were no restrictions on urban water use in the Tambo basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 1,531 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was more than the 1,339 ML diverted in the previous year.

6.11.2.1 Water for the environment

Environmental watering sites and environmental values in the Tambo basin that depend on water for the environment include:

- the Gippsland Lakes, which are listed as internationally significant wetlands under the Ramsar Convention and which partially rely on freshwater inputs from the Tambo basin to function ecologically
- populations of Australian grayling and black bream
- the Tambo River, which has an extensive estuary extending from The Cliffs (upstream of Swan Reach) to the Gippsland Lakes at Lake King; significant wetlands along the estuary reach of the river include the East Swamps (south of Sardine Flat Road), Lake King Wetlands and Russells Swamp
- the Nicholson River, which has an extensive estuary reach that extends from the Great Alpine Road bridge at Sarsfield to where the river enters the Gippsland Lakes at Jones Bay; there are several important wetlands on both sides of the river, the largest being Bosses Swamp and Nebbor Swamp.

In 2020–21, water for the environment in the Tambo basin comprised:

- water set aside for the environment through the operation of passing flow conditions:
  - consumptive bulk entitlements held by East Gippsland Water
  - on licensed diversions
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

6.11.3 Water balance

The total volumes of water available and supplied from water resources in the Tambo basin in 2020–21 are shown in Table 6-64.

Table 6-64 Water balance, Tambo basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	-	-
Volume in storage at the end of the year	1	-	-
Change in storage		**-**	**-**
Inflows			
Catchment inflow	2	460,084	72,072
Rainfall on major storages	1	-	-
Treated wastewater discharged back to river	3	0	0
Total inflows		**460,084**	**72,072**
Outflows			
Diversions			
Urban diversions		22	24
Licensed diversions from unregulated streams		277	573
Small catchment dams	4	1,232	742
Total diversions		***1,531***	***1,339***
Losses			
Evaporation from major storages	1	-	-
Net evaporation from small catchment dams	4	626	840
In-stream infiltration to groundwater, flows to floodplain and evaporation	5	-	-
Total losses		***626***	***840***
Water passed at outlet of basin			
River outflows to the ocean		457,927	69,893
Total water passed at outlet of basin		***457,927***	***69,893***
Total outflows		**460,084**	**72,072**

6.11.3.1 Notes to the water balance

1. Storage volumes

There are no major — greater than 1,000 ML — storages in the Tambo basin.

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows and the known inflows.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-65 lists the wastewater treatment plants in the Tambo basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance, but in 2020–21 there were no such discharges into the Tambo basin's waterways. In 2020–21, 100% of the water produced in treatment plants in the Tambo basin was recycled and used for agricultural applications including pastures, tree plantations, racecourses and golf courses.

Table 6-65 Volume and use of recycled water, Tambo basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML): Urban and industrial	Type of end use (ML): Agriculture	Type of end use (ML): Beneficial allocation	Type of end use (ML): Within plant process	Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
Lakes Entrance	C	620	620	100%	0	620	0	0	0	0
Metung	C	149	149	100%	0	149	0	0	0	0
Total 2020–21		**769**	**769**	**100%**	**0**	**769**	**0**	**0**	**0**	**0**
Total 2019–20		739	739	100%	0	739	0	0	0	0

4. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-66 provides information about small catchment dams in the basin.

Table 6-66 Estimated small catchment dam information, Tambo basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	4,933	1,002	583	1,585
Registered/licensed commercial and irrigation	1,356	230	43	273
Total 2020–21	**6,289**	**1,232**	**626**	**1,858**
Total 2019–20	6,289	741	840	1,581

5. In-stream infiltration to groundwater, flows to floodplain and evaporation

An assessment of in-stream infiltration to groundwater, flows to floodplain and evaporation is not made in the Tambo basin as there are no suitable models and the distribution of streamflow gauges across the basin makes it difficult to estimate in-stream losses (see chapter 6.1.5.3).

6.11.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Tambo – Key compliance points
✓ **There was no net increase in the total entitlement volume from the previous year.**
✓ **The total volume diverted (529 ML) was within the volume available for the year (5,741 ML).**
✓ **No individual bulk entitlement holder took more than the annual volume made available to them.**
✓ **Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlements in the Tambo basin provide the basis for how water is shared in the basin. Rights to water in the Tambo basin are set out in Table 6-67.

Table 6-67 Entitlement volumes, Tambo basin

Water entitlement – Tambo	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Nowa Nowa) Conversion Order 1997	118	118
Bulk Entitlement (Swifts Creek) Conversion Order 1997	224	224
Take and use licences – unregulated surface water	4,041	4,043
Licensed small catchment dams – on-waterway	106	106
Licensed small catchment dams – off-waterway	1,250	1,251
Total	**5,739**	**5,741**

Table 6-68 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

Table 6-68 Available water and take, Tambo basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Nowa Nowa [(1)]	-	118	0	118	0
Swifts Creek	-	224	0	224	22
Take and use licences – unregulated surface water	-	4,043	0	4,043	277
Licensed small catchment dams	-	1,356	0	1,356	230
Total 2020–21	**-**	**5,741**	**0**	**5,741**	**529**
Total 2019–20	-	5,741	0	5,741	722

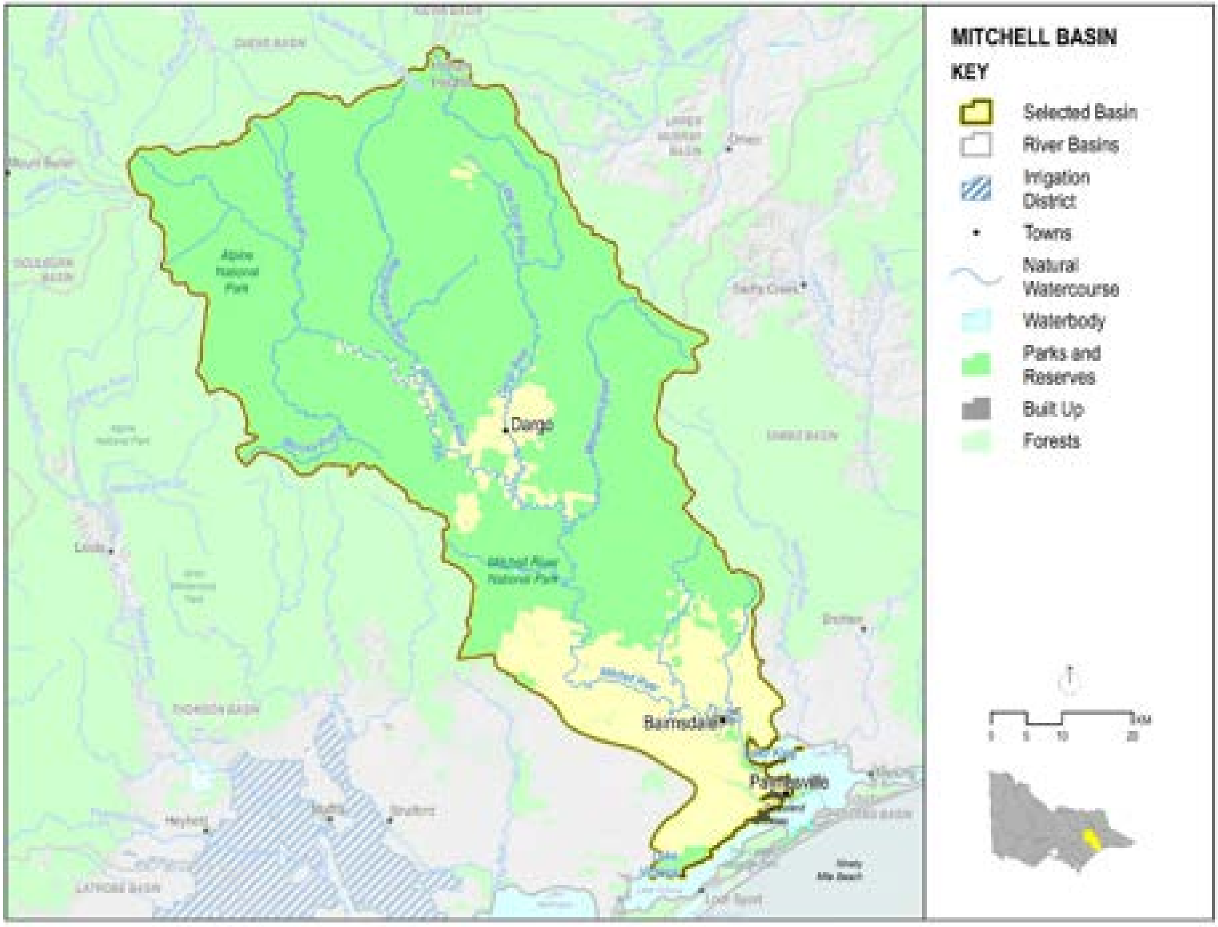
Note

(1) No water was taken under the Nowa Nowa bulk entitlement in 2020–21 as the Nowa Nowa storage has been decommissioned. East Gippsland Water supplied Nowa Nowa under the Bairnsdale bulk entitlement, reported in Table 6-74 in the Mitchell basin.

6.12 Mitchell basin

The Mitchell basin (Figure 6-22) is in south-east Victoria. The Mitchell River flows into the Gippsland Lakes near Bairnsdale.

Figure 6-22 Map of the Mitchell basin



6.12.1 Management arrangements

Management of water in the Mitchell basin is undertaken by various parties, as shown in Table 6-69.

Table 6-69 Water resource management responsibilities, Mitchell basin

Authority	Management responsibilities
Southern Rural Water	Manages licensed diversions
East Gippsland Water	Supplies towns including Bairnsdale, Lakes Entrance and Paynesville
East Gippsland Catchment Management Authority	Responsible for waterway and catchment management in the Mitchell basin

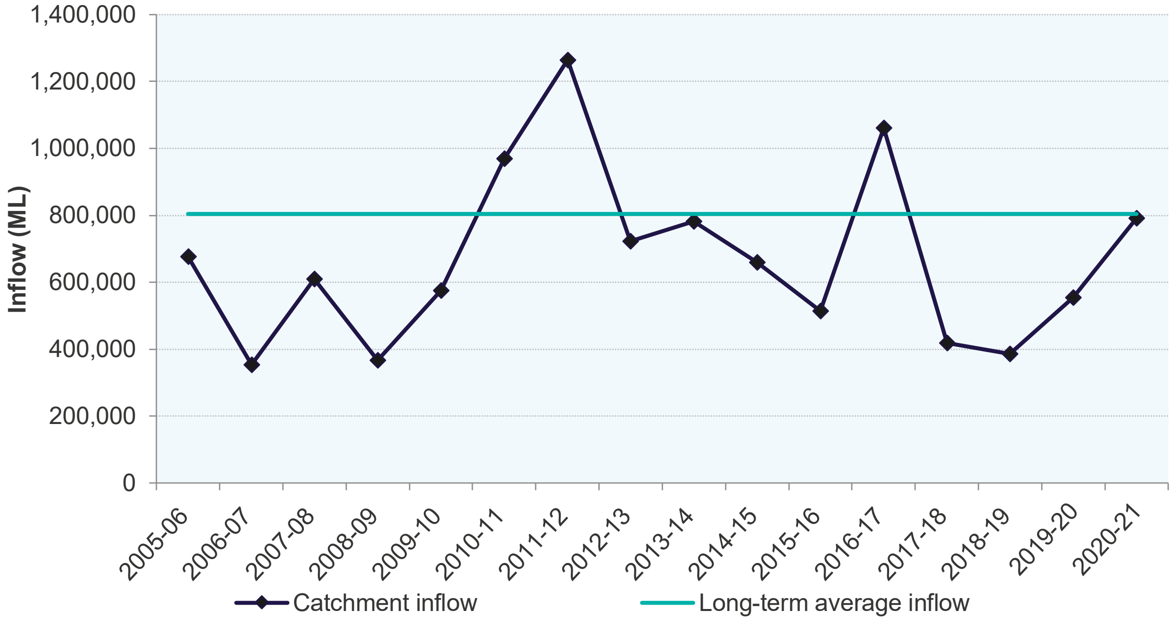
6.12.2 2021–21 water resources overview

In 2020–21, rainfall was:

- average in the basin's north near Dargo, Alpine National Park and south of Hotham Heights
- above average south of Dargo and in the south-east of the basin
- very much above average in the western part of the basin, from Bairnsdale to south of the Alpine National Park.

Catchment inflows to the basin in 2020–21 were 98% of the long-term average of 804,100 ML, greater than in 2019–20 when inflows were 69% of the long-term average. Consumptive use in the basin is low compared to the total water resource. About 98% of the total inflows were not diverted and flowed through to the Gippsland Lakes.

Figure 6-23 Catchment inflows, Mitchell basin



There were no restrictions placed on licensed diversions from unregulated streams in the Mitchell basin for the entirety of 2020–21, the same as in the previous year.

There were no restrictions on urban water use in the Mitchell basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 15,320 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the volume diverted in the previous year (17,829 ML).

6.12.2.1 Water for the environment

Environmental watering sites and environmental values in the Mitchell basin that depend on water for the environment include:

- the Gippsland Lakes, which are listed as internationally significant wetlands under the Ramsar Convention and partially rely on freshwater inputs from the Mitchell basin to function ecologically
- the Mitchell River, which has a long estuary reach extending from the old barrier upstream of Bairnsdale to where the river enters the Gippsland Lakes at Lake King via the internationally significant silt jetties; there are important wetlands on both sides of the river including Macleod Morass, Jones Bay and the Lake King Wetlands at Eagle Point
- heritage river reaches, fish populations (including Australian grayling and black bream), waterbirds (for example, the great egret) and botanical values (for example, yellowwood).

In 2020–21, water for the environment in the Mitchell basin comprised:

- water set aside for the environment through the operation of passing flow conditions on:
  - the consumptive bulk entitlement held by East Gippsland Water
  - on licensed diversions
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

6.12.3 Water balance

The total volumes of water available and supplied from water resources in the Mitchell basin in 2020–21 are shown in Table 6-70.

Table 6-70 Water balance, Mitchell basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	-	-
Volume in storage at the end of the year	1	-	-
Change in storage		**-**	**-**
Inflows			
Catchment inflow	2	790,885	554,446

Rainfall on major storages	1	-	-
Treated wastewater discharged back to river	3	42	75
Total inflows		**790,927**	**554,522**
Outflows			
Diversions			
Urban diversions		4,370	4,438
Licensed diversions from unregulated streams		9,653	12,782
Small catchment dams	4	1,297	609
Total diversions		***15,320***	17,829
Losses			
Evaporation from major storages	1	-	-
Net evaporation from small catchment dams	4	638	608
In-stream infiltration to groundwater, flows to floodplain and evaporation	5	0	648
Total losses		***638***	1,256
Water passed at outlet of basin			
River outflows to the Gippsland Lakes		774,969	535,437
Total water passed at outlet of basin		***774,969***	535,437
Total outflows		**790,927**	**554,522**

6.12.3.1 Notes to the water balance

1. Storage volumes

There are no major — greater than 1,000 ML — storages in the Mitchell basin.

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows and the known inflows.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-71 lists the wastewater treatment plants in the Mitchell basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance, but during 2020–21 there were no such discharges.

Water for Mount Hotham Alpine Resort is sourced from Swindlers Creek, which is in the upper Murray basin. In 2020–21, 42 ML of wastewater was treated and returned from the Mount Hotham Alpine Resort to the Dargo River. This volume is included as an inflow to the water balance for the Mitchell basin. A further 5 ML was treated to Class A and delivered to Loch Dam (Swindlers Creek catchment) and used for snow-making. This volume is not included in the water balance.

Table 6-71 Volume and use of recycled water, Mitchell basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Bairnsdale	C	1,351	1,351	100%	0	18	1,333	0	0	0
Lindenow	C	13	13	100%	0	0	13	0	0	0
Paynesville	C	359	359	100%	0	359	0	0	0	0
Total 2020–21		**1,723**	**1,723**	**100%**	**0**	**377**	**1,346**	**0**	**0**	**0**
Total 2019–20		1,324	1,324	100%	0	252	1,072	0	0	0

4. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-72 provides information about small catchment dams in the basin.

Table 6-72 Estimated small catchment dam information, Mitchell basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	3,957	756	515	1,271
Registered/licensed commercial and irrigation	2,912	541	123	664
Total 2020–21	**6,869**	**1,297**	**638**	**1,935**
Total 2019–20	6,869	608	609	1,217

5. In-stream infiltration to groundwater, flows to floodplain and evaporation

In the Mitchell basin, in-stream loss is estimated to occur when flow rates at streamflow gauges across the basin are below 100 ML per day. Because flow rates for each of the gauges were above this level each day, no in-stream loss has been reported for 2020–21.

6.12.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Mitchell – Key compliance points

- ✓ **There was a net increase of 2,000 ML in the total entitlement volume from the previous year.**
  - The increase of 2,000 ML was due to the issue of a new winterfill take and use licence in the system.
- ✓ **The total volume diverted (14,563 ML) was within the volume available for the year (30,162 ML).**
- ✓ **No individual bulk entitlement holder took more than the annual volume made available to them.**
- ✓ **Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlements in the Mitchell basin provide the basis for how water is shared in the basin. Rights to water in the Mitchell basin are set out in Table 6-73.

Table 6-73 Entitlement volumes, Mitchell basin

Water entitlement – Mitchell	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Bairnsdale) Conversion Order 2000	9,208	9,208
Take and use licences – unregulated surface water (1)	18,238	16,238
Licensed small catchment dams – on-waterway	147	147
Licensed small catchment dams – off-waterway	2,766	2,766
Total	**30,358**	**28,358**

Note

(1) The total volume of take and use licences increased in 2020–21. A 2,000 ML winterfill take and use licence was issued to Traditional Owners from unallocated water in the Mitchell system.

Table 6-74 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

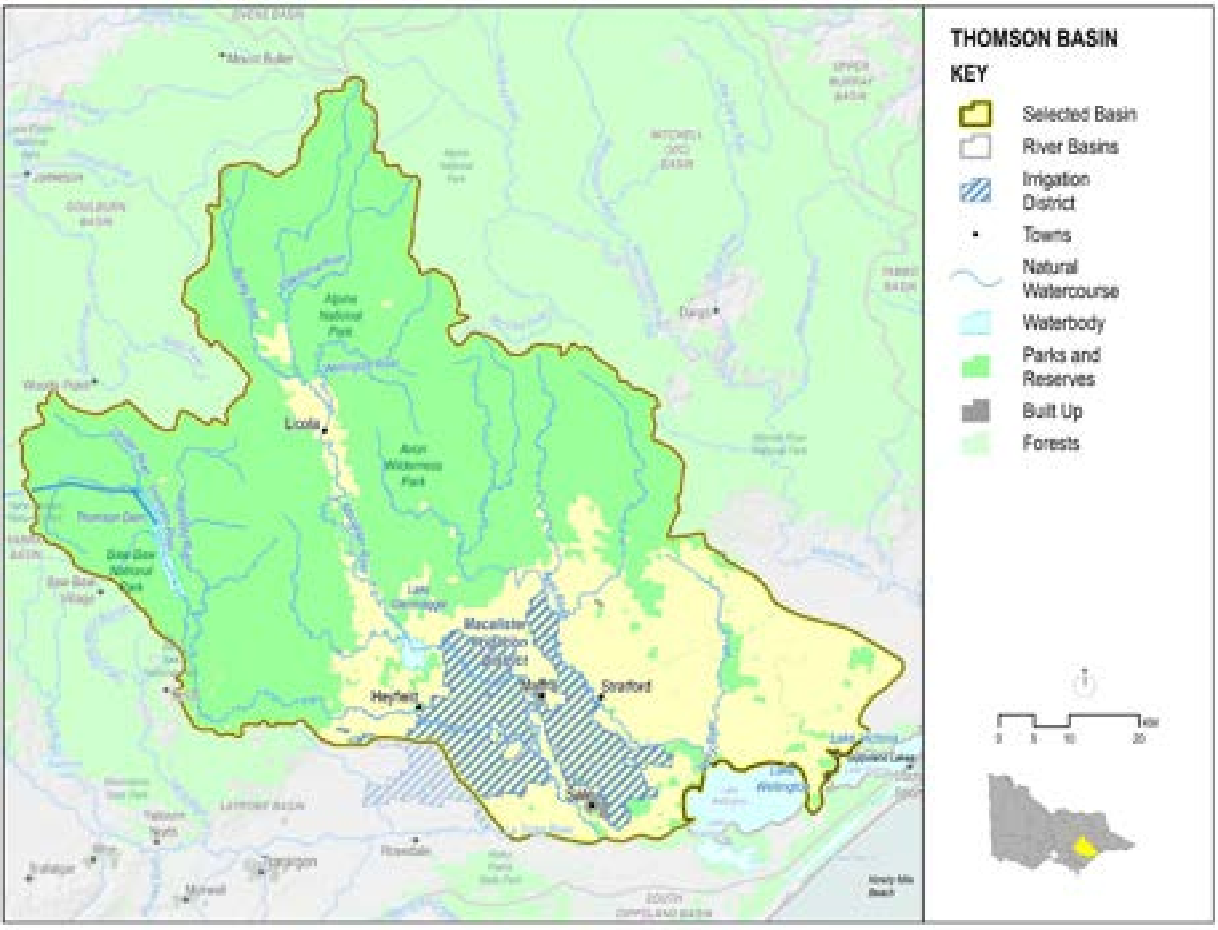
Table 6-74 Available water and take, Mitchell basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Bairnsdale	-	9,208	0	9,208	4,370
Take and use licences – unregulated surface water	-	18,041	0	18,041	9,653
Licensed small catchment dams	-	2,912	0	2,912	540
Total 2020–21	**-**	**30,162**	**0**	**30,162**	**14,563**
Total 2019–20	-	28,358	0	28,358	17,432

6.13 Thomson basin

The Thomson basin (Figure 6-24) is in south-east Victoria. The Thomson and Macalister rivers join the Latrobe River before flowing into the Gippsland Lakes.

Figure 6-24 Map of the Thomson basin



6.13.1 Management arrangements

Management of water in the Thomson basin is undertaken by various parties, as shown in Table 6-75.

Table 6-75 Water resource management responsibilities, Thomson basin

Authority	Management responsibilities
Melbourne Water	Operates Thomson Reservoir, which supplies water to the Greater Yarra system – Thomson River Pool entitlement holders (Melbourne surface water supply system) and irrigators in the Macalister Irrigation District Releases water to the Thomson River for environmental flows and Southern Rural Water
Southern Rural Water	Provides irrigation supplies to the Macalister Irrigation District Manages groundwater and surface water licensed diversions Provides bulk water supply to Gippsland Water Operates Lake Glenmaggie
Gippsland Water	Supplies towns including Sale, Maffra, Heyfield, Stratford and Boisdale
West Gippsland Catchment Management Authority	Responsible for waterway and catchment management in the Thomson basin

6.13.2 2020–21 water resources overview

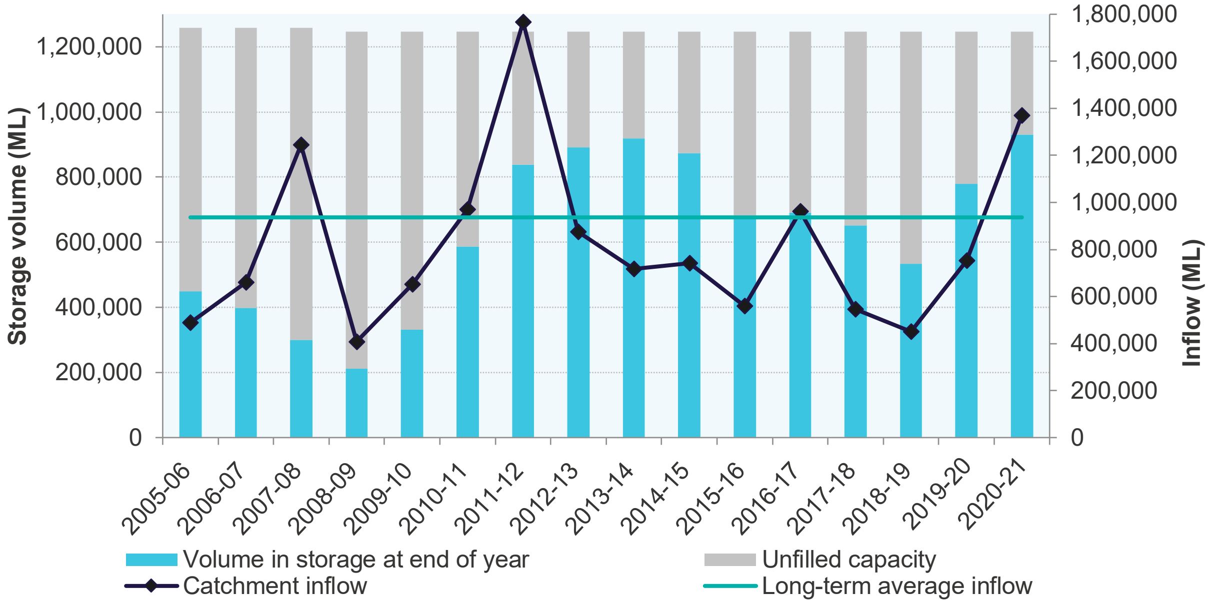
In 2020–21, rainfall was:

- average in a small section in the far north of the basin, near Mount Buller
- above average in the north of the basin, from Alpine National Park to Baw Baw National Park
- very much above average in the basin's central section around Licola, Maffra and south of Stratford
- average in the south of the basin, near Sale, and in a small south-east section of the basin, near Lake Victoria.

Catchment inflows to the basin in 2020–21 were 146% of the long-term average of 936,400 ML, greater than in 2019–20 when inflows were 80% of the long-term average.

Major storages in the basin were at 63% of capacity on 1 July 2020 and higher (at 75% of capacity) on 30 June 2021.

Figure 6-25 Storage volumes and catchment inflows, Thomson basin



In 2020–21, the seasonal determination opened at 100% for high-reliability water shares in the Macalister Irrigation District on 1 July 2020 compared to 45% in July 2019. A 10% seasonal determination for low-reliability water shares was announced in December 2020, increasing to a 20% determination by March 2021 and reaching a final determination of 100% by April 2021.

Key aspects of restrictions on licensed diversions from unregulated streams in the Thomson basin in 2020–21 were:

- rosters on both sections of the Avon River were in place from February to April 2020, ranging from stage 1 to stage 2; diversions were unrestricted for the rest of the year in the Avon River
- there was a stage 1 roster on Valencia Creek from December 2020 to the end of April 2021
- a peak of two streams were restricted in March 2021, the same as in the previous year
- no restrictions were in place for four streams during 2020–21.

There were no restrictions on urban water use in the Thomson basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 250,594 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was more than the 223,002 ML diverted in the previous year.

6.13.2.1 Water for the environment

Environmental watering sites and environmental values in the Thomson basin that depend on water for the environment include:

- the Gippsland Lakes, which are listed as internationally significant wetlands under the Ramsar Convention and partially rely on freshwater inputs from the Thomson basin to function ecologically
- the upper Thomson River (a heritage river reach) and its Australian grayling populations
- the Macalister River, supporting seven migratory native fish species, platypus and the water rat.

In 2020–21, water for the environment in the Thomson basin comprised:

- the *Bulk Entitlement (Thomson River – Environment) Order 2005* comprising a 3.9% share of inflows — on average, 10,000 ML a year — and 10,000 ML of high-reliability entitlement held by the VEWH and water set aside for the environment through the operation of passing flow conditions on the entitlement
- the *Macalister River Environmental Entitlement 2010* comprising 12,461 ML of high-reliability and 6,230 ML of low-reliability entitlements held by the VEWH
- water set aside for the environment through the operation of passing flow conditions:
    - on consumptive bulk entitlements held by Southern Rural Water

- on licensed diversions

- all other water in the basin not allocated under entitlements: this water also provides social, recreational and cultural benefits.

In 2020–21, a total of 28,609 ML of environmental water was delivered in-stream in the Thomson basin.

6.13.3 Water balance

The total volumes of water available and supplied from water resources in the Thomson basin in 2020–21 are shown in Table 6-76.

Table 6-76 Water balance, Thomson basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	779,170	534,357
Volume in storage at the end of the year	1	929,880	779,170
Change in storage		**150,710**	**244,813**
Inflows			
Catchment inflow	2	1,368,986	751,602
Rainfall on major storages	1	39,104	25,898
Return flow from irrigation		3,782	3,866
Treated wastewater discharged back to river	3	106	39
Total inflows		**1,411,978**	**781,405**
Outflows			
Diversions			
Urban diversions		1,387	1,443
Transfers to Yarra River basin for urban use		67,478	36,045
Irrigation district diversions		158,360	160,162
Licensed diversions from regulated streams		17,212	19,687
Licensed diversions from unregulated streams		4,423	4,974
Environmental water diversions		0	15
Small catchment dams	4	1,734	691
Total diversions		***250,594***	***223,017***
Losses			
Evaporation from major storages	1	36,644	36,377
Net evaporation from small catchment dams	4	832	594
In-stream infiltration to groundwater, flows to floodplain and evaporation		26,974	14,489
Total losses		***64,450***	***51,460***
Water passed at outlet of basin			
River outflows to Latrobe River		643,402	184,134
River outflows to Lake Wellington	5	302,822	77,981
Total water passed at outlet of basin		***946,224***	***262,115***
Total outflows		**1,261,268**	**536,592**

6.13.3.1 Notes to the water balance

1. Storage volumes

Major — greater than 1,000 ML — storages in the Thomson basin are included in the water balance. Table 6-77 shows how storage volumes changed during the year.

Table 6-77 Storage volumes, Thomson basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflows less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Lake Glenmaggie	177,640	140,291	13,622	18,704	5,060	140,270
Thomson Reservoir (1)	1,068,000	638,879	25,482	17,941	143,190	789,610
Total 2020–21	**1,245,640**	**779,170**	**39,104**	**36,644**	**148,250**	**929,880**
Total 2019–20	1,245,640	534,357	25,898	36,377	255,292	779,170

Note

(1) Volumes in storage in the Thomson Reservoir do not include 55,100 ML in dead storage.

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, the known inflows and the net change in storage volume.

The 2019–20 catchment inflow volume has been corrected from the previous accounts. The volume for 'River outflows to Lake Wellington' was incorrectly reported, which in turn caused an error in the catchment inflow amount.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-78 lists the wastewater treatment plants in the Thomson basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

In addition to the recycled water reported below, 7 ML was returned from Mount Baw Baw to Charity Creek and other waterways during the water year.

Table 6-78 Volume and use of recycled water, Thomson basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Heyfield	C	100	100	100%	0	100	0	0	0	0
Maffra	C	340	272	80%	0	272	0	0	68	0
Rawson	B	31	0	0%	0	0	0	0	31	0
Sale	C	755	755	100%	0	755	0	0	0	0
Stratford	C	149	149	100%	0	149	0	0	0	0
Total 2020–21		**1,375**	**1,276**	**93%**	**0**	**1,276**	**0**	**0**	**99**	**0**
Total 2019–20		1,149	1,119	97%	0	1,119	0	0	30	0

4. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-79 provides information about small catchment dams in the basin.

Table 6-79 Estimated small catchment dam information, Thomson basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	5,396	1,149	714	1,863
Registered/licensed commercial and irrigation	3,175	585	118	703
Total 2020–21	**8,571**	**1,734**	**832**	**2,566**
Total 2019–20	8,572	691	594	1,285

5. River outflows to Lake Wellington

The 2019–20 'River outflows to Lake Wellington' item has been corrected from the previous accounts. The volume was erroneously reported as 776,472 ML, and the error was subsequently identified and corrected.

6.13.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
    - **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Thomson – Key compliance points	
✓	**There was no net increase in the total entitlement volume from the previous year.**
✓	**The total volume diverted (274,272 ML) was within the volume available for the year (551,116 ML).**
✓	**No individual bulk entitlement holder took more than the annual volume made available to them.**
✓	**Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlements in the Thomson basin provide the basis for how water is shared in the basin. Rights to water in the Thomson basin are set out in Table 6-80.

Melbourne Water holds a bulk entitlement to divert surface water from the Thomson River. This entitlement is one of four that contribute to the Greater Yarra system – Thomson River Pool, which primarily supplies Melbourne and supports regional urban water corporations Barwon Water, Western Water, South Gippsland Water and Westernport Water (Table 6-104 and Table 6-105). Details of the entitlement arrangements are provided in the Yarra basin chapter. Surface water is also diverted by licensed diverters and is harvested in small catchment dams.

The VEWH holds environmental entitlements for the Thomson and Macalister rivers. Water available under these entitlements is used to support streamflows, and a small volume is diverted out of waterways to wetlands in the basin.

Table 6-80 Entitlement volumes, Thomson basin

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Thomson Macalister – Southern Rural Water) Conversion Order 2001 (1)		
High-reliability water shares	155,839	155,839
Low-reliability water shares	74,638	74,639
Bulk Entitlement (Thomson Macalister Towns – Gippsland Water) Conversion Order 2005	2,335	2,335
Macalister River Environmental Entitlement 2010		
Macalister River Environmental Entitlement – high-reliability	12,461	12,461
Macalister River Environmental Entitlement – low-reliability	6,230	6,230
Subtotal: Macalister River Environmental Entitlement 2010	*18,690*	*18,690*
Subtotal: Bulk Entitlement (Thomson Macalister - Southern Rural Water) Conversion Order 2001	*251,502*	*251,503*
Bulk Entitlement (Thomson River – Melbourne Water) Order 2014 (2)	171,800	171,800
Bulk Entitlement (Thomson River – Environment) Conversion Order 2005 (3)		
Thomson River – high-reliability	10,000	10,000
Share of inflows (3)	n/a	n/a
Subtotal: Bulk Entitlement (Thomson River – Environment) Conversion Order 2005	*10,000*	*10,000*
Take and use licences – unregulated surface water	17,207	17,207
Licensed small catchment dams – on-waterway	30	30
Licensed small catchment dams – off-waterway	3,145	3,145
Total	**453,685**	**453,685**

Notes

(1) Under this bulk entitlement, Southern Rural Water operates Lake Glenmaggie and Cowwarr Weir to supply water share holders in the Macalister Irrigation District and diverters on the Thomson and Macalister rivers and Rainbow Creek and to supply water to Gippsland Water's Thomson Macalister towns bulk entitlement.

(2) Melbourne Water holds the source bulk entitlement on the Thomson River. The annual entitlement volume is the annual diversion limit for Melbourne Water's Yarra River, Thomson River and Silver and Wallaby Creeks bulk entitlements. The limit is calculated using a method for showing compliance with diversion limits approved by the Minister for Water in February 2018. This water is used to supply primary entitlement holders — City West Water, South East Water, Yarra Valley Water, Barwon Water, Western Water, South Gippsland Water and Westernport Water — with entitlement to the Greater Yarra system – Thomson River Pool, which sources water from the Yarra River, Thomson River, Tarago River, Silver Creek and Wallaby Creek.

(3) The *Bulk Entitlement (Thomson River – Environment) 2005* includes a 3.9% share of inflows into storage, with the actual volume available in any year varying depending on inflow conditions (8,000 ML a year on average).

Table 6-81 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

Table 6-81 Available water and take, Thomson basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Thomson Macalister – Southern Rural Water (1)					
Water shares (2)	-	255,602	0	255,602	137,666
Thomson Macalister towns – Gippsland Water	-	2,335	0	2,335	1,387
Macalister River Environmental Entitlement 2010 (3)	7,647	18,690	0	26,338	9,010
Operating provisions (4)	-	34,124	-	34,124	34,124
Net diversion: Thomson Macalister – Southern Rural Water (5)				*318,399*	*182,187*
Thomson River – Melbourne Water (1)	-	171,800	0	171,800	67,478
Thomson River – Environment (3)	19,611	20,924	0	40,535	19,599
Take and use licences – unregulated surface water	-	17,207	0	17,207	4,423
Licensed small catchment dams	-	3,175	0	3,175	585
Total 2020–21	**27,258**	**523,857**	**0**	**551,116**	**274,272**
Total 2019–20	20,320	501,077	0	521,397	250,628

Notes

(1) The water available to Melbourne Water and Southern Rural Water is determined by an inflow and storage capacity share in the system. In any year, available inflows will vary; entitlement holders may have water available from the previous year in their storage share, but the maximum annual amount that can be taken is shown here.

(2) 'Allocation issued' includes 25,125 ML of spill allocation made available to water shares holders in 2020–21.

(3) The water use reported reflects environmental use. The in-stream use is not reflected in the water balance in Table 6-76 as it does not represent an actual diversion from the waterway. Unused water is available to be carried over under these entitlements (Table 4-4).

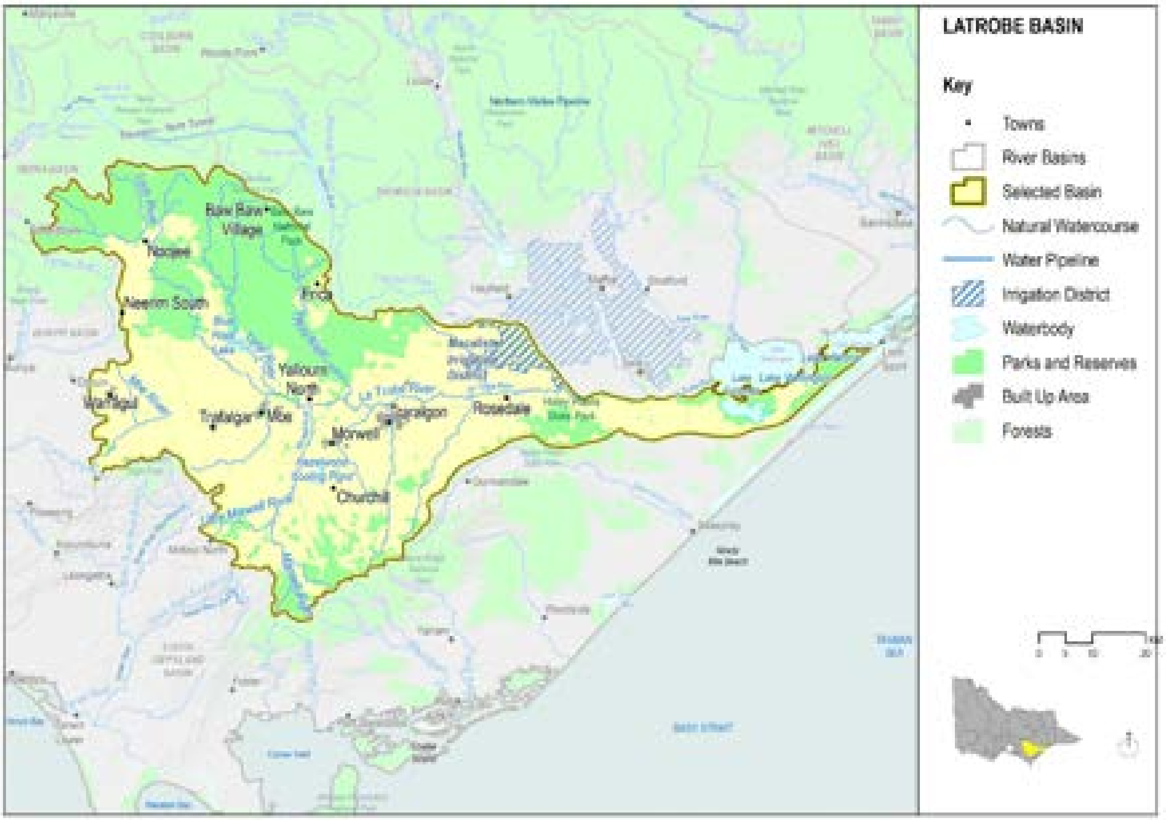
(4) This reflects the use of water to manage the system. It includes any loss incurred in supplying the primary entitlements. There is no specified volume for operating provisions under this source bulk entitlement.

(5) The water use reported in this line item represents the net diversion to supply primary entitlements and fulfil other operating requirements under the Thomson Macalister source bulk entitlement (net of return flow from irrigation). It includes in-stream environmental diversions of 9,010 ML.

6.14 Latrobe basin

The Latrobe basin (Figure 6-26) lies between the Strzelecki Ranges and the Great Dividing Range. The Latrobe River flows east and joins the Thomson River before flowing into the Gippsland Lakes.

Figure 6-26 Map of the Latrobe basin



6.14.1 Management arrangements

Management of water in the Latrobe basin is undertaken by various parties, as shown in Table 6-82.

Table 6-82 Water resource management responsibilities, Latrobe basin

Authority	Management responsibilities
Southern Rural Water	Manages the Macalister Irrigation District (which is supplied from the Thomson basin) Manages licensed diversions Operates part of the Latrobe water supply system including Blue Rock Reservoir and Lake Narracan for supply to Gippsland Water, the VEWH, power stations and licensed diverters
Gippsland Water	Supplies towns including Moe, Morwell and Traralgon Provides industrial supply to major industries Operates Moondarra Reservoir
West Gippsland Catchment Management Authority	Responsible for waterway and catchment management in the Latrobe basin

6.14.2 2020–21 water resources overview

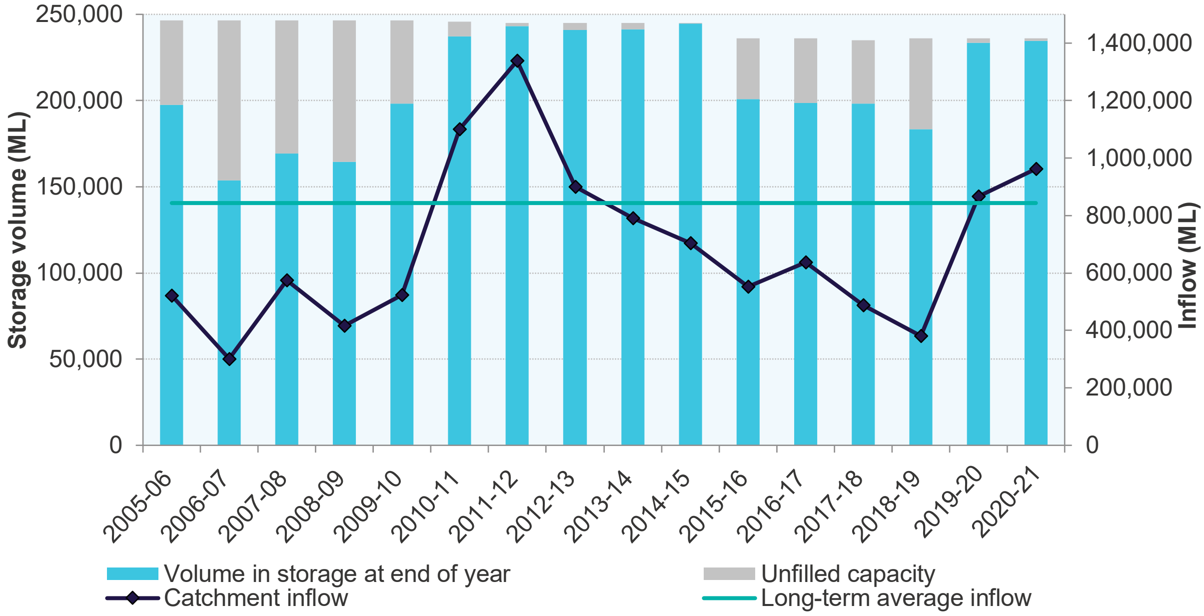
In 2020–21, rainfall was:

- above average in the north, centre and east of the basin over Noojee, Yallourn North, Traralgon, Rosedale and Lake Victoria
- very much above average in the basin's north-east, near Erica
- average in the south-west of the basin, near Morwell.

Catchment inflows to the basin in 2020–21 were 114% of the long-term average of 843,300 ML, greater than in 2019–20 when inflows were 103% of the long-term average.

Major storages in the basin were at 99% of capacity on 1 July 2020 and the same on 30 June 2021.

Figure 6-27 Storage volumes and catchment inflows, Latrobe basin



There were no restrictions placed on licensed diversions from unregulated streams in the Latrobe basin for the entirety of 2020–21, the same as in the previous year.

There were no restrictions on urban water use in the Latrobe basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 119,144 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was similar to the 122,226 ML diverted in the previous year.

6.14.2.1 Water for the environment

Environmental watering sites and environmental values in the Latrobe basin that depend on water for the environment include:

- the lower Latrobe wetlands (including Sale Common, Dowd Morass and Heart Morass, which are part of the internationally recognised Gippsland Lakes Ramsar site). The lower Latrobe wetlands provide habitat for a variety of waterbirds. Mature river red gums also grow adjacent to the wetlands and provide nesting habitat for sea eagles and other birds of prey that hunt in the wetlands
- the Latrobe River, which contains native estuarine and freshwater fish species including black bream, Australian bass and short- and long-finned eel as well as continuous stands of river red gums in its upper reaches. The banks along the lower reaches support stands of swamp scrub, an endangered vegetation group.

In 2020–21, water for the environment in the Latrobe basin comprised:

- the *Lower Latrobe Wetlands Environmental Entitlement 2010*, held by the VEWH, which allows water to be diverted to Dowd Morass, Sale Common and Heart Morass when river levels are above heights specified in the environmental entitlement
- the *Blue Rock Environmental Entitlement 2013*, held by the VEWH, which provides a 9.45% share of inflows into Blue Rock Reservoir
- water set aside for the environment through the operation of passing flow conditions:
  - on consumptive bulk entitlements held by Southern Rural Water and Gippsland Water
  - on licensed diversions
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

In 2020–21, no environmental water was delivered in-stream in the Latrobe basin. This was because all target flow components for the freshwater reaches of the Latrobe River were fully met or exceeded with natural flows and operational releases. 2020–21 was the first time no environmental flows were provided to the Latrobe River since the *Blue Rock Environmental Entitlement* was established in 2013.

6.14.3 Water balance

The total volumes of water available and supplied from water resources in the Latrobe basin in 2020–21 are shown in Table 6-83.

Table 6-83 Water balance, Latrobe basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	233,567	183,451
Volume in storage at the end of the year	1	234,757	233,567
Change in storage		**1,190**	**50,116**
Inflows			
Catchment inflow	2	961,926	866,562
Rainfall on major storages	1	10,098	12,802
Inflow from groundwater	3	26,858	13,954
Return flow from power stations and major industry	3	28,915	39,661
Treated wastewater discharged back to river	4	4,110	4,673
Total inflows		**1,031,906**	**937,652**
Outflows			
Diversions			
Urban and industrial diversions	3	100,745	100,647
Licensed diversions from regulated streams		6,453	6,377
Licensed diversions from unregulated streams		925	782
Small catchment dams	5	11,021	14,420
Total diversions		***119,144***	***122,226***
Losses			
Evaporation from major storages	1	14,370	14,636
Net evaporation from small catchment dams	5	1,945	337
In-stream infiltration to groundwater, flows to floodplain and evaporation	6	-	-
Total losses		***16,315***	***14,973***
Water passed at outlet of basin			
River outflows to the Gippsland Lakes (excluding Thomson River)		895,257	750,337
Total water passed at outlet of basin		***895,257***	***750,337***
Total outflows		**1,030,716**	**887,536**

6.14.3.1 Notes to the water balance

1. Storage volumes

Major — greater than 1,000 ML — on-stream storages in the Latrobe basin are included in the water balance. Table 6-84 shows how storage volumes changed during the year.

Table 6-84 Storage volumes, Latrobe basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflows less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Blue Rock Lake	198,280	198,337	6,406	8,953	3,447	199,237
Lake Narracan	7,230	4,772	2,023	2,882	1,148	5,062
Moondarra Reservoir	30,458	30,458	1,669	2,536	867	30,458
Total 2020–21	**235,968**	**233,567**	**10,098**	**14,370**	**5,462**	**234,757**
Total 2019–20	235,968	183,451	12,802	14,636	51,950	233,567

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, the known inflows and the net change in storage volume.

3. Other inflows

In 2020–21, 26,858 ML of groundwater was transferred into the waterway from an industrial site.

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Another 28,915 ML was returned back to the waterway after being diverted for power generation and other major industrial uses.

4. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-85 lists the wastewater treatment plants in the Latrobe basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

Table 6-85 Volume and use of recycled water, Latrobe basin

Wastewater treatment plant	Class of water	Volume of treated wastewater	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Mirboo North	C	85	85	100%	21	64	0	0	0	0
Moe	B	2,376	0	0%	0	0	0	0	2,376	0
Morwell	B	635	635	100%	0	0	635	0	0	0
Dutson Downs (regional outfall sewer)	B	10,575	0	0%	0	0	0	0	0	10,575
Saline wastewater outfall pipeline	n/a	8,953	0	0%	0	0	0	0	0	8,953
Warragul	B	1,734	0	0%	0	0	0	0	1,734	0
Willow Grove	C	22	22	100%	0	22	0	0	0	0
Total 2020–21		**24,380**	**742**	**3%**	**21**	**86**	**635**	**0**	**4,110**	**19,528**
Total 2019–20		25,151	774	3%	13	39	722	0	4,673	19,704

n/a Data not available

5. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-86 provides information about small catchment dams in the basin.

Table 6-86 Estimated small catchment dam information, Latrobe basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	15,339	5,030	1,365	6,396
Registered/licensed commercial and irrigation	16,170	5,991	580	6,570
Total 2020–21	**31,509**	**11,021**	**1,945**	**12,966**
Total 2019–20	31,509	14,420	337	14,757

6. In-stream infiltration to groundwater, flows to floodplain and evaporation

An assessment of in-stream infiltration to groundwater, flows to floodplain and evaporation is not made in the Latrobe basin as there are no suitable models, and the distribution of streamflow gauges across the basin makes it difficult to estimate in-stream losses (see chapter 6.1.5.3).

6.14.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Latrobe – Key compliance points
✓ **There was no net increase in the total entitlement volume from the previous year.**
✓ **The total volume diverted (114,114 ML) was within the volume available for the year (265,268 ML).**
✓ **No individual bulk entitlement holder took more than the annual volume made available to them.**
✓ **Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlements in the Latrobe basin provide the basis for how water is shared in the basin. Rights to water in the Latrobe basin are set out in Table 6-87.

The *Lower Latrobe Wetlands Environmental Entitlement 2010* held by the VEWH provides for unregulated flows in the Latrobe River to be diverted to floodplain wetlands. The volume of unregulated flows available for diversion varies depending on seasonal conditions.

Table 6-87 Entitlement volumes, Latrobe basin

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Blue Rock Environmental Entitlement 2013 (1)	n/a	n/a
Bulk Entitlement (Boolarra) Conversion Order 1997	145	145
Bulk Entitlement (Gippsland Water – Blue Rock) Conversion Order 1997 (2)	20,000	20,000
Bulk Entitlement (Erica) Conversion Order 1997	340	340
Bulk Entitlement (Latrobe – Southern Rural) Conversion Order 1996 (3)	13,400	13,400
Lower Latrobe Wetlands Environmental Entitlement 2010 (4)	n/a	n/a
Bulk Entitlement (Mirboo North) Conversion Order 1997	270	270
Bulk Entitlement (Moe – Narracan Creek) Conversion Order 1998	3,884	3,884
Bulk Entitlement (Moondarra Reservoir) Conversion Order 1997	62,000	62,000
Bulk Entitlement (Noojee) Conversion Order 1997	73	73
Bulk Entitlement (Thorpdale) Conversion Order 1997 (5)	80	80
Bulk Entitlement (Latrobe – Loy Yang B) Conversion Order 1996 (2)	20,000	20,000
Bulk Entitlement (Latrobe – Loy Yang A) Conversion Order 1996 (2)	40,000	40,000
Bulk Entitlement (Latrobe – Loy Yang 3/4 Bench) Conversion Order 1996 (2)	25,000	25,000
Bulk Entitlement (Latrobe – Yallourn) Conversion Order 1996 (2)	36,500	36,500
Bulk Entitlement (Latrobe Reserve) Order 2013 (6)	n/a	n/a
Take and use licences – unregulated surface water (7)	12,940	12,993
Licensed small catchment dams – on-waterway	10,928	10,875
Licensed small catchment dams – off-waterway	5,242	5,242
Total	**250,802**	**250,802**

Notes

(1) The *Blue Rock Environmental Entitlement 2013* consists of a 9.45% share of inflows into storage, with the actual volume available in any year varying depending on inflow conditions.

(2) The water available is determined by an inflow and storage capacity share in the system. In any year, available inflows will vary; entitlement holders may have water available from the previous year in their storage share, but the maximum annual amount that can be taken is shown here.

(3) This entitlement supplies water for take and use licences on the Tanjil River and the lower Latrobe River: there was 11,215 ML of take and use entitlement volume as of 30 June 2021.

(4) The *Lower Latrobe Wetlands Environmental Entitlement 2010* allows flows to be diverted to wetlands. The volume of flows available for diversion varies depending on suitable river heights as specified in the entitlement. As such, an annual volume is not applicable for this entitlement.

(5) Thorpdale is no longer supplied from the Easterbrook Creek under the *Thorpdale Bulk Entitlement 1997*. Since September 2015, Thorpdale has been supplied by water carting from the Moe treated water system. This is now the normal supply arrangement for Thorpdale.

(6) The Latrobe Reserve consists of an 18.87% share of inflows into Blue Rock Reservoir after passing flow requirements have been met. This bulk entitlement is held by Southern Rural Water and managed in line with very specific rules to provide a reserve of water for the bulk/environmental entitlement holders and section 51 licence holders in the Latrobe regulated system.

(7) The volume of unregulated surface water entitlements includes licences for in-stream diversions. In the Latrobe basin, there is 5,000 ML of in-stream licence as well as 457 ML of licence for extraction with full return to the waterway.

Table 6-88 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

Table 6-88 Available water and take, Latrobe basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Blue Rock Environmental Entitlement (1)	18,746	507	0	19,253	0
Boolarra	-	145	0	145	0
Gippsland Water – Blue Rock (2)	-	15,150	0	15,150	2,268
Erica	-	340	0	340	60
Latrobe – Southern Rural Water (3)	-	13,582	50	13,632	6,453
Lower Latrobe Wetlands Environmental Entitlement (4)	-	-	-	-	-
Mirboo North	-	270	0	270	178
Moe – Narracan Creek	-	3,884	0	3,884	2,299
Moondarra Reservoir	-	62,000	0	62,000	32,480
Noojee (5)	-	73	0	73	0
Thorpdale	-	80	0	80	0
Latrobe – Loy Yang B (2)	-	20,000	0	20,000	19,643
Latrobe – Loy Yang A (2)	-	40,000	0	40,000	20,623
Latrobe – Loy Lang 3/4 Bench (2)	-	25,000	0	25,000	0
Latrobe – Yallourn (2)	-	36,500	0	36,500	23,194
Latrobe Reserve (6)	-	50	(50)	0	0
Take and use licences – unregulated surface water	-	12,759	(68)	12,691	925
Licensed small catchment dams	-	16,182	68	16,250	5,991
Total 2020–21	**18,746**	**246,522**	**0**	**265,268**	**114,114**
Total 2019–20	9,260	257,900	0	267,160	118,588

Notes

(1) The water use reported reflects environmental in-stream use. This amount is not reflected in the water balance in Table 6-83 as it is not an actual diversion from the waterway. Unused water is available to carry over in this system. For details, refer to Table 4-4.

(2) The water available to entitlement holders is determined by an inflow and storage capacity share in the system. In any year, available inflows will vary; entitlement holders may have water available from the previous year in their storage share, but the maximum annual amount that can be taken is shown here.

(3) This represents the water available and used by take and use licence holders. Allocation issued includes 1,941 ML of water made available to take and use licences under spill rules.

(4) Use of this entitlement depends on suitable river heights, as specified in the entitlement. In 2020–21, water under this entitlement was used to inundate Sale Common, Heart Morass and Dowd Morass. Volumes delivered in the wetlands are not measured.

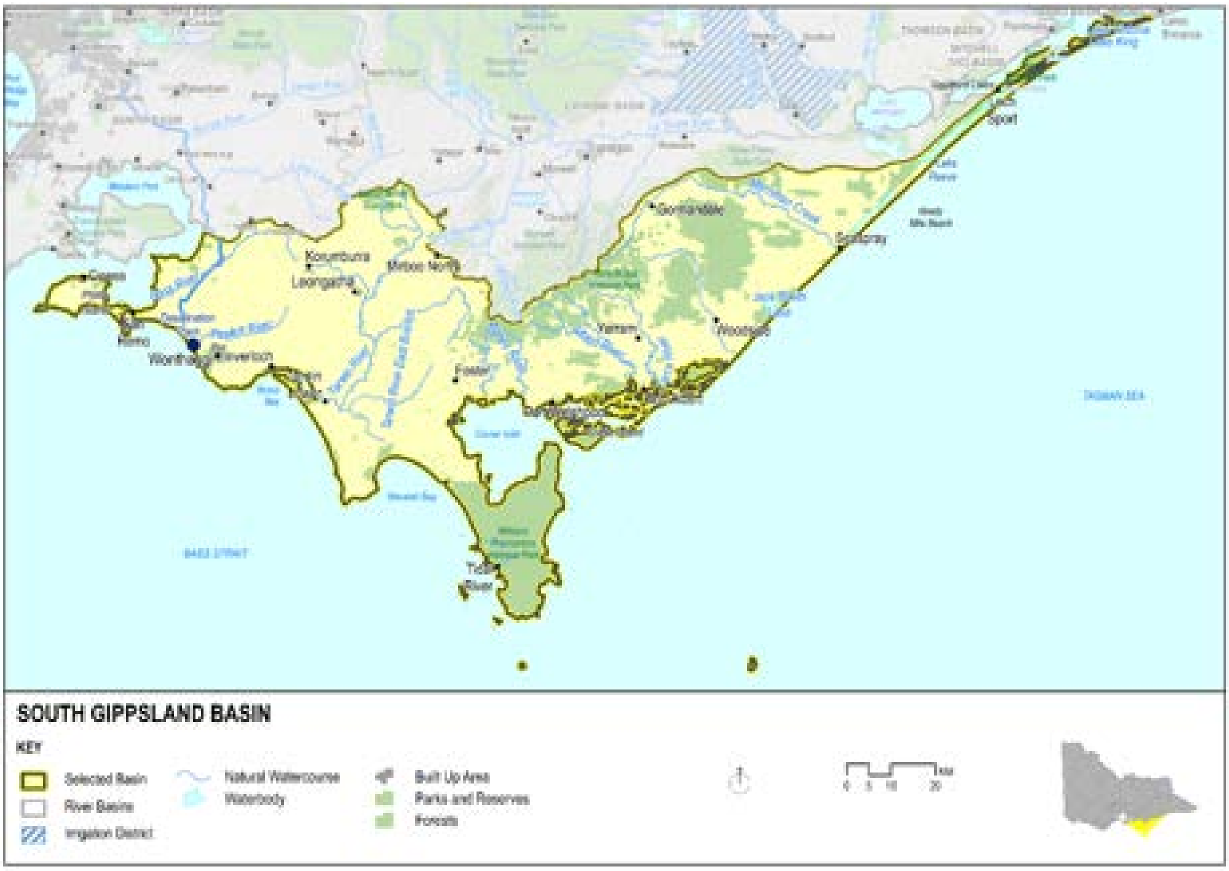
(5) Gippsland Water is not taking water from the Loch River under its Noojee bulk entitlement, and instead it supplies Noojee from Tarago Reservoir in the Bunyip basin.

(6) In line with the rules in the Latrobe Reserve bulk entitlement, licence holders purchased 50 ML of temporary water from the reserve.

6.15 South Gippsland basin

The South Gippsland basin (Figure 6-28) is in south-east Victoria. The basin includes the Bass River, which flows into Western Port and smaller rivers that flow directly into Bass Strait.

Figure 6-28 Map of the South Gippsland basin



6.15.1 Management arrangements

Management of water in the South Gippsland basin is undertaken by various parties, as shown in Table 6-89.

Table 6-89 Water resource management responsibilities, South Gippsland basin

Authority	Management responsibilities
Southern Rural Water	Manages surface water licensed diversions
South Gippsland Water	Supplies towns including Leongatha, Inverloch, Wonthaggi, Korumburra and Foster
Westernport Water	Supplies towns including San Remo and Phillip Island
Gippsland Water	Supplies towns in the far east of the basin including Seaspray
West Gippsland Catchment Management Authority	Manages most waterways and catchment in the South Gippsland basin
Melbourne Water	Manages waterways in the far west of the South Gippsland basin
AquaSure (Consortium of Thiess and Suez)	Operate the Victorian Desalination Project, located near Wonthaggi

6.15.2 2020–21 water resources overview

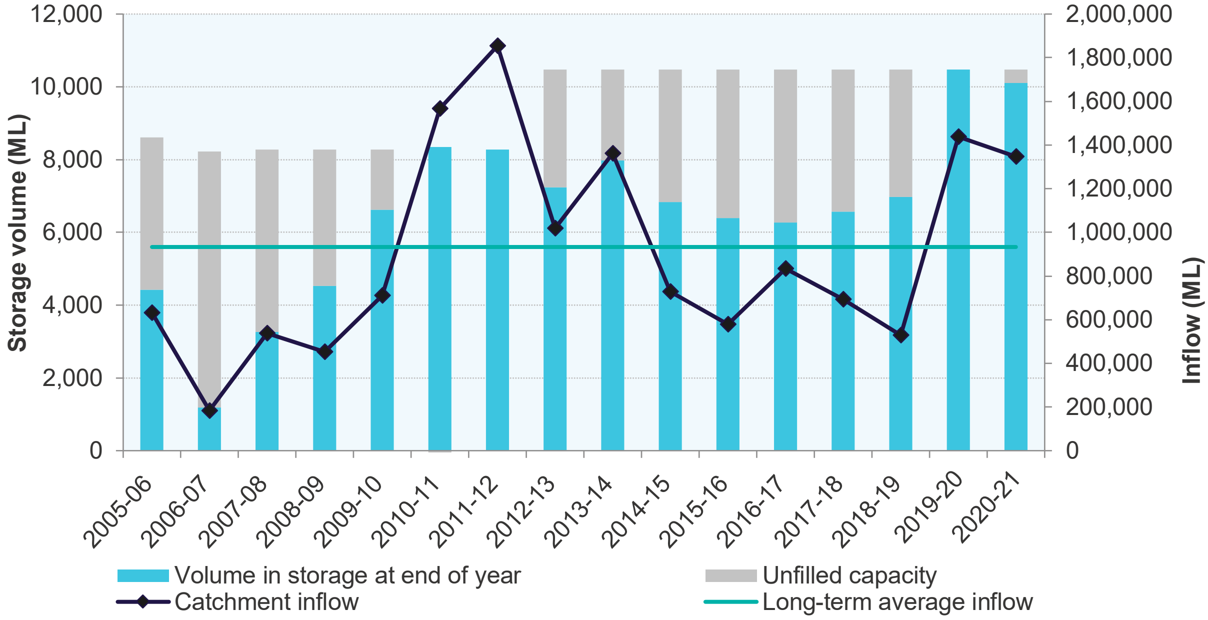
In 2020–21, rainfall was:

- average in the east of the basin, to Snake Island
- above average in the west of the basin
- very much above average in a small area near Yarram.

Catchment inflows to the basin in 2020–21 were 144% of the long-term average of 932,900 ML, less than in 2019–20, when inflows were 154% of the long-term average. The amount of water flowing from the South Gippsland basin into Bass Strait and Western Port represented 98% of the catchment inflows to the basin in 2020–21.

Major storages in the basin were at 100% of capacity on 1 July 2020 and slightly lower (at 96% of capacity) on 30 June 2021.

Figure 6-29 Storage volumes and catchment inflows, South Gippsland basin



Key aspects of restrictions on licensed diversions from unregulated streams in the South Gippsland basin in 2020–21 were:

- a total ban on Merrimans Creek in December 2020 and from February to March 2021
- total bans on the remaining three streams from February to March 2021.
- a peak of four streams were restricted in February, four more than in the previous year
- all bans were lifted by the end of March 2021.

There were no restrictions on urban water use in the South Gippsland basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 25,926 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 27,098 ML diverted in the previous year.

6.15.2.1 Water for the environment

Environmental watering sites and environmental values in the South Gippsland basin that depend on water for the environment include:

- the Bald Hills Wetland, which is a rehabilitated wetland complex that supports rare and intact vegetation communities in a largely agricultural environment
- the Bunurong Coast wetlands, which provide habitat connectivity with the marine and estuarine systems
- Corner Inlet and Western Port, which are listed as internationally significant wetlands under the Ramsar Convention and rely on freshwater inputs from the South Gippsland basin to function ecologically
- the Australian grayling population, listed in the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* and the Victorian *Flora and Fauna Guarantee Act 1988*, which also relies on water for the environment.

In 2020–21, water for the environment in the South Gippsland basin comprised:

- water set aside for the environment through the operation of passing flow conditions:
  - on consumptive bulk entitlements held by Gippsland Water and South Gippsland Water
  - on licensed diversions
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

6.15.3 Water balance

The total volumes of water available and supplied from water resources in the South Gippsland basin in 2020–21 are shown in Table 6-90.

Table 6-90 Water balance, South Gippsland basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	10,471	6,974
Volume in storage at the end of the year	1	10,099	10,471
Change in storage		**(372)**	**3,497**
Inflows			
Catchment inflow	2	1,345,789	1,439,013
Rainfall on major storages	1	1,894	1,820
Treated wastewater discharged back to river	3	1,563	1,552
Total inflows		**1,349,246**	**1,442,385**
Outflows			
Diversions			
Urban diversions		7,230	6,591
Licensed diversions from unregulated streams		1,931	2,119
Small catchment dams	4	16,765	18,388
Total diversions		***25,926***	***27,098***
Losses			
Evaporation from major storages	1	1,463	1,853
Net evaporation from small catchment dams	4	4,440	811
In-stream infiltration to groundwater, flows to floodplain and evaporation	5	-	-
Total losses		***5,903***	**2,664**
Water passed at outlet of basin			
River outflows to Bass Strait and Westernport		1,317,789	1,409,126
Total water passed at outlet of basin		***1,317,789***	***1,409,126***
Total outflows		**1,349,618**	**1,438,888**

6.15.3.1 Notes to the water balance

1. Storage volumes

Major — greater than 1,000 ML — on-stream storages in the South Gippsland basin are included in the water balance. Table 6-91 shows how storage volumes changed during the year.

Table 6-91 Storage volumes, South Gippsland basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflows less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Candowie Reservoir	4,463	4,463	818	630	(188)	4,463
Hyland Reservoir	671	671	90	76	(111)	574
Lance Creek Reservoir	4,200	4,200	846	631	(317)	4,098
Western Reservoir	1,137	1,137	140	126	(187)	964
Total 2020–21	**10,471**	**10,471**	**1,894**	**1,463**	**(803)**	**10,099**
Total 2019–20	10,471	6,974	1,820	1,853	3,530	10,471

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, the known inflows and the net change in storage volume.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-92 lists the wastewater treatment plants in the South Gippsland basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

Recycling opportunities within the basin are limited due to a small industrial base and crop types that are not suited to recycled water. Westernport Water reuses water from its treatment plants at Coronet Bay and Cowes for sporting fields and significant gardens. Gippsland Water operates the Seaspray wastewater treatment plant and reuses all the recycled water to irrigate pasture.

Table 6-92 Volume and use of recycled water, South Gippsland basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Coronet Bay [1]	B	247	98	40%	0	98	0	0	200	0
Cowes [2]	C, A	1,439	28	2%	0	20	0	8	0	1,411
Foster	C	143	0	0%	0	0	0	0	0	143
Korumburra	B	694	0	0%	0	0	0	0	694	0
Leongatha Domestic	B	617	0	0%	0	0	0	0	617	0
Leongatha Trade Waste	n/a	927	0	0%	0	0	0	0	0	927
Meeniyan	B	45	3	7%	2	2	0	0	41	0
Seaspray	C	9	9	100%	0	9	0	0	0	0
Toora	C	48	2	4%	2	0	0	0	0	46
Waratah Bay	C	21	10	48%	0	10	0	0	11	0
Welshpool	C	79	0	0%	0	0	0	0	0	79
Wonthaggi / Cape Paterson / Inverloch	C	1,599	0	0%	0	0	0	0	0	1,599
Yarram / Tarraville	C	178	178	100%	0	178	0	0	0	0
Total 2020–21		**6,046**	**328**	**5%**	**4**	**317**	**0**	**8**	**1,563**	**4,205**
Total 2019–20		6,352	361	6%	50	294	0	17	1,552	4,439

Notes
n/a Data not available
(1) At Coronet Bay, 51 ML of water was carried over from the previous year, and 200 ML of treated effluent was discharged to Guys Creek from the King Road treatment plant, which is permissible under a wet weather licence condition.
(2) At the Cowes treatment plant, the wet year limited re-use, and the Class A RWTP remained offline due to operational issues.

4. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-93 provides information about small catchment dams in the basin.

Table 6-93 Estimated small catchment dam information, South Gippsland basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	31,856	11,152	3,741	14,893
Registered/licensed commercial and irrigation	13,942	5,613	699	6,312
Total 2020–21	**45,798**	**16,765**	**4,440**	**21,205**
Total 2019–20	45,798	18,388	811	19,199

5. In-stream infiltration to groundwater, flows to floodplain and evaporation

An assessment of in-stream infiltration to groundwater, flows to floodplain and evaporation was not made in the South Gippsland basin as there are no suitable models, and the distribution of streamflow gauges across the basin makes it difficult to estimate in-stream losses (see chapter 6.1.5.3).

6.15.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

South Gippsland – Key compliance points	
✓	**There was no net increase in the total entitlement volume from the previous year.**
✓	**The total volume diverted (14,774 ML) was within the volume available for the year (44,831 ML).**
✓	**No individual bulk entitlement holder took more than the annual volume made available to them.**
✓	**Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlements in the South Gippsland basin provide the basis for how water is shared in the basin. Rights to water in the South Gippsland basin are set out in Table 6-94.

Table 6-94 Entitlement volumes, South Gippsland basin

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Devon North Alberton–Yarram and Port Albert) Conversion Order 1997	853	853
Bulk Entitlement (Dumbalk) Conversion Order 1997	100	100
Bulk Entitlement (Fish Creek) Conversion Order 1997	251	251
Bulk Entitlement (Foster) Conversion Order 1997	326	326
Bulk Entitlement (Korumburra) Conversion Order 1997	1,000	1,000
Bulk Entitlement (Leongatha) Conversion Order 1997	2,476	2,476
Bulk Entitlement (Loch, Poowong and Nyora) Conversion Order 1997	420	420
Bulk Entitlement (Meeniyan) Conversion Order 1997	200	200
Bulk Entitlement (Seaspray) Conversion Order 1997	133	133
Bulk Entitlement (Toora Port Franklin–Welshpool and Port Welshpool) Conversion Order 1997	1,617	1,617
Bulk Entitlement (Westernport) Conversion Order 1997	2,911	2,911
Bulk Entitlement (Westernport–Bass River) Order 2009	3,000	3,000
Bulk Entitlement (Wonthaggi–Inverloch) Conversion Order 1997	5,600	5,600
Take and use licences – unregulated surface water	11,998	12,003
Licensed small catchment dams – on-waterway	3,222	3,222
Licensed small catchment dams – off-waterway	10,719	10,754
Total	**44,827**	**44,866**

Table 6-95 shows the amount available to be taken by entitlement holders and the amount they took in the water year.

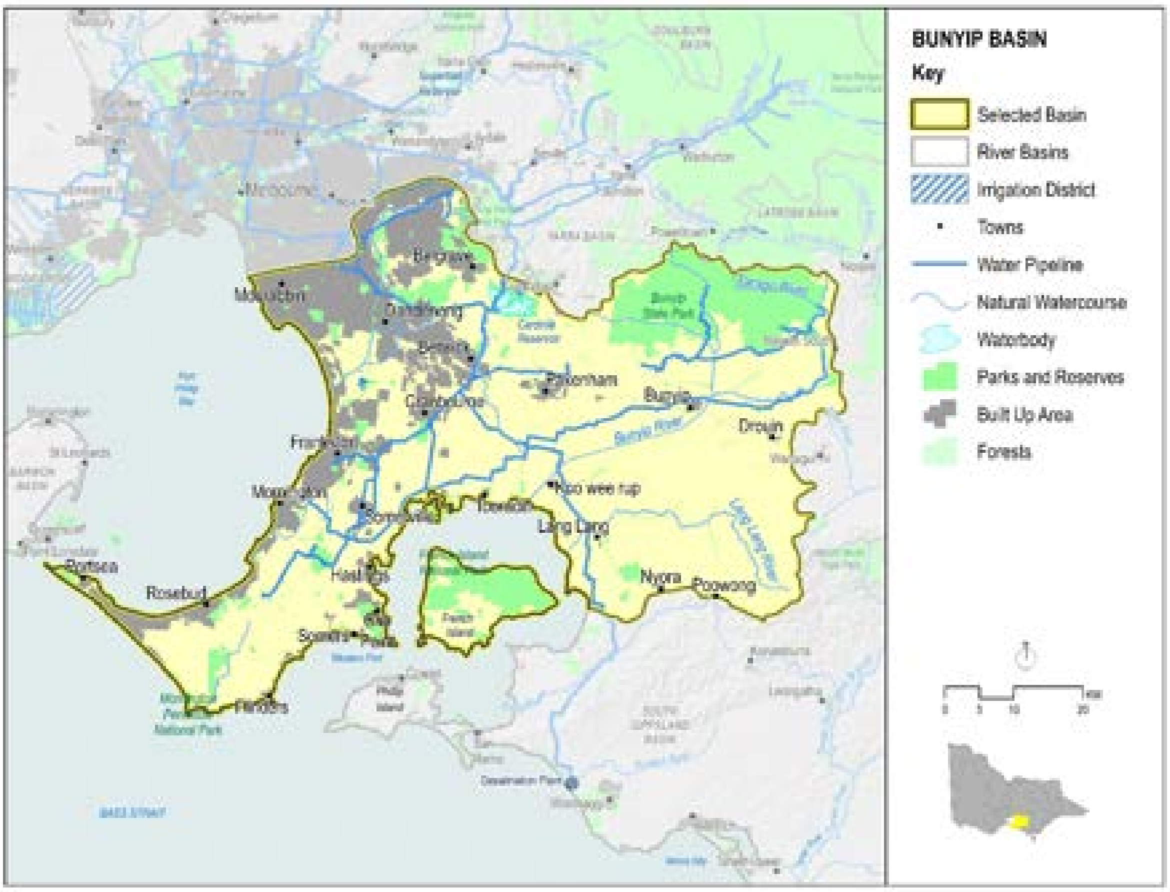
Table 6-95 Available water and take, South Gippsland basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Devon North Alberton–Yarram and Port Albert	-	853	0	853	442
Dumbalk	-	100	0	100	16
Fish Creek	-	251	0	251	102
Foster	-	326	0	326	219
Korumburra	-	1,000	0	1,000	0
Leongatha	-	2,476	0	2,476	1,735
Loch, Poowong and Nyora	-	420	0	420	0
Meeniyan	-	200	0	200	47
Seaspray	-	133	0	133	34
Toora Port Franklin–Welshpool and Port Welshpool	-	1,617	0	1,617	450
Westernport	-	2,911	0	2,911	2,106
Westernport–Bass River	-	3,000	0	3,000	0
Wonthaggi–Inverloch	-	5,600	0	5,600	2,079
Take and use licences – unregulated surface water	-	12,003	0	12,003	1,931
Licensed small catchment dams	-	13,942	0	13,942	5,613
Total 2020–21	**-**	**44,831**	**0**	**44,831**	**14,774**
Total 2019–20	-	44,881	0	44,881	14,957

6.16 Bunyip basin

The Bunyip basin (Figure 6-30) is located south-east of Melbourne's inner suburbs. The basin includes the Lang Lang and Bunyip rivers, which flow into Western Port, and the Patterson River, which flows into Port Phillip Bay. Melbourne's middle and outer south-eastern suburbs are located within the Bunyip basin.

Figure 6-30 Map of the Bunyip basin



6.16.1 Management arrangements

Management of water in the Bunyip basin is undertaken by various parties, as shown in Table 6-96.

Table 6-96 Water resource management responsibilities, Bunyip basin

Authority	Management responsibilities
Southern Rural Water	Manages surface water and private licensed diversions
Melbourne Water	Operates Eastern Treatment Plant Provides bulk water supply to South East Water Operates Tarago Reservoir Responsible for waterway management in the Bunyip basin
South East Water	Supplies part of the metropolitan Melbourne area including Dandenong, Frankston, Pakenham and the Mornington Peninsula (1)
Gippsland Water	Supplies towns in the east of the basin including Drouin and Neerim South
Port Phillip and Westernport Catchment Management Authority	Responsible for catchment management in the Bunyip basin

Note
(1) Metropolitan Melbourne is mostly supplied from the Yarra and Thomson basins.

6.16.2 2020–21 water resources overview

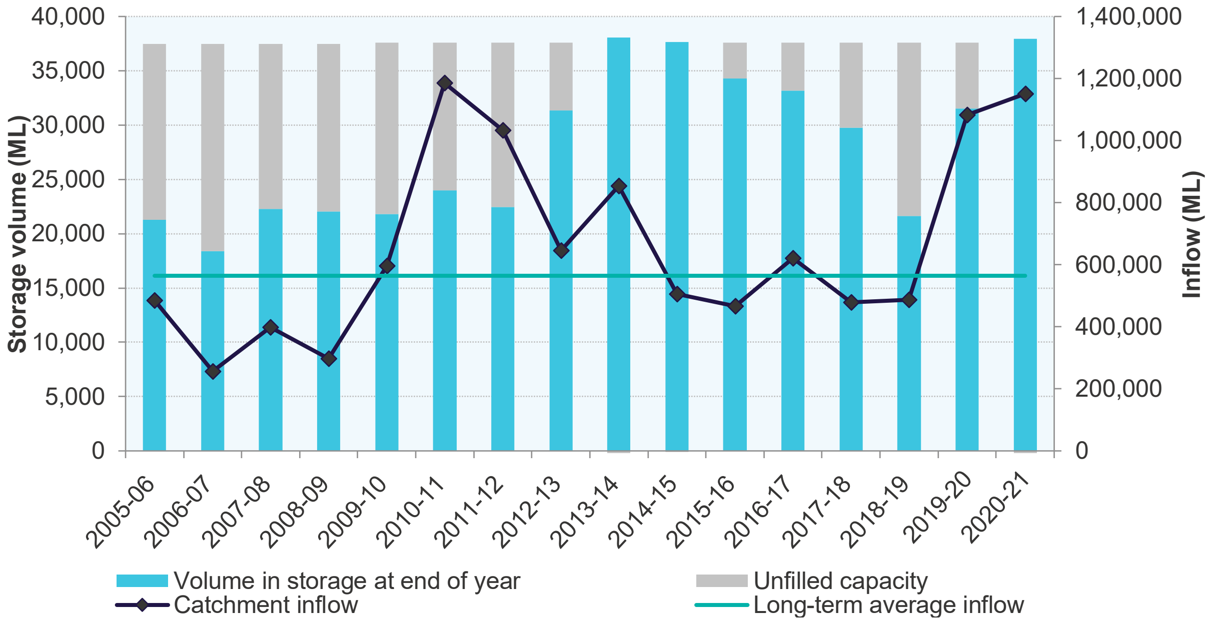
In 2020–21, rainfall was:

- average in most of the basin
- above average in the north-east of the basin, from Belgrave to Neerim South
- above average in the far west of the basin, from Rosebud to Portsea.

Catchment inflows to the basin in 2020–21 were 204% of the long-term average of 564,400 ML, greater than in 2019–20 when inflows were 192% of the long-term average. The amount of water flowing from the Bunyip basin into Port Phillip Bay and Western Port represented 95% of the inflows to the basin in 2020–21.

Major storages in the basin were at 84% of capacity on 1 July 2020 and higher (at 100% of capacity) on 30 June 2021.

Figure 6-31 Storage volumes and catchment inflows, Bunyip basin



There were no restrictions placed on licensed diversions from unregulated streams in the Bunyip basin for the entirety of 2020–21, the same as in the previous year.

There were no restrictions on urban water use in the Bunyip basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 37,313 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 40,783 ML diverted in the previous year.

6.16.2.1 Water for the environment

Environmental watering sites and environmental values in the Bunyip basin that depend on water for the environment include:

- Western Port, which is listed as an internationally significant wetland under the Ramsar Convention and which relies on freshwater inputs from the Bunyip basin to function ecologically
- populations of threatened dwarf galaxias and Australian grayling.

In 2020–21, water for the environment in the Bunyip basin comprised:

- the *Tarago and Bunyip Rivers Environmental Entitlement 2009*, comprising 10.3% of inflows (on average 3,000 ML a year) held by the VEWH
- water set aside for the environment through the operation of passing flows conditions:
  - as part of the environmental entitlement held by the VEWH
  - on consumptive bulk entitlements held by Gippsland Water and Melbourne Water
  - on licensed diversions
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

In 2020–21, 1,334 ML of environmental water was delivered in-stream in the Bunyip basin.

6.16.3 Water balance

The total volumes of water available and supplied from water resources in the Bunyip basin in 2020–21 are shown in Table 6-97.

Table 6-97 Water balance, Bunyip basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	31,528	21,611
Volume in storage at the end of the year	1	37,923	31,528
Change in storage		**6,395**	**9,917**
Inflows			
Catchment inflow	2	1,150,940	1,083,251
Rainfall on major storages	1	4,357	3,717
Treated wastewater discharged back to river	3	2,205	1,557
Total inflows		**1,157,502**	**1,088,525**
Outflows			
Diversions			
Urban diversions		17,263	18,737
Licensed diversions from regulated streams	4	0	102
Licensed diversions from unregulated streams	4	2,826	3,882
Small catchment dams	5	17,223	18,062
Total diversions		***37,313***	***40,783***
Losses			
Evaporation from major storages	1	3,367	2,837
Net evaporation from small catchment dams	5	4,109	2,687
In-stream infiltration to groundwater, flows to floodplain and evaporation		2,077	1,314
Total losses		***9,553***	***6,838***
Water passed at outlet of basin			
River outflows to Port Phillip Bay and Western Port		1,104,242	1,030,987
Total water passed at outlet of basin		***1,104,242***	***1,030,987***
Total outflows		**1,151,107**	**1,078,608**

6.16.3.1 Notes to the water balance

1. Storage volumes

The one major — greater than 1,000 ML — on-stream storage in the Bunyip basin is included in the water balance. Table 6-98 shows how storage volumes changed during the year. Although Cardinia Reservoir is in the Bunyip basin, it is reported in the Yarra basin (see chapter 6.17.3).

Table 6-98 Storage volumes, Bunyip basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflows less regulated releases (ML)	End volume in store (ML)
On-stream storage						
Tarago Reservoir	37,580	31,528	4,357	3,367	5,405	37,923
Total 2020–21	**37,580**	**31,528**	**4,357**	**3,367**	**5,405**	**37,923**
Total 2019–20	37,580	21,611	3,717	2,837	9,037	31,528

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, the known inflows and the net change in storage volume.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin.

Table 6-99 lists the wastewater treatment plants in the Bunyip basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

Table 6-99 Volume and use of recycled water, Bunyip basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to the sea / other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Blind Bight	C	188	188	100%	0	188	0	0	0	0
Boneo (1)	A, B	4,741	855	18%	48	798	0	9	0	3,886
Drouin	B, C	1,047	99	9%	10	89	0	0	948	0
Eastern Treatment Plant	A	151,416	14,442	10%	5,812	0	0	8,630	0	136,974
Koo Wee Rup (2)	C	148	137	93%	0	85	0	52	11	0
Lang Lang (3)	A, C	203	5	2%	0	0	0	5	198	0
Longwarry (4)	C	346	72	21%	0	72	0	0	274	0
Mt Martha (5)	A	5,864	734	13%	0	8	0	725	0	6,748
Neerim South	B	58	0	0%	0	0	0	0	58	0
Pakenham (6)	A, C	1,344	688	51%	68	565	0	55	656	0
Somers (7)	A+, C	2,139	461	22%	219	53	0	190	60	0
Total 2020–21		**167,494**	**17,681**	**11%**	**6,157**	**1,858**	**0**	**9,666**	**2,205**	**147,608**
Total 2019–20		172,316	17,925	10%	5,857	1,931	0	10,137	1,557	152,834

Notes

(1) The Boneo treatment plant used potable water within the process for most of 2020–21 due to the stage 4 upgrade.
(2) At the Koo Wee Rup treatment plant, totals include 20 ML of evaporation.
(3) At the Lang Lang treatment plant, totals include 11 ML of evaporation.
(4) At the Longwarry treatment plant, totals include 62 ML of evaporation.
(5) At the Mt Martha treatment plant, the 'Volume of treated wastewater produced' does not include an additional 1,617 ML of effluent that was received from the Somers treatment plant. This amount is reflected in the 'Volume discharged to the sea/ other' in this table.
(6) At the Pakenham treatment plant, 8 ML from Class C was reused at Pakenham golf club; the rest from Class A.
(7) At the Somers treatment plant, 1,617 ML of effluent was transferred to the Mt Martha treatment plant for further treatment. This amount is not reflected in the volume discharged or used in this table.

4. Licensed diversions

Licensed diversions from regulated streams represents the volume taken by Southern Rural Water under its Tarago River bulk entitlement, which is water is released from Tarago Reservoir to supplement unregulated flows for section 51 licence holders downstream of the reservoir.

Licensed diversions from unregulated streams is a calculated value to represent the unregulated flow volume taken by section 51 licence holders in the Bunyip and Tarago rivers. This value is calculated by subtracting the volume taken by Southern Rural Water under its Tarago River bulk entitlement (minus a loss factor to account for in-stream loss) from the metered volume taken by section 51 licence holders. This calculation ensures that the diversion of water by section 51 licence holders is not overstated.

5. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-100 provides information about small catchment dams in the basin.

Table 6-100 Estimated small catchment dam information, Bunyip basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	23,665	8,139	2,963	11,102
Registered/licensed commercial and irrigation	23,587	9,084	1,146	10,230
Total 2020–21	**47,252**	**17,223**	**4,109**	**21,332**
Total 2019–20	47,251	18,061	2,687	20,749

6.16.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year

- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Bunyip – Key compliance points
✓ **There was a net increase of 14 ML in total entitlement volume from the previous year.** • An increase of 35 ML of licensed small catchment dams occurred to correct a data error (previously recorded in the South Gippsland basin); the total change in entitlement volume was also affected by the cancellation of 21 ML of licences.
✓ **The total volume diverted (30,508 ML) was within the volume available for the year (81,469 ML).**
✓ **No individual bulk entitlement holder took more than the annual volume made available to them.**
✓ **Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlements in the Bunyip basin provide the basis for how water is shared in the basin. Rights to water in the Bunyip basin are set out in Table 6-101.

Melbourne Water holds a bulk entitlement to divert surface water in the Bunyip basin. This entitlement is one of four that contribute to the Greater Yarra system – Thomson River Pool, which primarily supplies Melbourne and supports regional urban water corporations Barwon Water, Western Water, South Gippsland Water and Westernport Water (Table 6-104 and Table 6-105).

The *Tarago and Bunyip Rivers Environmental Entitlement 2009* provides the VEWH with a 10.3% share of inflows to Tarago Reservoir. The water available under the entitlement is used to support streamflows and is not diverted out of the waterway.

Table 6-101 Entitlement volumes, Bunyip basin

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Tarago River – Gippsland Water) Conversion Order 2009 (1)	4,825	4,825
Bulk Entitlement (Tarago River – Southern Rural Water) Conversion Order 2009 (2)	1,260	1,260
Bulk Entitlement (Tarago and Bunyip Rivers – Melbourne Water) Order 2014 (3)	30,510	30,510
Tarago and Bunyip Rivers Environmental Entitlement 2009 (4)	n/a	n/a
Take and use licences – unregulated surface water (5)	16,858	16,769
Licensed small catchment dams – on-waterway	2,120	2,213
Licensed small catchment dams – off-waterway	21,467	21,450
Total	**77,040**	**77,026**

Notes

(1) The maximum volume that can be taken each year is 275 ML, plus 22,750 ML over any five-year period (4,550 ML annual average).
(2) The maximum volume that can be taken over any five-year period is 6,300 ML (1,260 ML annual average).
(3) Melbourne Water holds the source bulk entitlement in the Tarago and Bunyip rivers and can take an average annual amount of up to 30,510 ML over any consecutive five-year period. This water is used to supply primary entitlement holders — City West Water, South East Water, Yarra Valley Water, Barwon Water, Western Water, South Gippsland Water and Westernport Water — with entitlement to the Greater Yarra system – Thomson River Pool, which sources water from the Yarra River, Thomson River, Tarago River, Silver Creek and Wallaby Creek.
(4) The *Tarago and Bunyip Rivers Environmental Entitlement 2009* consists of a 10.3% share of inflows into storage, with the actual volume available in any year varies depending on inflow conditions.
(5) Southern Rural Water's Tarago River bulk entitlement is used to supplement unregulated flows for licence holders in the Tarago River downstream of the Tarago Reservoir and upstream of the Bunyip River confluence, and in the Bunyip River downstream of the Tarago River confluence and upstream of the Koo Wee Rup-Pakenham Road bridge. Therefore, the total entitlement volume shown as 'Take and use licences – unregulated surface water'' includes some licences that are partly supplied by regulated water taken under Southern Rural Water's Tarago River bulk entitlement.

Table 6-102 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

Table 6-102 Available water and take, Bunyip basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Tarago River – Gippsland Water	-	4,825	0	4,825	3,598
Tarago River – Southern Rural Water [1] [3]	-	1,260	0	1,260	0
Tarago and Bunyip Rivers – Melbourne Water	-	30,510	0	30,510	13,665
Tarago and Bunyip Rivers Environmental Entitlement [2]	3,766	568	0	4,334	1,334
Take and use licences – unregulated surface water [3]	-	16,781	93	16,873	2,826
Licensed small catchment dams	-	23,759	(93)	23,667	9,084
Total 2020–21	**-**	**77,703**	**0**	**81,469**	**30,508**
Total 2019–20	-	79,456	30	81,010	32,271

Notes

(1) Water use represents the volume of water ordered via regulated release from Tarago Reservoir to supply licensed diverters downstream of Tarago Reservoir.

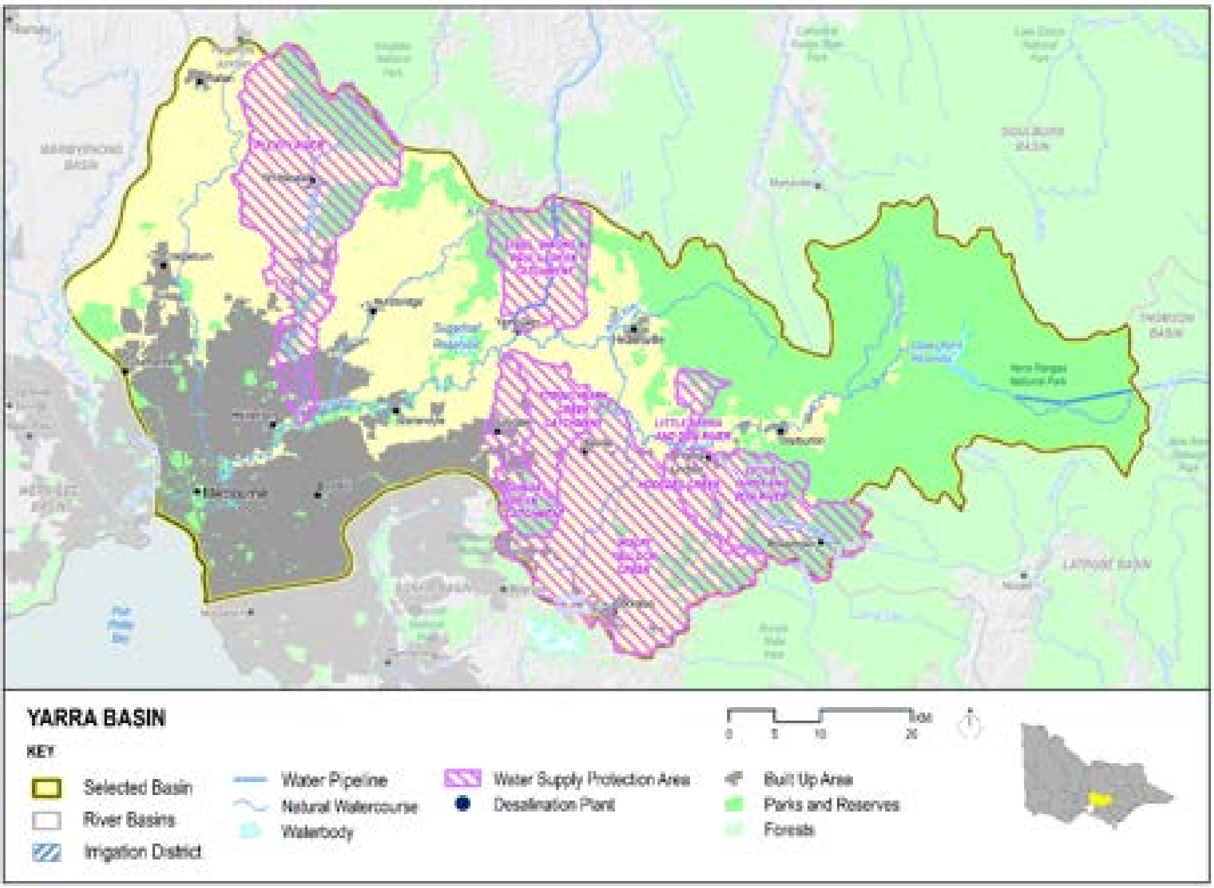
(2) Any unused water under this environmental entitlement is available to carry over. Allocation issued includes allocation lost in seasons and corrections and alterations to account for water lost and gained from internal spills, evaporation, over-releases and changes in storage volume.

(3) The water taken by Southern Rural Water under its Tarago River bulk entitlement is released from Tarago Reservoir to supplement unregulated flows for section 51 licence holders downstream of the reservoir. The water taken by take and use licences (unregulated surface water) is a calculated value to represent the unregulated flow volume taken by section 51 licence holders in the Bunyip and Tarago rivers. This value is calculated by subtracting the volume taken by Southern Rural Water under its Tarago River bulk entitlement (minus a loss factor to account for in-stream loss) from the metered volume taken by section 51 licence holders. This calculation ensures that the diversion of water by section 51 licence holders is not overstated.

6.17 Yarra basin

The Yarra basin (Figure 6-32) is in south-central Victoria. The Yarra River originates in the Yarra Ranges National Park and flows through the heart of Melbourne before reaching Port Phillip Bay.

Figure 6-32 Map of the Yarra basin



6.17.1 Management arrangements

Management of water in the Yarra basin is undertaken by various parties, as shown in Table 6-103.

Table 6-103 Water resource management responsibilities, Yarra basin

Authority	Management responsibilities
Melbourne Water	Manages surface water licensed diversions in the Yarra basin Provides bulk water to the Melbourne retail water authorities Manages waterways in the Yarra basin Operates storages for the Melbourne supply system (1)
Yarra Valley Water	Supplies the northern and eastern part of the metropolitan Melbourne area including Healesville, Yarra Glen and Warburton from the Greater Yarra system – Thomson River Pool
South East Water	Supplies the central and eastern part of the metropolitan Melbourne area from the Greater Yarra system – Thomson River Pool
City West Water	Supplies the western part of the metropolitan Melbourne area from the Greater Yarra system – Thomson River Pool
Western Water	Supplies the Bulla locality, which is in the basin, with water from both the Greater Yarra system – Thomson River Pool and water from the Maribyrnong basin
Goulburn Valley Water	Supplies the Wallan locality, which is within the Yarra basin, using water sources from outside the basin
Port Phillip and Westernport Catchment Management Authority	Responsible for catchment management in the Yarra basin

Note

(1) Melbourne is also supplied from the Thomson, Goulburn and Bunyip basins, as well as from the Victorian Desalination Project.

6.17.1.1 Melbourne headworks system: Greater Yarra system – Thomson River Pool

Melbourne's water has traditionally been sourced from the Yarra, Thomson, Bunyip (Bunyip and Tarago rivers) and Goulburn (Silver and Wallaby creeks) basins. Since the Millennium Drought, major investments in infrastructure have brought other water sources online to support Melbourne's water security. These include the North–South Pipeline, which can bring water from the Goulburn River to be stored in Sugarloaf Reservoir and used to supply Melbourne. However, it can only be used once Melbourne's storage levels fall below 30%. Another major investment has been the Victorian Desalination Project near Wonthaggi.

Surface water sourced from the Yarra, Thomson, Bunyip (Bunyip and Tarago rivers) and Goulburn (Silver and Wallaby creeks) basins is known collectively as the Greater Yarra system – Thomson River Pool.

Melbourne Water holds the bulk entitlements to surface water in the Thomson River, Yarra River, Tarago River and Silver and Wallaby creeks (Table 6-104). It uses this water to supply the bulk entitlement holders in the Greater Yarra system – Thomson River Pool: City West Water, South East Water, Yarra Valley Water, Barwon Water, South Gippsland Water, Western Water and Westernport Water.

The annual entitlement volume is the annual diversion limit for Melbourne Water's Yarra River, Thomson River and Silver and Wallaby creeks bulk entitlements. The limit is calculated using a method for showing compliance with diversion limits approved by the Minister for Water in February 2018 (Table 6-105). Melbourne Water makes an allocation at the beginning of each month to distribute the available water to entitlement holders according to their entitlement share. In 2020–21, the allocation reached 75.5%, lower than in the previous year when it reached 85.5%.

Volumes of water taken from the river systems to supply the Greater Yarra system – Thomson River Pool are reported in each individual river basin subchapter, while deliveries to customers by the Melbourne retailers — South East Water, Yarra Valley Water and City West Water — are accounted for in the distribution system chapter.

Table 6-104 Melbourne Water bulk entitlements to supply the Greater Yarra system – Thomson River Pool

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Yarra River – Melbourne Water) Order 2014 (1)	400,000	400,000
Bulk Entitlement (Tarago and Bunyip Rivers – Melbourne Water) Order 2014	30,510	30,510
Bulk Entitlement (Thomson River – Melbourne Water) Order 2014 (1)	171,800	171,800
Bulk Entitlement (Silver and Wallaby Creeks – Melbourne Water) Order 2014 (1)	22,000	22,000
Total	**624,310**	**624,310**

Note

(1) The annual entitlement volume is the annual diversion limit for Melbourne Water's Yarra River, Thomson River and Silver and Wallaby Creeks bulk entitlements. The limit is calculated using a method for showing compliance with diversion limits approved by the Minister for Water in February 2018.

Table 6-105 Greater Yarra system – Thomson River Pool bulk entitlements

Water entitlement	Annual entitlement volume (ML) 30 June 2020	Annual entitlement volume (ML) 30 June 2019
Bulk Entitlement (Greater Yarra System-Thomson River Pool- Barwon Water) Order 2014	16,000	16,000
Bulk Entitlement (Greater Yarra System-Thomson River Pool-City West Water Limited) Conversion Order 2014	152,797	152,797
Bulk Entitlement (Greater Yarra System-Thomson River Pool-South East Water Limited) Conversion Order 2014	206,281	206,281
Bulk Entitlement (Greater Yarra System-Thomson River Pool- South Gippsland Water) Order 2014	1,000	1,000
Bulk Entitlement (Greater Yarra System-Thomson River Pool- Western Water) Order 2014	18,250	18,250
Bulk Entitlement (Greater Yarra System-Thomson River Pool- Westernport Water) Order 2014	1,000	1,000
Bulk Entitlement (Greater Yarra System-Thomson River Pool-Yarra Valley Water Limited) Conversion Order 2014	219,776	219,776
Total	**615,104**	**615,104**

6.17.1.2 Victorian Desalination Project

Desalinated seawater from the Victorian Desalination Project near Wonthaggi may be sourced to supplement surface water supplies from the Melbourne headworks system. The three metropolitan water corporations — City West Water, Yarra Valley Water and South East Water — hold the bulk entitlements to this desalinated seawater. These entitlements are shown in Table 6-106.

In 2020–21, 125 GL of water was delivered from the Victorian Desalination Project, and this water was allocated to the three Melbourne retailers in accordance with their bulk entitlements. The volume delivered is included as an inflow into the Yarra basin, as it represents an inflow of water into part of the Melbourne headworks system in the Yarra basin (Table 6-107).

Table 6-106 Desalinated water bulk entitlements

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Desalinated Water – City West Water Limited) Order 2014	39,595	39,595
Bulk Entitlement (Desalinated Water – South East Water Limited) Order 2014	53,454	53,454
Bulk Entitlement (Desalinated Water – Yarra Valley Water Limited) Order 2014	56,951	56,951
Total	**150,000**	**150,000**

6.17.2 2020–21 water resources overview

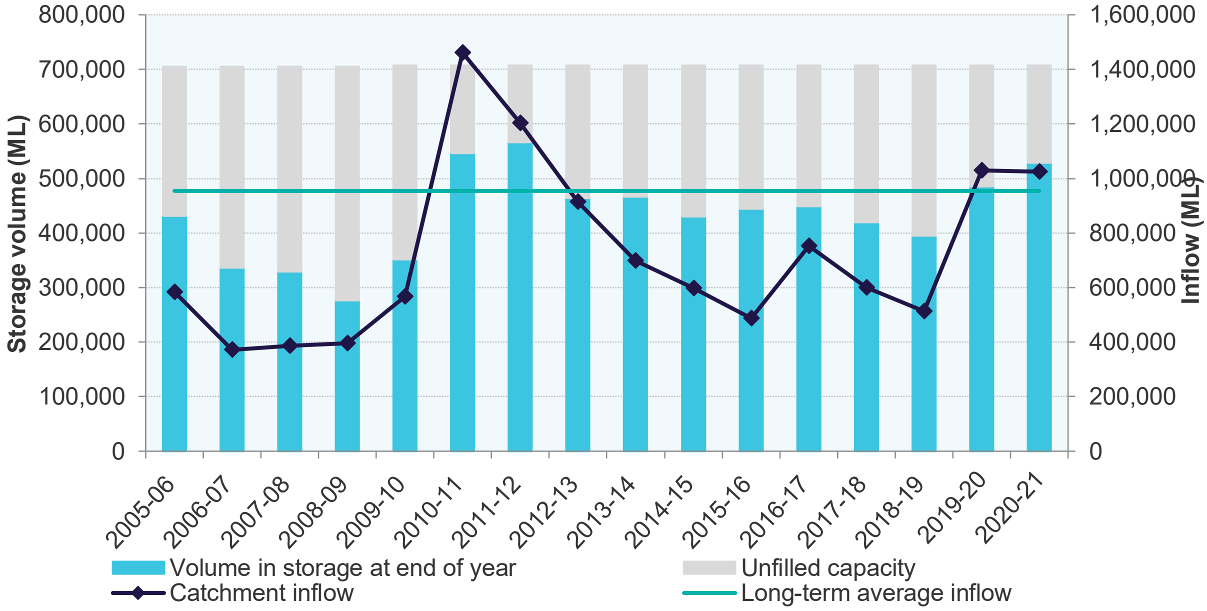
In 2020–21, rainfall was:

- average in most of the basin
- above average in the south-east of the basin, from the Olinda Creek catchment and over Warburton and the Yarra Ranges.

Catchment inflows to the basin in 2020–21 were 107% of the long-term average of 954,200 ML, slightly less than in 2019–20 when inflows were 108% of the long-term average.

Major storages in the basin were at 51% of capacity on 1 July 2020 and higher (at 70% of capacity) on 30 June 2021.

Figure 6-33 Storage volumes and catchment inflows, Yarra basin



Key aspects of restrictions on licensed diversions from unregulated streams in the Yarra basin in 2020–21 were:

- a total ban on the upper Olinda Creek from September to December 2020 and from February to May 2021
- total bans in place for four streams in February 2021 and Diamond Creek from February to April 2021
- restrictions on McCrae Creek in February and April 2021, and on Cockatoo Creek and Shepherd Creek in February 2021
- restrictions on the upper Yarra River in December 2020 and March to April 2021, and on the lower Yarra River in December and April 2021
- there was a peak of ten streams with bans or restrictions in February 2021, lower than the 18 streams the previous year.
- all bans were lifted by the end of May 2021
- there were no restrictions on 14 streams for the whole of 2020–21.

There were no restrictions on urban water use in the Yarra basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

Another order for water from the Victorian Desalination Project was made for 2020–21 by the Minister for Water. The total volume delivered to 30 June 2021 was 125 GL, representing 6.9% of Melbourne's storage capacity, the same as in the previous year.

In 2020–21, 322,144 ML of surface water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 435,923 ML diverted in the previous year.

6.17.2.1 Water for the environment

Environmental watering sites and environmental values in the Yarra basin that depend on water for the environment include:

- Australian grayling, river blackfish, Macquarie perch and numerous billabongs and wetlands
- the Yarra River between Warburton and Warrandyte, which has been identified as a Victorian heritage river and depends on water for the environment
- billabongs on the Yarra River floodplain between Millgrove and Yering Gorge as well as on the reach around Banyule Flats near Heidelberg and further downstream, which support distinct vegetation communities and provide foraging and breeding habitat for waterbirds and frogs.

In 2020–21, water for the environment in the Yarra basin comprised:

- the *Yarra River Environmental Entitlement 2006*, comprising 17,000 ML of high-reliability entitlement and 55 ML of unregulated surface water entitlement held by the VEWH
- water set aside for the environment through the operation of:
  - passing flow conditions on the *Yarra River Environmental Entitlement 2006*
  - seven streamflow management plans (see chapter 4.2.2)
  - passing flow conditions on licensed diversions
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

In 2020–21, a total of 8,504 ML of environmental water was delivered in the Yarra basin: 52 ML of this was diverted off-stream.

6.17.3 Water balance

The total volumes of water available and supplied from water resources in the Yarra basin in 2020–21 are shown in Table 6-107.

Table 6-107 Water balance, Yarra basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	129,874	125,851
Volume in storage at the end of the year	1	178,661	129,874
Change in storage		**48,787**	**4,023**
Inflows			
Catchment inflow	2	1,025,530	1,028,892
Rainfall on major storages	1	13,654	11,853
Inflow of desalinated water	3	125,000	118,324
Transfers from Thomson	4	67,478	36,045
Transfers from Goulburn (Silver and Wallaby creeks)	4	2,604	808
Transfers from Goulburn via North–South Pipeline		12	11
Treated wastewater discharged back to river	5	9,968	8,471
Total inflows		**1,244,245**	**1,204,404**
Outflows			
Diversions			
Urban diversions	4	429,339	537,407
Licensed diversions from unregulated streams		6,882	5,202
Environmental water diversions	6	52	69
Small catchment dams	7	10,923	11,638
Total diversions		***447,196***	***554,316***
Losses			
Evaporation from major storages	1	11,270	11,077
Net evaporation from small catchment dams	7	2,570	1,371
In-stream infiltration to groundwater, flows to floodplain and evaporation	8	-	-
Total losses		***13,840***	***12,448***
Water passed at outlet of basin			

River outflows to Port Phillip Bay		734,422	633,617
Total water passed at outlet of basin		***734,422***	***633,617***
Total outflows		**1,195,458**	**1,200,381**

6.17.3.1 Notes to the water balance

1. Storage volumes

Major — greater than 1,000 ML — on-stream storages in the Yarra basin are included in the water balance. Table 6-108 shows how storage volumes changed during the year. Volumes in off-stream storages are presented for additional information about the resource condition.

Melbourne Water operates eight major storages within the Yarra basin. Water is harvested by the Upper Yarra, O'Shannassy and Maroondah reservoirs. Sugarloaf and Yan Yean reservoirs are off-stream storages but have dual roles: to harvest water and to act as seasonal balancing reservoirs. Silvan and Greenvale reservoirs are off-stream storages and act as seasonal balancing reservoirs.

Table 6-108 Storage volumes, Yarra basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflows less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Maroondah Reservoir	22,179	22,179	2,422	1,787	(1,606)	21,208
O'Shannassy Reservoir	3,123	2,604	446	259	329	3,120
Upper Yarra Reservoir	200,579	79,062	6,913	4,078	45,430	127,327
Yan Yean Reservoir	30,266	26,029	3,873	5,146	2,250	27,006
Subtotal	**256,147**	**129,874**	**13,654**	**11,270**	**46,403**	**178,661**
Off-stream storages						
Cardinia Reservoir	286,911	208,151	11,727	10,579	(1,453)	207,846
Greenvale Reservoir	26,839	21,700	1,036	1,712	1,544	22,569
Silvan Reservoir	40,445	35,551	4,045	2,864	(155)	36,577
Sugarloaf Reservoir	96,253	90,129	3,917	4,307	(6,287)	83,452
Subtotal	**450,448**	**355,531**	**20,726**	**19,462**	**(6,351)**	**350,444**
Total 2020–21	**706,595**	**485,405**	**34,380**	**30,732**	**40,053**	**529,105**
Total 2019–20	706,595	394,593	33,205	30,289	87,896	485,405

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, the known inflows and the net change in storage volume.

3. Inflow of desalinated water

This is the net volume into the three metropolitan water corporations' accounts.

4. Transfers and urban diversions

Water transferred from the Thomson and Goulburn basins to the Yarra basin portion of the Melbourne headworks system to supply the Greater Yarra system – Thomson River Pool bulk entitlements (greater Melbourne and regional towns) is shown here as water transferred into and then used out of the Yarra basin.

5. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-109 lists the wastewater treatment plants in the Yarra basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

Table 6-109 Volume and use of recycled water, Yarra basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Aurora [(1)]	B	1,372	325	24%	130	0	0	195	1,047	0
Brushy Creek [(2)]	B	4,090	728	18%	121	0	0	0	3,969	0
Craigieburn [(3)]	B	749	380	51%	21	0	0	0	728	0
Healesville	B	517	107	21%	0	0	0	107	410	0
Kinglake [(1)]	C	5	2	40%	0	2	0	0	3	0
Lilydale [(4)]	B	2,454	448	18%	33	0	0	0	2,421	0
Monbulk	B	26	0	0%	0	0	0	0	26	0
Upper Yarra [(5)]	B	843	358	42%	0	0	0	0	843	0
Wallan [(1)]	C	1,650	1,353	82%	233	972	0	148	297	0
Whittlesea [(1)]	B	361	137	38%	48	63	0	26	224	0
Total 2020–21		**12,067**	**3,838**	**32%**	**586**	**1,037**	**0**	**476**	**9,968**	**0**
Total 2019–20		11,605	1,799	16%	657	765	0	377	8,471	1,335

Notes

(1) Aurora, Kinglake, Wallan and Whittlesea treatment plants have storage lagoons associated with them. The total volumes include losses from these storages, which are not accounted for (such as by evaporation).

(2) At the Brushy Creek treatment plant, 607 ML of water was used within plant process and then discharged to the environment after use. This has been accounted for in 'Volume discharged to the environment'. It has not been recorded in 'Within plant process' to avoid double-counting.

(3) At the Craigieburn treatment plant, 359 ML of water was used within plant process and then discharged to the environment after use. This has been accounted for in 'Volume discharged to the environment'. It has not been recorded in 'Within plant process' to avoid double-counting.

(4) At the Lilydale treatment plant, 415 ML of water was used within plant process and then discharged to the environment after use. This has been accounted for in 'Volume discharged to the environment'. It has not been recorded in 'Within plant process' to avoid double-counting.

(5) At the Upper Yarra treatment plant, 358 ML of water was used within plant process and then discharged to the environment after use. This has been accounted for in 'Volume discharged to the environment'. It has not been recorded in 'Within plant process' to avoid double-counting.

6. Environmental water diversions

This volume represents the amount that was diverted by the VEWH to Annulus Billabong and Yering Backswamp.

7. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-110 provides information about small catchment dams in the basin.

Table 6-110 Estimated small catchment dam information, Yarra basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	17,959	6,773	2,103	8,877
Registered/licensed commercial and irrigation	9,453	4,150	467	4,616
Total 2020–21	**27,412**	**10,923**	**2,570**	**13,493**
Total 2019–20	27,412	11,639	1,371	13,010

8. In-stream infiltration to groundwater, flows to floodplain and evaporation

An assessment of in-stream infiltration to groundwater, flows to floodplain and evaporation is not made in the Yarra basin as there are no suitable models, and the distribution of streamflow gauges across the basin makes it difficult to estimate in-stream losses (see chapter 6.1.5.3).

6.17.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year

- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Yarra – Key compliance points
✓ There was no net increase in the total entitlement volume from the previous year.
✓ The total volume diverted (253,793 ML) was within the volume available for the year (492,012 ML).
✓ No individual bulk entitlement holder took more than the annual volume made available to them.
✓ Individual bulk entitlement holders complied with all provisions in their entitlements.

Entitlements in the Yarra basin provide the basis for how water is shared in the basin. Rights to water in the Yarra basin are outlined in Table 6-111.

Melbourne Water holds a bulk entitlement to divert surface water in the Yarra basin. This entitlement is one of four that contribute to the Greater Yarra system – Thomson River Pool, which primarily supplies Melbourne and supports regional urban water corporations including Barwon Water, Western Water, South Gippsland Water and Westernport Water (Table 6-104 and Table 6-105).

Table 6-111 Entitlement volumes, Yarra basin

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Yarra River – Melbourne Water) Order 2014 (1)	400,000	400,000
Yarra River Environment Entitlement 2006		
High-reliability	17,000	17,000
Unregulated surface water	55	55
Subtotal: Yarra River Environment Entitlement 2006	**17,055**	**17,055**
Take and use licences – unregulated surface water (2)	34,245	39,408
Licensed small catchment dams – on-waterway	1,725	1,708
Licensed small catchment dams – off-waterway	7,728	7,743
Total	**460,753**	**465,914**

Notes

(1) Melbourne Water holds the source bulk entitlement on the Yarra River. The annual entitlement volume is the annual diversion limit for Melbourne Water's Yarra River, Thomson River and Silver and Wallaby Creeks bulk entitlements. The limit is calculated using a method for showing compliance with diversion limits approved by the Minister for Water in February 2018. This water is used to supply the primary entitlement holders — City West Water, South East Water, Yarra Valley Water, Barwon Water, Western Water, South Gippsland Water and Westernport Water — with entitlement to the Greater Yarra system – Thomson River Pool, which sources water from the Yarra River, Thomson River, Tarago River, Silver Creek and Wallaby Creek.

(2) The volume of unregulated surface water entitlements includes licences with full return to the waterway. In the Yarra basin, there are 7,000 ML of entitlement in this category.

Table 6-112 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

Table 6-112 Available water and take, Yarra basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Yarra River – Melbourne Water	-	400,000	0	400,000	234,257
Yarra River Environment Entitlement (1)	26,137	17,000	0	43,137	8,504
Take and use licences – unregulated surface water	-	39,408	(69)	39,339	6,882
Licensed small catchment dams	-	9,467	69	9,536	4,150
Total 2020–21	**26,137**	**465,875**	**0**	**492,012**	**253,793**
Total 2019–20	13,137	465,984	0	479,121	395,856

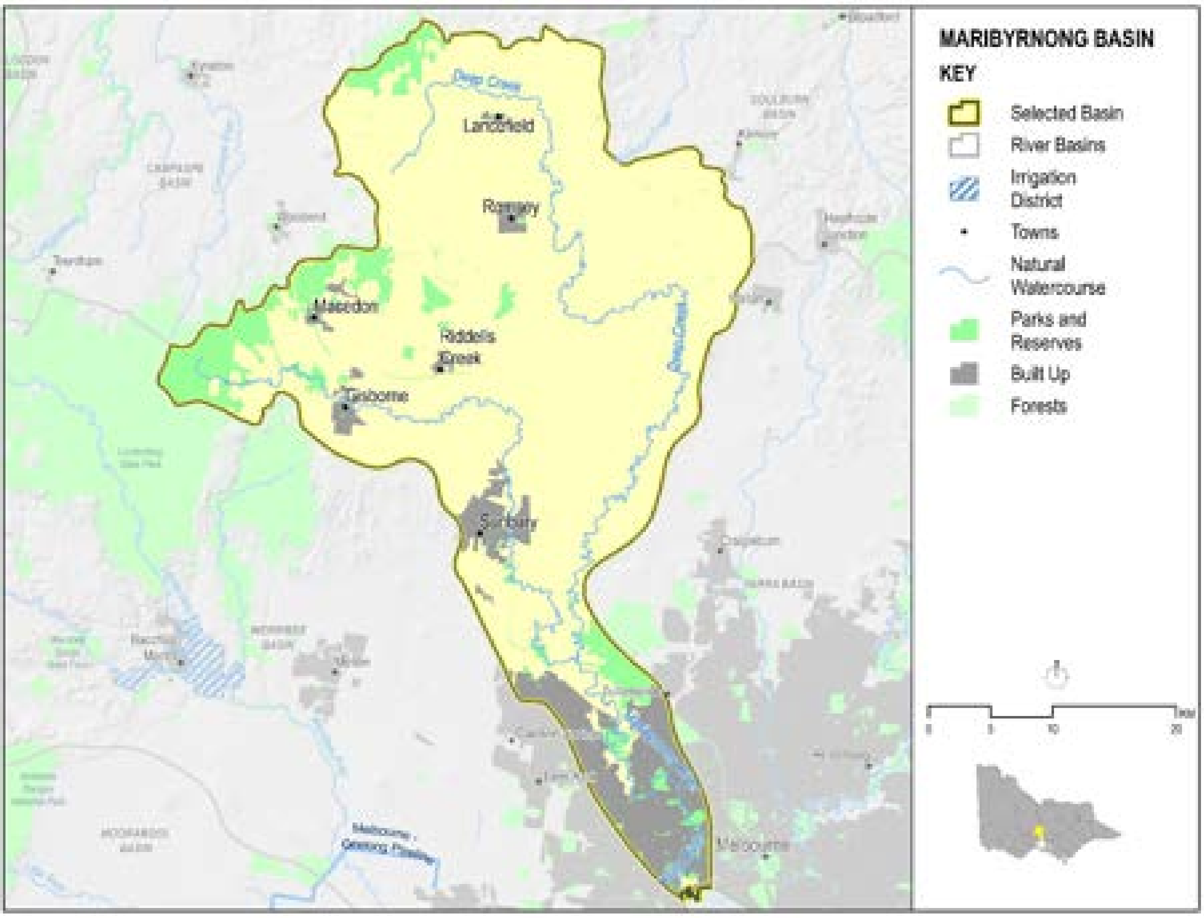
Note

(1) Water taken under the Yarra environmental entitlement includes 52 ML of diversions to wetlands and 8,452 ML of environmental in-stream use. The in-stream use amount is not included in the water balance in Table 6-107 as it is not an actual diversion from the waterway. Any unused water under this environmental entitlement is available to carry over.

6.18 Maribyrnong basin

The Maribyrnong basin (Figure 6-34) is located north of Melbourne in central Victoria. The headwaters are located near Lancefield and Macedon, and the Maribyrnong River flows through Melbourne before joining the Yarra estuary just upstream of the mouth of the river into Port Phillip Bay.

Figure 6-34 Map of the Maribyrnong basin



6.18.1 Management arrangements

Management of water in the Maribyrnong basin is undertaken by various parties, as shown in Table 6-113.

Table 6-113 Water resource management responsibilities, Maribyrnong basin

Authority	Management responsibilities
Melbourne Water	Manages surface water licensed diversions in the lower Maribyrnong basin below the confluence of Deep Creek and the Maribyrnong River Provides bulk water supplies to City West Water and Western Water (from the Greater Yarra system – Thomson River Pool) Manages waterways, drainage and floodplains in the Maribyrnong basin
City West Water	Supplies part of metropolitan Melbourne (largely from the Yarra and Thomson basins)
Western Water	Supplies towns in the basin outside metropolitan Melbourne Operates Macedon reservoirs
Southern Rural Water	Manages surface water licensed diversions in the upper Maribyrnong basin and groundwater licensed diversions in the whole of the basin Operates Rosslynne Reservoir
Port Phillip and Westernport Catchment Management Authority	Responsible for catchment management in the Maribyrnong basin

6.18.2 2020–21 water resources overview

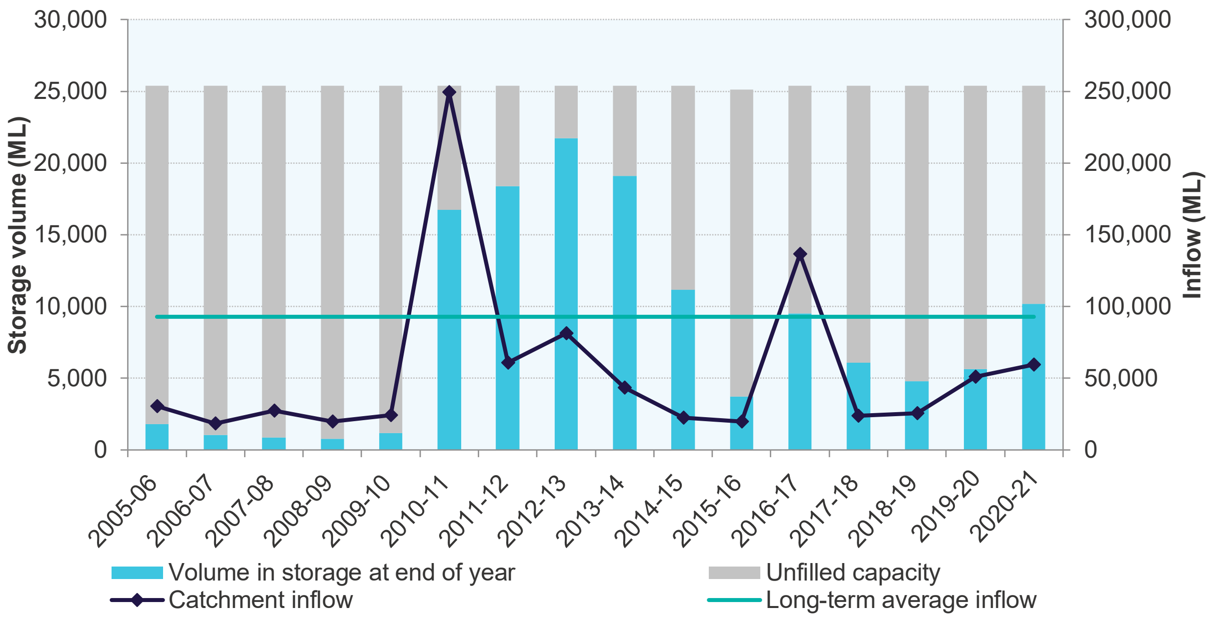
In 2020–21, rainfall was:

- average in most of the basin
- above average in the west of the basin, over Macedon, Gisborne and north of Sunbury.

Catchment inflows to the basin in 2020–21 were 64% of the long-term average annual volume of 92,800 ML, greater than in 2019–20 when inflows were 55% of the long-term average.

Rosslynne Reservoir was at 22% of capacity on 1 July 2020 and higher (at 40% of capacity) on 30 June 2021.

Figure 6-35 Storage volumes and catchment inflows, Maribyrnong basin



Key aspects of restrictions on licensed diversions from unregulated streams in the Maribyrnong basin in 2020–21 were:

- a total ban on winterfill licences on the Maribyrnong River from November 2020 until the end of June 2021
- rosters on Emu Creek ranging from stage1 to stage 3, starting in October 2021 and ending in May 2021
- the rest of the streams were unrestricted for the whole year
- fewer streams were restricted in 2020–21 than in the previous year when Turitable Creek and Willimigongon Creek were restricted, as were all-year licences on the Maribyrnong River.

There were no restrictions on urban water use in the Maribyrnong basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 5,889 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was more than the 5,191 ML diverted in the previous year.

6.18.2.1 Water for the environment

Environmental watering sites and environmental values in the Maribyrnong basin that depend on water for the environment include:

- Australian grayling and the Jacksons Creek platypus population
- the upper Maribyrnong catchment, which contains areas of intact streamside vegetation that provide important habitat for native fish including migratory short-finned eels, common and ornate galaxias, flathead gudgeon, tupong and Australian smelt
- a large population of waterbugs that provides an abundant food source for a significant platypus population in several reaches in the Maribyrnong system.

In 2020–21, water for the environment in the Maribyrnong basin comprised:

- water set aside for the environment through the operation of passing flow conditions:
  - on consumptive bulk entitlements held by Western Water and Southern Rural Water
  - on licensed diversions (regulated and unregulated waterways)
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

The VEWH does not hold an environmental entitlement in the Maribyrnong system, and it was unable to purchase water to meet environmental objectives in 2020–21.

In 2020–21, no environmental water was available for use in the Maribyrnong basin.

6.18.3 Water balance

The total volumes of water available and supplied from water resources in the Maribyrnong basin in 2020–21 are shown in Table 6-114.

Table 6-114 Water balance, Maribyrnong basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	5,641	4,776
Volume in storage at the end of the year	1	10,200	5,641
Change in storage		**4,559**	**865**
Inflows			
Catchment inflow	2	59,558	50,964
Rainfall on major storages	1	806	1,560
Treated wastewater discharged back to river	3	2,958	2,555
Total inflows		**63,321**	**55,079**
Outflows			
Diversions			
Urban diversions		2,166	1,966
Licensed diversions from regulated streams		139	85
Licensed diversions from unregulated streams		197	226
Small catchment dams	4	3,387	2,914
Total diversions		***5,889***	***5,191***
Losses			
Evaporation from major storages	1	946	2,178
Net evaporation from small catchment dams	4	1,548	1,533
In-stream infiltration to groundwater, flows to floodplain and evaporation		1,979	2,090
Total losses		***4,473***	***5,801***
Water passed at outlet of basin			
River outflows to the Yarra River		48,400	43,222
Total water passed at outlet of basin		***48,400***	***43,222***
Total outflows		**58,762**	**54,214**

6.18.3.1 Notes to the water balance

1. Storage volumes

The one major — greater than 1,000 ML — on-stream storage in the Maribyrnong basin is included in the water balance. Table 6-115 shows how storage volumes changed during the year.

Table 6-115 Storage volumes, Maribyrnong basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflows less regulated releases (ML)	End volume in store (ML)
On-stream storage						
Rosslynne Reservoir	25,368	5,641	806	946	4,699	10,200
Total 2020–21	**25,368**	**5,641**	**806**	**946**	**4,699**	**10,200**
Total 2019–20	25,368	4,776	1,560	2,178	1,483	5,641

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, the known inflows and the net change in storage volume.

The 2019–20 catchment inflow volume has been corrected from the previous accounts: the volume was incorrect.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin.

Table 6-116 lists the wastewater treatment plants in the Maribyrnong basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

Table 6-116 Volume and use of recycled water, Maribyrnong basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Gisborne	B	1,015	181	18%	17	10	0	154	834	0
Riddells Creek	C	148	82	55%	5	77	0	0	66	0
Romsey	C	654	654	100%	14	640	0	0	0	0
Sunbury	B	2,705	647	24%	252	194	0	201	2,058	0
Total 2020–21		**4,522**	**1,564**	**35%**	**288**	**921**	**0**	**355**	**2,958**	**0**
Total 2019–20		3,574	1,013	28%	374	617	0	22	2,555	6

4. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-117 provides information about small catchment dams in the basin.

Table 6-117 Estimated small catchment dam information, Maribyrnong basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	10,262	2,852	1,426	4,278
Registered/licensed commercial and irrigation	1,790	535	122	657
Total 2020–21	**12,052**	**3,387**	**1,548**	**4,935**
Total 2019–20	12,052	2,915	1,533	4,448

6.18.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Maribyrnong – Key compliance points

✓ **There was no net increase in the total entitlement volume from the previous year.**
✓ **The total volume diverted (3,200 ML) was within the volume available for the year (13,754 ML).**
✓ **No individual bulk entitlement holder took more than the annual volume made available to them.**
✓ **Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlements in the Maribyrnong basin provide the basis for how water is shared in the basin. Rights to water in the Maribyrnong basin are set out in Table 6-118.

Table 6-118 Entitlement volumes, Maribyrnong basin

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Gisborne – Barringo Creek) Conversion Order 2004 (1)	585	585
Bulk Entitlement (Lancefield) Conversion Order 2001	315	315
Bulk Entitlement (Macedon and Mount Macedon) Conversion Order 2004 (2)	873	873
Bulk Entitlement (Maribyrnong – Melbourne Water) Conversion Order 2000 (3)	1,396	1,396
Bulk Entitlement (Maribyrnong – Southern Rural Water) Conversion Order 2000 (4)	682	682
Bulk Entitlement (Maribyrnong – Western Water) Conversion Order 2000 (5)	6,100	6,100
Bulk Entitlement (Riddells Creek) Conversion Order 2001	300	300
Bulk Entitlement (Romsey) Conversion Order 2001	460	460
Take and use licences – unregulated surface water	1,895	1,895
Licensed small catchment dams – on-waterway	130	130
Licensed small catchment dams – off-waterway	1,659	1,659
Total	**14,396**	**14,396**

Notes

(1) This entitlement specifies that up to 585 ML can be diverted in any one year. The maximum volume that can be taken over any five-year period is 1,600 ML (320 ML annual average).
(2) This entitlement specifies that up to 873 ML can be diverted in any one year. The maximum volume that can be taken over any five-year period is 3,225 ML (645 ML annual average).
(3) This entitlement supplies water for take and use licences: there was 1,124 ML of take and use entitlement volume as of 30 June 2020. This entitlement includes an inflow and storage capacity share in Rosslynne Reservoir; in any year, inflows available will vary, and they may have water available from the previous year in their storage share.
(4) This entitlement supplies water for take and use licences: there was 214 ML of take and use entitlement volume as of 30 June 2020. This entitlement includes an inflow and storage capacity share in Rosslynne Reservoir; in any year, inflows available will vary, and they may have water available from the previous year in their storage share.
(5) This entitlement specifies that Western Water can take from the waterway up to an annual average of 6,100 ML over any period of five consecutive years. The water available is determined by an inflow and storage capacity share in the system. In any year, inflows available will vary; entitlement holders may have water available from the previous year in their storage share, but the maximum annual amount that can be taken is shown here.

Table 6-119 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

Table 6-119 Available water and take, Maribyrnong basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Gisborne – Barringo Creek	-	585	0	585	0
Lancefield	-	315	0	315	67
Macedon and Mount Macedon	-	873	0	873	285
Maribyrnong – Melbourne Water (1)	-	1,124	0	1,124	115
Maribyrnong – Southern Rural Water (2)	-	214	0	214	25
Maribyrnong – Western Water (3)	-	6,100	0	6,100	1,320
Riddells Creek	-	300	0	300	19
Romsey (4)	98	460	0	558	475
Take and use licences – unregulated surface water	-	1,895	0	1,895	197
Licensed small catchment dams	-	1,790	0	1,790	535
Total 2020–21	**98**	**13,656**	**0**	**13,754**	**3,037**
Total 2019–20	258	13,686	0	13,944	2,764

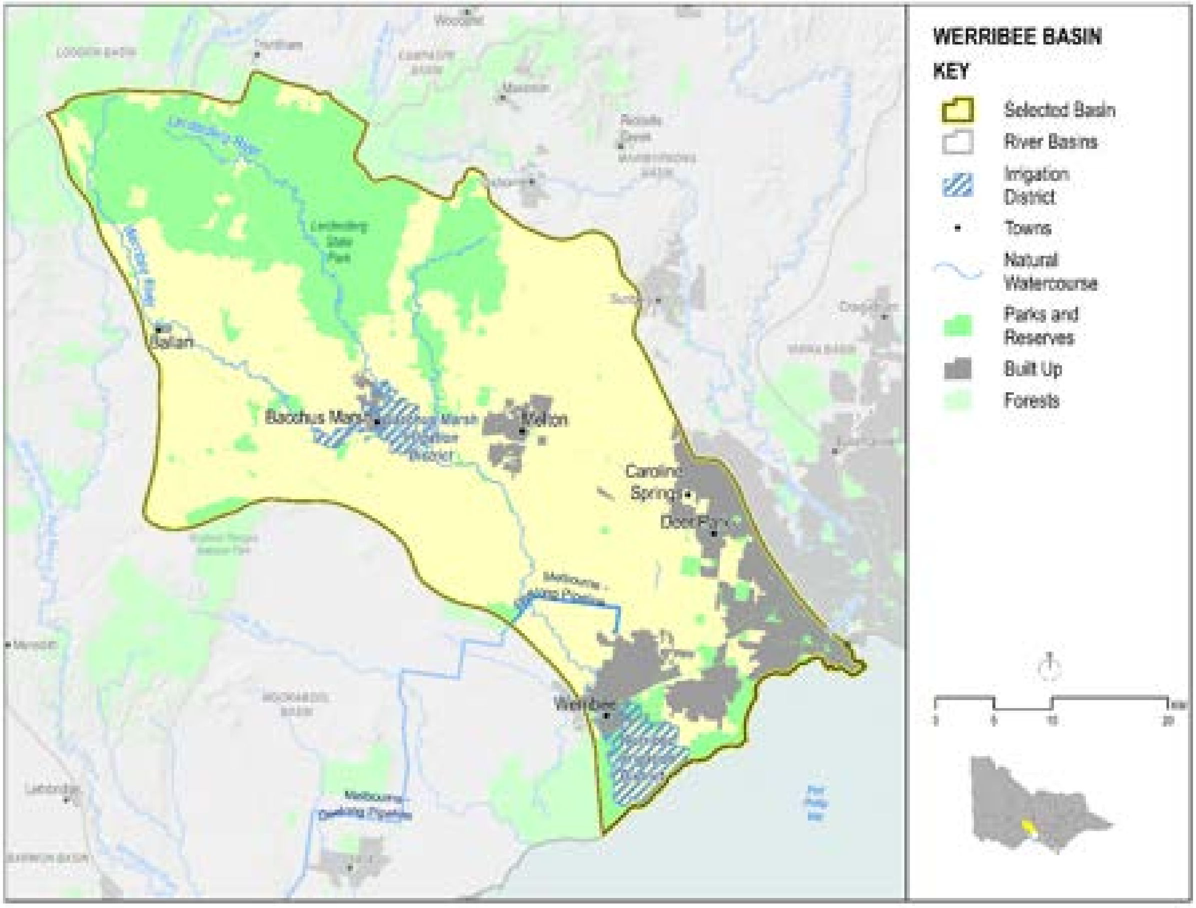
Notes

(1) This represents the amount of water available and used by take and use licence holders supplied under the Maribyrnong – Melbourne Water bulk entitlement.
(2) This represents the amount of water available and used by take and use licence holders supplied under the Maribyrnong – Southern Rural Water bulk entitlement. In 2019–20, Southern Rural Water did not release water from its share of Rosslynne Reservoir to supply these licence holders.
(3) The water available to Western Water is determined by an inflow and storage capacity share in the system. In any year, available inflows will vary; entitlement holders may have water available from the previous year in their storage share, but the maximum annual amount that can be taken is shown here.
(4) Western Water can use unused allocation of up to 280 ML from a previous year under a drought reserve arrangement. The volume taken for Romsey includes 15 ML from the drought reserve in 2019–20.

6.19 Werribee basin

The Werribee basin (Figure 6-36) is located west of Melbourne. The Werribee and Lerderderg rivers meet upstream of Melton Reservoir and flow through Werribee before entering Port Phillip Bay.

Figure 6-36 Map of the Werribee basin



6.19.1 Management arrangements

Management of water in the Werribee basin is undertaken by various parties, as shown in Table 6-120.

Table 6-120 Water resource management responsibilities, Werribee basin

Authority	Management responsibilities
Southern Rural Water	Manages Werribee and Bacchus Marsh irrigation districts Manages licensed diversions Operates Pykes Creek Reservoir, Melton Reservoir and Merrimu Reservoir
Western Water	Supplies towns in the north of the basin including Melton and Bacchus Marsh Operates Djerriwarrh Reservoir
Melbourne Water	Manages surface water licensed diversions for the lower reaches of Kororoit Creek Provides bulk water to City West Water and Western Water from the Greater Yarra system – Thomson River Pool Operates the Western Treatment Plant and supplies recycled water to Southern Rural Water Manages waterways, drainage and floodplains in all of the Werribee basin
City West Water	Supplies towns and manages wastewater in metropolitan Melbourne
Central Highlands Water	Supplies Blackwood and Ballan
Port Phillip and Westernport Catchment Management Authority	Responsible for waterway and catchment management in the Werribee basin

6.19.2 2020–21 water resources overview

In 2020–21, rainfall was:

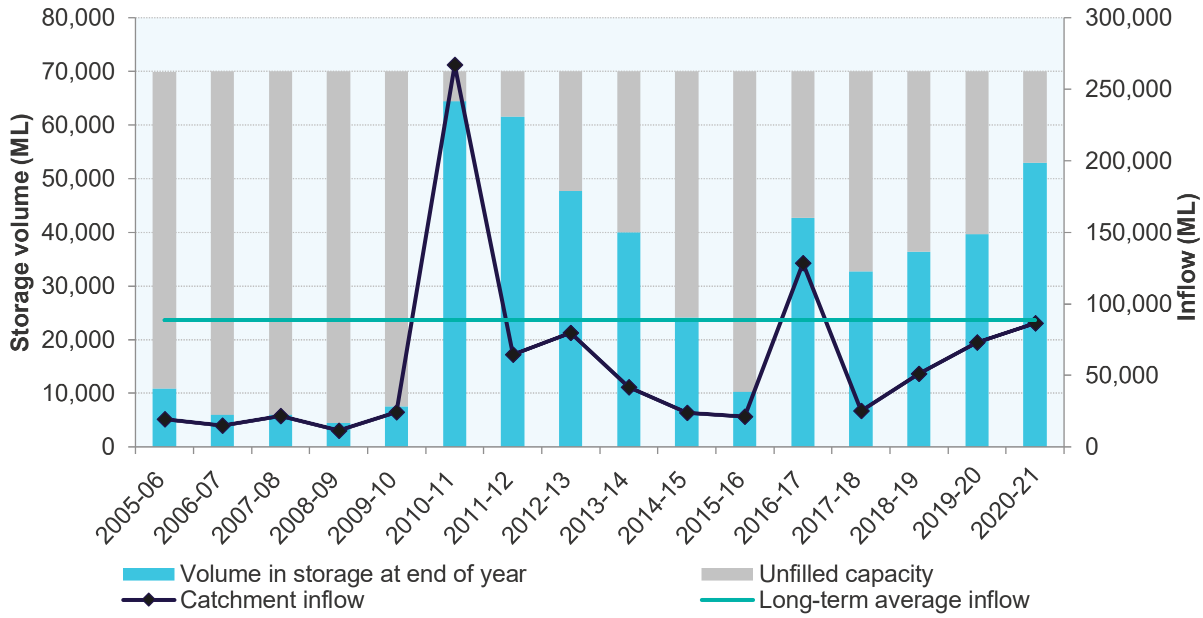
- above average in most of the basin
- average in a small section in the north of the basin near the Loddon Basin and south of Caroline Springs to Werribee

- average in the southern section of the basin from Rockbank to Altona Bay.

Catchment inflows to the basin in 2020–21 were 98% of the long-term average of 88,600 ML, greater than in 2019–20 when inflows were 82% of the long-term average.

Major storages in the basin were at 57% of capacity on 1 July 2020 and higher (at 76% of capacity) on 30 June 2021.

Figure 6-37 Storage volumes and catchment inflows, Werribee basin



In 2020–21, the seasonal determination for high-reliability water shares opened at 30% on 1 July 2020 and increased to 100% by December 2020. Low-reliability water shares did not receive a determination until 16 December 2020 at 10%, increasing steadily to 80% by February 2021 and reaching 100% by April 2021.

There were no restrictions placed on licensed diversions from unregulated streams in the Werribee basin in 2020–21 compared to one in the previous year.

There were no restrictions on urban water use in the Werribee basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 15,646 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was slightly less than the 15,988 ML diverted in the previous year.

6.19.2.1 Water for the environment

Environmental watering sites and environmental values in the Werribee basin that depend on water for the environment include:

- a highly diverse community of frogs and waterbugs that inhabit the upper reaches of the Werribee River
- platypus that inhabit the lower reaches of the Werribee River
- the freshwater-saltwater interface of the Werribee River estuary: it is a regionally significant ecosystem due to the many aquatic plants and animals it supports and its provision of nursery habitat for juvenile freshwater fish species and estuarine species (such as black bream)
- Australian grayling, tupong and red gums.

In 2020–21, water for the environment in the Werribee basin comprised:

- the *Werribee River Environmental Entitlement 2011* comprising a 10% share of inflows (on average 1,500 ML per year) held by the VEWH in Lake Merrimu
- 734 ML of high-reliability water shares and 361 ML of low-reliability water shares held for the environment in Melton Reservoir
- 1,095 ML of water traded temporarily to the VEWH for release to meet environmental objectives in the Werribee system
- water set aside for the environment through the operation of passing flow conditions:
  - on consumptive bulk entitlements held by Central Highlands Water, Western Water and Southern Rural Water
  - on licensed diversions (regulated and unregulated waterways)

- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

In 2020–21, a total of 1,609 ML of environmental water was delivered in-stream in the Werribee basin.

6.19.3 Water balance

The total volumes of water available and supplied from water resources in the Werribee basin in 2020–21 are shown in Table 6-121.

Table 6-121 Water balance, Werribee basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	39,592	36,429
Volume in storage at the end of the year	1	52,921	39,592
Change in storage		**13,329**	**3,163**
Inflows			
Catchment inflow	2	86,600	73,090
Rainfall on major storages	1	3,544	4,902
Transfers from other basins		0	0
Return flow from irrigation		51	109
Treated wastewater discharged back to river	3	2,556	1,548
Total inflows		**92,751**	**79,649**
Outflows			
Diversions			
Urban diversions		2,619	2,553
Irrigation district diversions		11,114	11,629
Licensed diversions from regulated streams		13	106
Licensed diversions from unregulated streams		39	0
Small catchment dams	4	1,861	1,700
Total diversions		***15,646***	***15,988***
Losses			
Evaporation from major storages	1	5,519	10,332
Net evaporation from small catchment dams	4	822	946
In-stream infiltration to groundwater, flows to floodplain and evaporation		2,596	1,771
Total losses		***8,937***	***13,049***
Water passed at outlet of basin			
River outflows to Port Phillip Bay		54,840	47,448
Total water passed at outlet of basin		***54,840***	***47,448***
Total outflows		**79,423**	**76,485**

6.19.3.1 Notes to the water balance

1. Storage volumes

Major — greater than 1,000 ML — on-stream storages in the Werribee basin are included in the water balance. Table 6-122 shows how storage volumes changed during the year.

Table 6-122 Storage volumes, Werribee basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflows less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Djerriwarrh Reservoir	1,014	732	113	46	214	1,014
Melton Reservoir	14,364	10,167	1,123	2,168	5,385	14,507
Merrimu Reservoir (total)	32,516	10,577	864	1,437	5,248	15,252
Pykes Creek Reservoir	22,119	18,116	1,445	1,868	4,455	22,147
Total 2020–21	**70,013**	**39,592**	**3,544**	**5,519**	**15,303**	**52,921**
Total 2019–20	70,013	36,429	4,902	10,332	8,594	39,592

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, the known inflows and the net change in storage volume.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-123 lists the wastewater treatment plants in the Werribee basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

Table 6-123 Volume and use of recycled water, Werribee basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Altona [1]	A+	5,665	1,913	34%	1,901	0	0	327	0	3,437
Ballan	C	116	116	100%	0	116	0	0	0	0
Melton	C, A	6,259	3,703	59%	344	2,949	0	410	2,556	0
Parwan (Bacchus Marsh)	C	742	742	100%	32	710	0	0	0	0
Sunshine Golf Course Sewer Mining Plant	B	35	35	100%	35	0	0	0	0	0
Western Treatment Plant	A	190,481	26,488	14%	4,611	13,573	8,252	52	0	163,993
Total 2020–21		**203,298**	**32,997**	**16%**	**6,923**	**17,348**	**8,252**	**789**	**2,556**	**167,430**
Total 2019–20		179,884	38,970	22%	9,771	23,707	5,091	401	0	140,914

Note

(1) At the Altona treatment plant, about 315 ML of water and backwash from the salt reduction plant was recirculated back into the treatment system. This has been included in the 'Within plant process' volume.

4. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-124 provides information about small catchment dams in the basin.

Table 6-124 Estimated small catchment dam information, Werribee basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	9,033	1,691	779	2,469
Registered/licensed commercial and irrigation	936	170	43	213
Total 2020–21	**9,969**	**1,861**	**822**	**2,682**
Total 2019–20	9,969	1,701	946	2,646

6.19.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Werribee – Key compliance points	
✓	**There was no net increase in the total entitlement volume from the previous year.**
✓	**The total volume diverted (16,018 ML) was within the volume available for the year (42,933 ML).**
✓	**No individual bulk entitlement holder took more than the annual volume made available to them.**
✓	**Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlements in the Werribee basin provide the basis for how water is shared in the basin. Rights to water in the Werribee basin are set out in Table 6-125.

Entitlements to water in the regulated Werribee system provide for the right to carry over unused allocation to the next season. In the Werribee basin, entitlement holders can carry over unused water (except for 15% of the unused volume, which is deducted for evaporation), and they can hold up to 100% of their entitlement volume. The VEWH holds an environmental entitlement in the Werribee basin, which also enables it to carry over unused water at the end of each year, subject to storage capacity and losses. The water available under the entitlement is used to provide environmental flows in the Werribee River and is not diverted out of the waterway.

Table 6-125 Entitlement volumes, Werribee basin

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Werribee system – Irrigation) Conversion Order 1997		
High-reliability water shares	15,471	15,473
Low-reliability water shares	7,256	7,256
Bulk Entitlement (Myrniong) Conversion Order 2004	58	58
Operating provision	4,256	4,253
Subtotal: Bulk Entitlement (Werribee system – Irrigation) Conversion Order 1997	*27,040*	*27,040*
Bulk Entitlement (Ballan) Conversion Order 1998	451	451
Bulk Entitlement (Blackwood and Barry's Reef) Conversion Order 1998	140	140
Bulk Entitlement (Werribee system – Western Water) Conversion Order 2004	13,749	13,749
Werribee River Environment Entitlement 2011 (1)	n/a	n/a
Take and use licences – unregulated surface water	697	697
Licensed small catchment dams – on-waterway	187	187
Licensed small catchment dams – off-waterway	749	749
Total	**43,014**	**43,014**

Note

(1) The *Werribee River Environmental Entitlement 2011* consists of a 10% share of inflows into Lake Merrimu, with the actual volume available in any year varying depending on inflow conditions.

Table 6-126 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

Table 6-126 Available water and take, Werribee basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Werribee system – Irrigation – SRW					
Water shares (1)	11,228	11,500	0	22,728	9,156
Myrniong	13	45	0	58	49
Operating provision (2)	-	2,470	-	2,470	2,470
Net diversion: Werribee system – Irrigation – SRW (3)				*25,256*	*11,675*
Ballan	-	451	0	451	0
Blackwood and Barry's Reef	-	140	0	140	54
Werribee system – Western Water (4)	-	13,749	0	13,749	2,516
Werribee River Environment Entitlement 2011 (5)	841	862	0	1,703	1,059
Take and use licences – unregulated surface water	-	697	0	697	39
Licensed small catchment dams	-	936	0	936	170
Total 2020–21	**12,082**	**30,851**	**0**	**42,933**	**15,513**
Total 2019–20	6,712	36,172	0	42,884	15,508

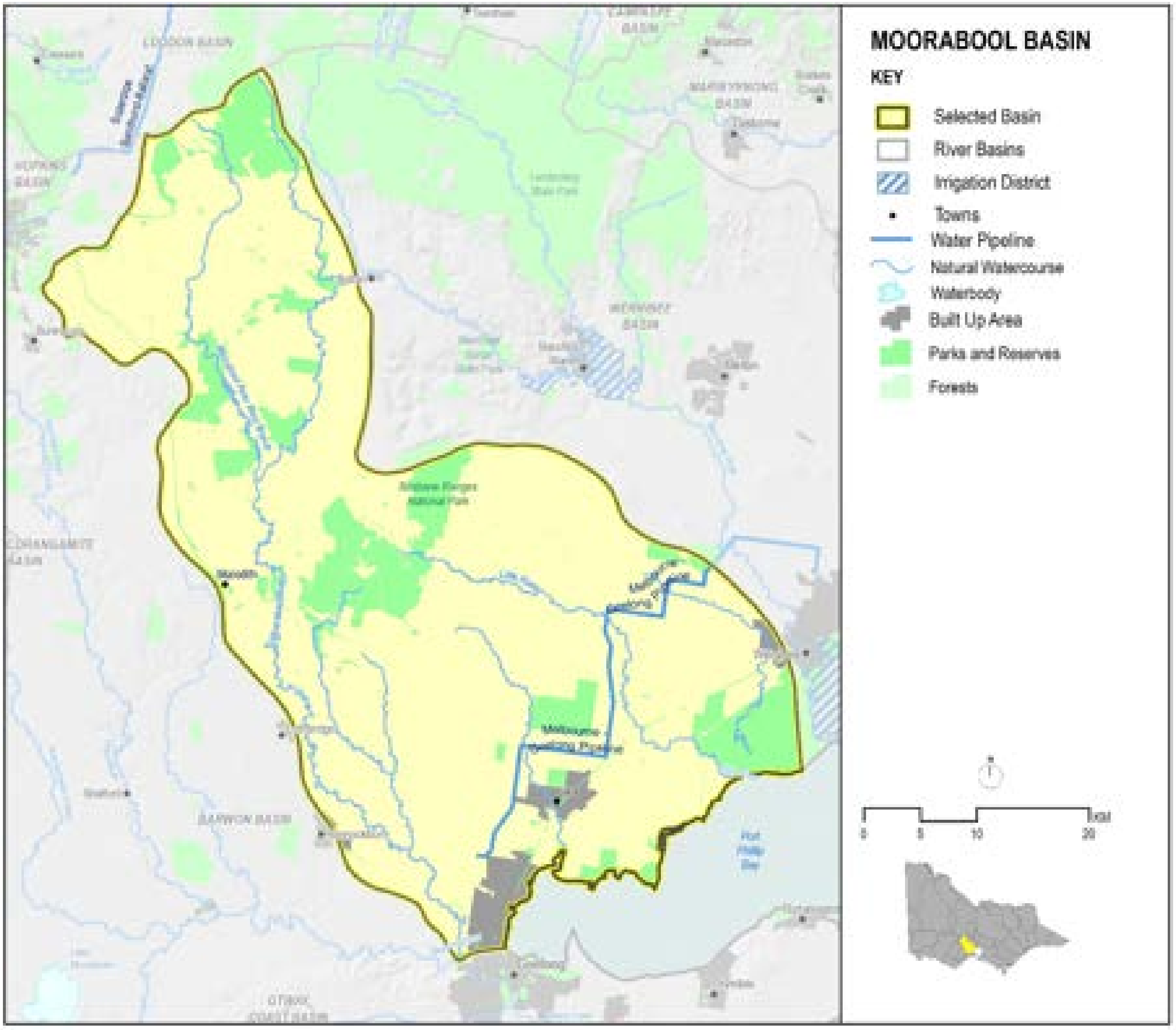
Notes

(1) Water use reported includes water taken by primary entitlement holders and includes 550 ML of environmental in-stream use. This volume of in-stream environmental use is not reflected in the water balance in Table 6-121, as it does not reflect an actual diversion from the waterway.
(2) This reflects the use of water to manage the system. It includes any loss incurred in supplying the primary entitlements.
(3) The water use reported in this line item represents the net diversion to supply primary entitlements and fulfil other operating requirements under the Werribee system bulk entitlement (net of return flow from irrigation). It includes environment deliveries in-stream (550 ML).
(4) The water available to Western Water is determined by an inflow and storage capacity share in the system. In any year, available inflows will vary; entitlement holders may have water available from the previous year in their storage share, but the maximum annual amount that can be taken is shown here.
(5) 'Allocation issued' reflects the share of inflows available under this entitlement during the year including adjustments made to account for water lost from internal spills, evaporation, return flow credits or changes in storage volume. 'Water use reported' reflects environmental in-stream use: this amount is not reflected in the water balance in Table 6-121 as it is not an actual diversion from the waterway.

6.20 Moorabool basin

The Moorabool basin (Figure 6-38) is located west of Melbourne. The Moorabool River begins as two major tributaries on the southern slopes of the Great Dividing Range near Ballan and flows south-east to join the Barwon River near Geelong. The Moorabool basin also includes Little River, which flows into Port Phillip Bay.

Figure 6-38 Map of the Moorabool basin



6.20.1 Management arrangements

Management of water in the Moorabool basin is undertaken by various parties, as shown in Table 6-127.

Table 6-127 Water resource management responsibilities, Moorabool basin

Authority	Management responsibilities
Southern Rural Water	Manages licensed diversions
Barwon Water	Supplies Geelong and surrounding towns (mainly sourced from the Barwon basin) Manages reservoirs on the east Moorabool River and has a third of the share of Lal Lal Reservoir on the west Moorabool River Manages Upper Stony Creek Reservoir on Stony Creek
Central Highlands Water	Supplies Ballarat and surrounding towns (sourced from both the Barwon and Moorabool basins) Manages reservoirs on the west Moorabool River and has two-thirds of the share of Lal Lal Reservoir
Corangamite Catchment Management Authority	Responsible for waterway and catchment management in the Moorabool basin, except for the Little River catchment
Melbourne Water	Responsible for waterway and catchment management in the Little River catchment

6.20.2 2020–21 water resources overview

In 2020–21, rainfall was:

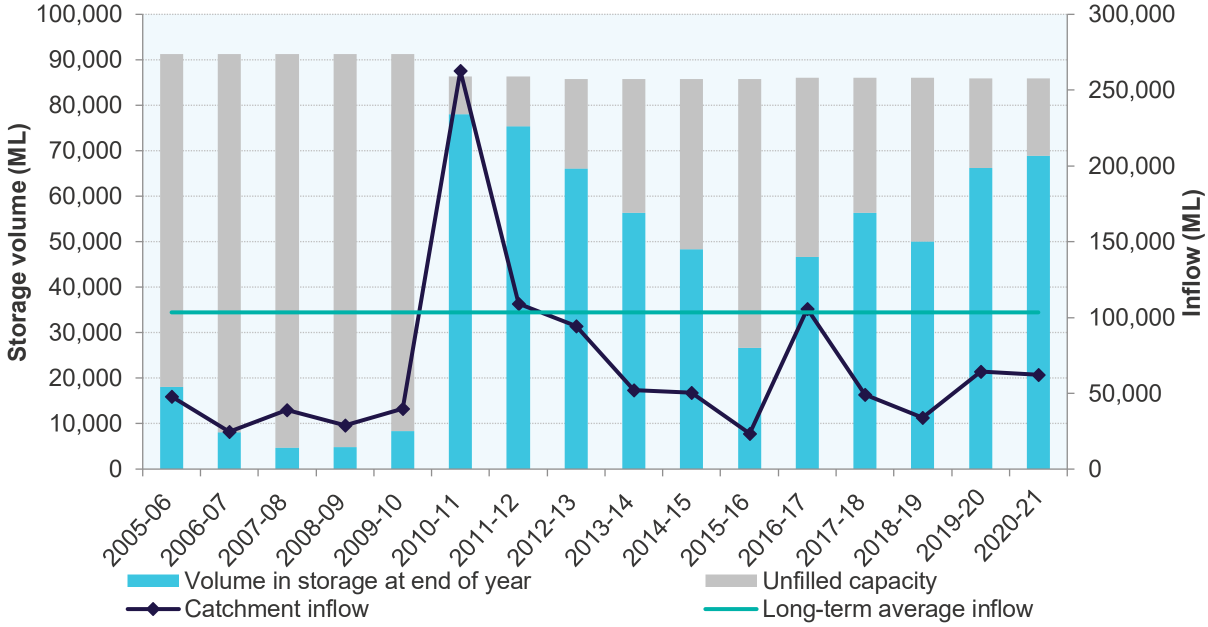
- above average in most of the basin

- average in a small area in the far north of the basin
- average in a small area in the far south-east of the basin, south of Werribee.

Catchment inflows to the basin in 2020–21 were 60% of the long-term average annual volume of 103,400 ML, lower than in 2019–20 when inflows were 62% of the long-term average.

Major storages in the basin were at 77% of capacity on 1 July 2020 and higher (at 82% of capacity) on 30 June 2021.

Figure 6-39 Storage volumes and catchment inflows, Moorabool basin



There were no restrictions placed on licensed diversions from unregulated streams in the Moorabool basin for the entirety of 2020–21 compared to two in the previous year.

There were no restrictions on urban water use in the Moorabool basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 23,922 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was more than the 22,130 ML diverted in the previous year.

6.20.2.1 Water for the environment

Environmental watering sites and environmental values in the Moorabool basin that depend on water for the environment include:

- river blackfish between Lal Lal Reservoir and She Oaks Weir
- the lower Barwon Wetlands, which is part of the Port Phillip Bay and Bellarine Peninsula Ramsar Site
- extensive areas of endangered remnant vegetation including streambank shrubland and riparian woodland ecological vegetation communities
- platypus, water rats and a range of waterbugs.

In 2020–21, water for the environment in the Moorabool basin comprised:

- the *Moorabool River Environmental Entitlement 2010*, comprising 11.9% of inflows held by the VEWH
- 3,480 ML of treated groundwater discharged from the Fyansford quarry to the lower Moorabool River
- water set aside for the environment through the operation of passing flow conditions:
  - on consumptive bulk entitlements held by Central Highlands Water and Barwon Water
  - on the VEWH's *Moorabool River Environmental Entitlement 2010*
  - on licensed diversions
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

In 2020–21, a total of 2,400 ML of environmental water was delivered in-stream in the Moorabool basin. Adding to the environmental benefit in the system, 3,408 ML of treated groundwater was discharged from the Fyansford quarry to the lower Moorabool River.

6.20.3 Water balance

The total volumes of water available and supplied from water resources in the Moorabool basin in 2020–21 are shown in Table 6-128.

Table 6-128 Water balance, Moorabool basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	59,057	45,169
Volume in storage at the end of the year	1	62,722	59,057
Change in storage		**3,665**	**13,888**
Inflows			
Catchment inflow	2	62,115	64,258
Rainfall on major storages	1	4,907	6,182
Inflow from groundwater	3	3,480	3,506
Treated wastewater discharged back to river	4	0	0
Total inflows		**70,502**	**73,946**
Outflows			
Diversions			
Urban diversions		11,937	10,366
Transfers to Barwon basin (White Swan Reservoir)	5	5,767	5,885
Licensed diversions from unregulated streams		739	671
Small catchment dams	6	5,479	5,208
Total diversions		***23,922***	***22,130***
Losses			
Evaporation from major storages	1	6,038	5,481
Net evaporation from small catchment dams	6	1,602	1,929
In-stream infiltration to groundwater, flows to floodplain and evaporation	7	8,199	8,407
Total losses		***15,839***	***15,817***
Water passed at outlet of basin			
River outflows to Port Phillip Bay (Little River) and other small coastal streams		7,588	5,235
River outflows to the Barwon River (Moorabool River)		19,488	16,876
Total water passed at outlet of basin		***27,076***	***22,111***
Total outflows		**66,837**	**60,058**

6.20.3.1 Notes to the water balance

1. Storage volumes

Major — greater than 1,000 ML — on-stream storages in the Moorabool basin are included in the water balance. Table 6-129 shows how storage volumes changed during the year. Volumes in the off-stream storage are presented for additional information about the resource condition.

Table 6-129 Storage volumes, Moorabool basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflows less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Bostock Reservoir	7,360	4,048	627	679	2,387	6,383
Korweinguboora Reservoir	2,327	1,215	384	449	(130)	1,020
Lal Lal Reservoir	59,549	50,225	2,670	3,634	2,361	51,621
Moorabool Reservoir	6,192	3,430	1,171	1,210	127	3,519
Wilsons Reservoir	1,010	139	55	66	51	179
Subtotal	**76,438**	**59,057**	**4,907**	**6,038**	**4,796**	**62,722**
Off-stream storage						
Upper Stony Creek Reservoir	9,494	7,158	1,410	1,388	(965)	6,215
Subtotal	**9,494**	**7,158**	**1,410**	**1,388**	**(965)**	**6,215**
Total 2020–21	**85,932**	**66,215**	**4,907**	**6,038**	**3,831**	**68,937**
Total 2019–20	85,932	49,966	6,182	5,481	15,548	66,215

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, the known inflows and the net change in storage volume.

The 2019–20 catchment inflow volume has been corrected from the previous account. The in-stream loss volume was incorrectly reported, which in turn caused an error in the catchment inflow amount.

3. Inflow from groundwater

3,480 ML of treated groundwater was discharged from the Fyansford quarry to the lower Moorabool River, providing an environmental benefit in the system.

4. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-130 lists the wastewater treatment plants in the Moorabool basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance, but in 2020–21 there were no such discharges into the Moorabool basin's waterways.

Table 6-130 Volume and use of recycled water, Moorabool basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Gordon	C	35	35	100%	0	35	0	0	0	0
Northern WRP	A	1,184	1,184	100%	1,095	0	0	89	0	0
Total 2020–21		**1,219**	**1,219**	**100%**	**1,095**	**35**	**0**	**89**	**0**	**0**
Total 2019–20		1,200	1,200	100%	1,048	27	0	125	0	0

5. Transfers to Barwon basin (White Swan Reservoir)

The 5,767 ML transfer represents water transferred to White Swan Reservoir in the Barwon basin before being supplied to urban customers in the Ballarat area, which is located within both the Barwon and Moorabool basins.

6. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-131 provides information about small catchment dams in the basin.

Table 6-131 Estimated small catchment dam information, Moorabool basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	13,000	3,383	1,270	4,653
Registered/licensed commercial and irrigation	7,326	2,096	332	2,428
Total 2020–21	**20,326**	**5,479**	**1,602**	**7,081**
Total 2019–20	20,326	5,208	1,929	7,137

7. In-stream infiltration to groundwater, flows to floodplain and evaporation

The 2019–20 in-stream loss volume has been corrected from the previous accounts, where it was incorrectly reported as 13,224 ML.

6.20.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Moorabool – Key compliance points
✓ **There was a net increase of 105 ML in the total entitlement volume from the previous year.**
• Two licensed small catchment dam registrations were incorrectly issued. This accounting error will be fixed in the 2021–22 accounts, and the incorrect licences will be cancelled.
✓ **The total volume diverted (22,939 ML) was within the volume available for the year (56,575 ML).**
✓ **No individual bulk entitlement holder took more than the annual volume made available to them.**
✓ **Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlements in the Moorabool basin provide the basis for how water is shared in the basin. Rights to water in the Moorabool basin are set out in Table 6-132.

The VEWH holds an environmental entitlement in the Moorabool basin, but the water available under the entitlement is used to support streamflows and is not diverted out of the waterway. As this water use is not a diversion from the waterway, it has not been included as part of the water balance diversions in Table 6-128.

Table 6-132 Entitlement volumes, Moorabool basin

Water entitlement – Moorabool	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Lal Lal – Barwon) Conversion Order 1995 (1)	5,925	5,925
Bulk Entitlement (Lal Lal – Central Highlands) Conversion Order 1995 (2)	12,575	12,575
Moorabool River Environment Entitlement 2010 (3)	n/a	n/a
Bulk Entitlement (Meredith) Conversion Order 1995	600	600
Bulk Entitlement (She Oaks) Conversion Order 1995 (4)	2,000	2,000
Bulk Entitlement (Upper East Moorabool System) Conversion Order 1995	9,000	9,000
Bulk Entitlement (Upper West Moorabool System) Conversion Order 1995	10,500	10,500
Take and use licences – unregulated surface water	2,143	2,143
Licensed small catchment dams – on-waterway	1,431	1,431
Licensed small catchment dams – off-waterway	5,896	5,790
Total	**50,069**	**49,963**

Notes

(1) Under this entitlement, the authority may take up to a total of 5,925 ML in any one year and up to 17,775 ML in any consecutive three-year period. The water available is determined by an inflow and storage capacity share in the system. In any year, available inflows will vary; entitlement holders may have water available from the previous year in their storage share, but the maximum annual amount that can be taken is shown here.

(2) Under this entitlement, the authority may take up to a total of 12,575 ML in any one year and up to 37,725 ML in any consecutive three-year period. The water available is determined by an inflow and storage capacity share in the system. In any year, available inflows will vary; entitlement holders may have water available from the previous year in their storage share, but the maximum annual amount that can be taken is shown here.

(3) The *Moorabool River Environmental Entitlement 2010* consists of an 11.9% share of inflows into storage, up to 7,500 ML every three years, with the actual volume available in any year varying depending on inflow conditions.

(4) Under this entitlement, the authority may take up to 6,000 ML in any three consecutive years.

Table 6-133 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

Table 6-133 Available water and take, Moorabool basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Lal Lal – Barwon (1)	-	5,925	0	5,925	2,709
Lal Lal – Central Highlands (1)	-	12,575	0	12,575	4,597
Moorabool River Environment Entitlement (2)	3,991	3,515	0	7,506	2,400
Meredith	-	600	0	600	0
She Oaks	-	2,000	0	2,000	0
Upper East Moorabool System	-	9,000	0	9,000	4,631
Upper West Moorabool System	-	10,500	0	10,500	5,767
Take and use licences – unregulated surface water	-	2,163	0	2,163	739
Licensed small catchment dams	-	7,306	0	7,306	2,096
Total 2020–21	**3,991**	**53,584**	**0**	**57,575**	**22,939**
Total 2019–20	1,786	54,858	0	56,644	22,573

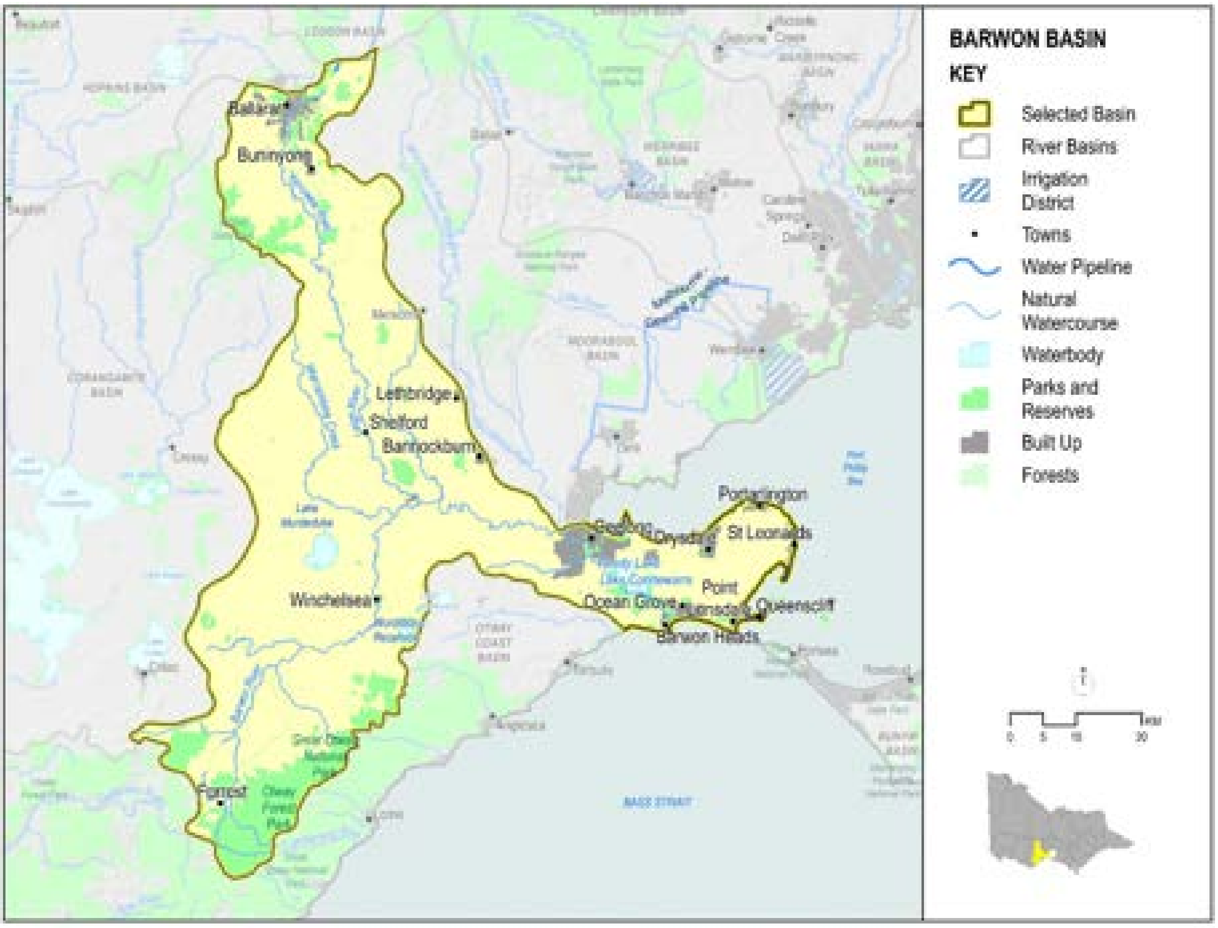
Notes

(1) The water available to entitlement holders is determined by an inflow and storage capacity share in the system. In any year, available inflows will vary; entitlement holders may have water available from the previous year in their storage share, but the maximum annual amount that can be taken is shown here.
(2) 'Water taken' reflects environmental in-stream use. This amount is not included in the water balance in Table 6-128 as it is not an actual diversion from the waterway. Unused water is available to carry over under this entitlement.

6.21 Barwon basin

The Barwon basin (Figure 6-40) is in western Victoria. The Barwon River originates in the Otway Ranges and receives inflows from the north from the Leigh River and the Moorabool River before it flows into Bass Strait at Barwon Heads.

Figure 6-40 Map of the Barwon basin



6.21.1 Management arrangements

Management of water in the Barwon basin is undertaken by various parties, as shown in Table 6-134.

Table 6-134 Water resource management responsibilities, Barwon basin

Authority	Management responsibilities
Southern Rural Water	Manages licensed diversions
Barwon Water	Supplies Geelong and surrounding towns, also by sourcing water from the Moorabool basin and from the Melbourne system via the Melbourne to Geelong Pipeline Operates West Barwon Reservoir and Lake Wurdee Boluc
Central Highlands Water	Supplies Ballarat and surrounding towns, mainly with water sourced from the Moorabool basin and the Campaspe and Goulburn basins, via the Goldfields Superpipe Operates White Swan and Gong Gong reservoirs
Corangamite Catchment Management Authority	Responsible for waterway and catchment management in the whole of the Barwon basin

6.21.2 2020–21 water resources overview

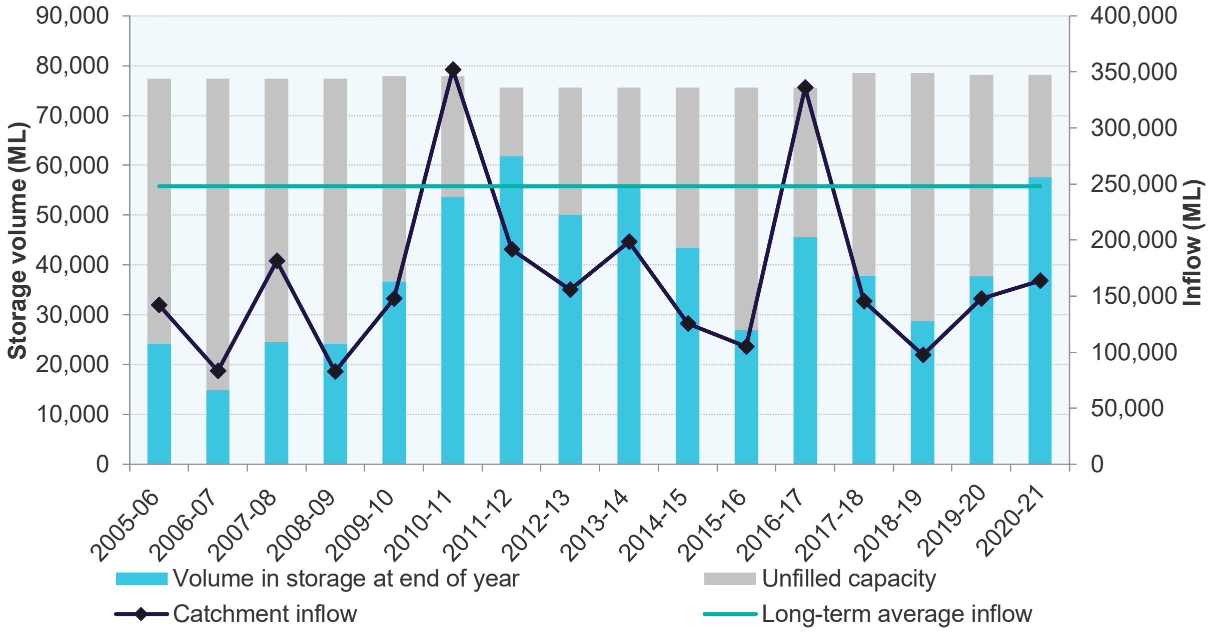
In 2020–21, rainfall was:

- average in the south-west of the basin, from Shelford to south of Winchelsea
- above average in the north, north-east and south-east, over Ballarat, Cressy, Shelford, Ocean Grove and St Leonards
- above average in the south of the basin, at Forrest.

Catchment inflows to the basin in 2020–21 were 66% of the long-term average of 248,000 ML, greater than in 2019–20 when inflows were 59% of the long-term average.

Major storages in the basin were at 43% of capacity on 1 July 2020 and higher (at 87% of capacity) on 30 June 2021.

Figure 6-41 Storage volumes and catchment inflows, Barwon basin



There were no restrictions placed on licensed diversions from unregulated streams in the Barwon basin for the entirety of 2020–21 compared to one in the previous year.

There were no restrictions on urban water use in the Barwon basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 44,285 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This is slightly less than the 44,731 ML diverted in the previous year.

6.21.2.1 Water for the environment

Environmental watering sites and environmental values in the Barwon basin that depend on water for the environment include:

- the Bellarine Peninsula's internationally significant wetlands, which are listed under the Ramsar Convention and which rely on freshwater inputs from the Barwon basin to function ecologically
- the Lake Connewarre complex
- native fish populations (such as Australian grayling, Yarra pygmy perch, Australian mudfish and tupong)
- the native waterbird population (particularly migratory shorebirds including the common greenshank, Pacific golden plover, curlew sandpiper and red-necked stint)
- platypus populations in the upper and middle catchment.

In 2020–21, water for the environment in the Barwon basin comprised:

- the *Barwon River Environmental Entitlement 2011*
- the *Upper Barwon River Environmental Entitlement 2018*, comprising 3.8% of inflows held by the VEWH
- water from the Ballarat South Wastewater Treatment Plant released into the Leigh and Barwon rivers
- a portion of the treated groundwater discharged from the Fyansford quarry to the lower Moorabool River
- water set aside for the environment through the operation of passing flow conditions:
  - on consumptive bulk entitlements held by Barwon Water and Central Highlands Water
  - on licensed diversions
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

In 2020–21, a total of 883 ML of environmental water was delivered in-stream in the Barwon basin.

6.21.3 Water balance

The total volumes of water available and supplied from water resources in the Barwon basin in 2020–21 are shown in Table 6-135.

Table 6-135 Water balance, Barwon basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	16,233	15,407
Volume in storage at the end of the year	1	32,945	16,233
Change in storage		**16,712**	**826**
Inflows			
Catchment inflow	2	163,448	146,346
Rainfall on major storages	1	2,683	3,021
Inflows from the Moorabool River		19,488	16,876
Transfers from the Corangamite basin via Woady Yaloak Channel		0	0
Transfers from Moorabool basin to White Swan Reservoir	3	5,767	5,885
Transfers from Campaspe basin to White Swan Reservoir	3	0	253
Treated wastewater discharged back to river	4	9,871	10,376
Total inflows		**201,257**	**182,757**
Outflows			
Diversions			
Urban diversions	5	36,732	37,628
Licensed diversions from unregulated streams		698	1,087
Small catchment dams	6	6,855	6,016
Total diversions		***44,285***	***44,731***
Losses			
Evaporation from major storages	1	2,383	2,597
Net evaporation from small catchment dams	6	2,840	3,208
In-stream infiltration to groundwater, flows to floodplain and evaporation		12,364	13,224
Total losses		***17,587***	***19,029***
Water passed at outlet of basin			
River outflows to the ocean		122,672	118,171
Total water passed at outlet of basin		***122,672***	***118,171***
Total outflows		**184,545**	**181,931**

6.21.3.1 Notes to the water balance

1. Storage volumes

Major — greater than 1,000 ML — on-stream storages in the Barwon basin are included in the water balance. Table 6-136 shows how storage volumes changed during the year. Volumes in the off-stream storage are presented for additional information about the resource condition.

Table 6-136 Storage volumes, Barwon basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflows less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Gong Gong Reservoir	1,902	738	143	159	207	929
West Barwon Reservoir	22,064	4,954	1,440	1,162	14,581	19,813
White Swan Reservoir (1)	14,107	10,541	1,100	1,062	1,625	12,203
Subtotal	**38,073**	**16,233**	**2,683**	**2,383**	**16,413**	**32,945**
Off-stream storage						
Wurdee Boluc Reservoir	40,032	21,553	2,842	4,448	4,752	24,699
Subtotal	**40,032**	**21,553**	**2,842**	**4,448**	**4,752**	**24,699**
Total 2020–21	**78,105**	**37,786**	**2,683**	**2,383**	**21,165**	**57,644**
Total 2019–20	78,105	28,713	3,021	2,597	8,649	37,786

Note

(1) White Swan Reservoir is treated as an on-stream storage for the purpose of the water balance.

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, the known inflows and the net change in storage volume.

The 2019–20 catchment inflow volume has been corrected from the previous account. There was an error in the urban diversion volume, which in turn caused an error in the catchment inflow amount.

3. Transfers from Moorabool basin

The 5,767 ML transfer represents water transferred to White Swan Reservoir from the Moorabool basin. This water is used to supply urban customers in the Ballarat area, which is located within both the Barwon and Moorabool basins.

4. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-137 lists the wastewater treatment plants in the Barwon basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

Barwon Water and Central Highlands Water operate treatment plants within the Barwon basin.

The 2019–20 percentage recycled number was incorrectly published as 7%. This has been corrected.

Table 6-137 Volume and use of recycled water, Barwon basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to the sea / other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Ballarat North	A, B	3,496	656	19%	8	0	195	453	2,840	0
Ballarat South	B	7,166	135	2%	0	0	0	135	7,031	0
Bannockburn	C	260	260	100%	78	0	0	182	0	0
Birregurra	C	36	36	100%	5	0	0	31	0	0
Black Rock	C, A	26,243	1,914	7%	1,379	351	0	184	0	24,329
Portarlington	C	343	343	100%	39	66	0	238	0	0
Winchelsea	C	89	89	100%	0	10	0	79	0	0
Total 2020–21		**37,633**	**3,433**	**9%**	**1,509**	**427**	**195**	**1,302**	**9,871**	**24,329**
Total 2019–20		37,155	3,843	10%	1,438	1,121	147	1,137	10,376	22,936

5. Urban diversions

The 2019–20 urban diversion volume has been corrected from the previous account. The volume now excludes passing flow and Corangamite Catchment Management Authority environmental releases from the Upper Barwon System bulk entitlement.

6. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-138 provides information about small catchment dams in the basin.

Table 6-138 Estimated small catchment dam information, Barwon basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	24,164	4,900	2,420	7,320
Registered/licensed commercial and irrigation	9,746	1,955	420	2,375
Total 2020–21	**33,910**	**6,855**	**2,840**	**9,695**
Total 2019–20	33,909	6,017	3,208	9,224

6.21.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals

- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Barwon – Key compliance points	
✓	**There was no net increase in the total entitlement volume from the previous year.**
✓	**The total volume diverted (40,267 ML) was within the volume available for the year (70,808 ML).**
✓	**No individual bulk entitlement holder took more than the annual volume made available to them.**
✓	**Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlements in the Barwon basin provide the basis for how water is shared in the basin. Rights to water in the Barwon basin are set out in Table 6-139.

Table 6-139 Entitlement volumes, Barwon basin

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlements (Upper Barwon System) Conversion Order 2002 (1)	42,466	42,466
Bulk Entitlement (Yarrowee–White Swan System) Conversion Order 2002 (2)	12,267	12,267
Barwon River Environmental Entitlement 2011 (3)	n/a	n/a
Upper Barwon River Environmental Entitlement 2018 (4)	n/a	n/a
Take and use licences – unregulated surface water	4,618	4,622
Licensed small catchment dams – on-waterway	923	921
Licensed small catchment dams – off-waterway	8,823	8,928
Total	**69,097**	**69,204**

Notes

(1) This entitlement specifies that the authority may take up to 127,400 ML in any successive three-year period. The water available is determined by an inflow and storage capacity share in the system. In any year, available inflows will vary; entitlement holders may have water available from the previous year in their storage share, but the maximum annual amount that can be taken is shown here.

(2) This entitlement specifies that the authority may take up to 36,800 ML in any successive three-year period. It includes up to 10,500 ML extracted from the upper West Moorabool system under Central Highlands Water's Upper West Moorabool bulk entitlement in the Moorabool basin.

(3) The *Barwon River Environmental Entitlement 2011* allows unregulated flows to be diverted to floodplain wetlands. The volume of unregulated flows available for diversion varies as it depends on suitable river heights as specified in the entitlement. As such, an annual volume is not applicable for this entitlement.

(4) An annual volume is not applicable for the *Upper Barwon River Environmental Entitlement 2018* as it allows for a 3.8% share of inflows into storage, with the actual volume available in any year depending on inflow conditions.

Table 6-140 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

Table 6-140 Available water and take, Barwon basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Upper Barwon system (1)	-	42,466	0	42,466	28,460
Yarrowee–White Swan system	-	12,267	0	12,267	8,272
Barwon River Environmental Entitlement (2)	-	-	-	-	-
Upper Barwon River Environmental Entitlement (3)	537	1,172	0	1,709	883
Take and use licences – unregulated surface water	-	4,732	(2)	4,730	698
Licensed small catchment dams	-	9,634	2	9,636	1,955
Total 2020–21	**537**	**70,271**	**0**	**70,808**	**40,268**
Total 2019–20	732	69,938	0	70,671	42,429

Notes

(1) The water available under this entitlement is determined by an inflow and storage capacity share in the system. In any year, available inflows will vary; entitlement holders may have water available from the previous year in their storage share, but the maximum annual amount that can be taken is shown here.

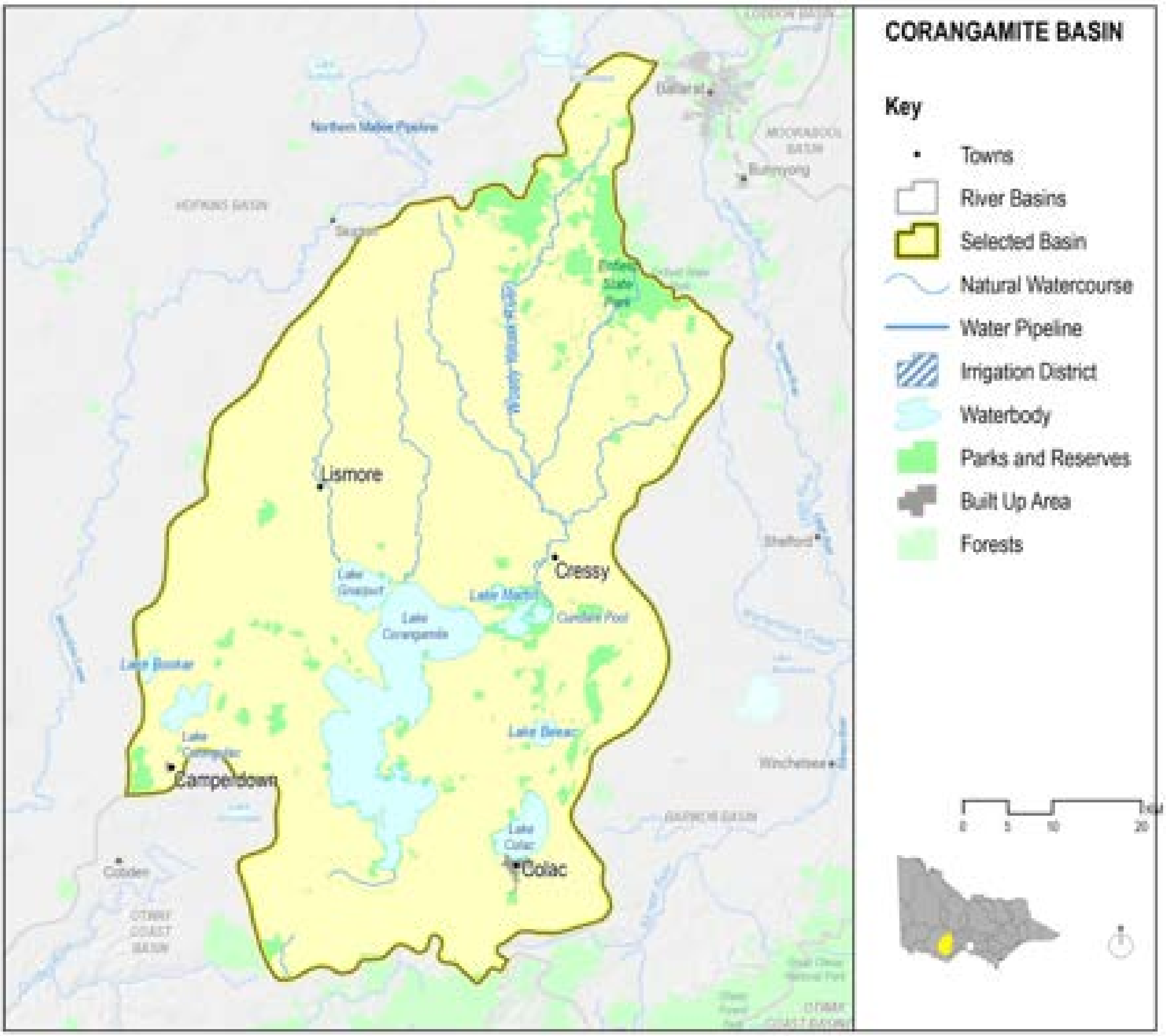
(2) Use of this entitlement depends on suitable river heights, as specified in the entitlement. Volumes delivered are not measured.

(3) 'Water taken' reflects environmental in-stream use: this amount is not included in the water balance in Table 6-135, as it is not an actual diversion from the waterway. Unused water is available to carry over under this entitlement.

6.22 Corangamite basin

The Corangamite basin (Figure 6-42) is in western Victoria. Rivers and streams within the basin terminate in a series of inland lakes, the largest of which is Lake Corangamite.

Figure 6-42 Map of the Corangamite basin



6.22.1 Management arrangements

Management of water in the Corangamite basin is undertaken by various parties, as shown in Table 6-141.

Table 6-141 Water resource management responsibilities, Corangamite basin

Authority	Management responsibilities
Southern Rural Water	Manages licensed diversions
Barwon Water	Supplies Colac and surrounding towns (from the Otway Coast basin)
Central Highlands Water	Supplies Ballarat and surrounding towns (Ballarat system, sourced from the Moorabool, Barwon and Goulburn basins)
Wannon Water	Provides urban water supply to Camperdown, Lismore and Derrinallum (from the Otway Coast basin)
Corangamite Catchment Management Authority	Responsible for waterway and catchment management in the Corangamite basin

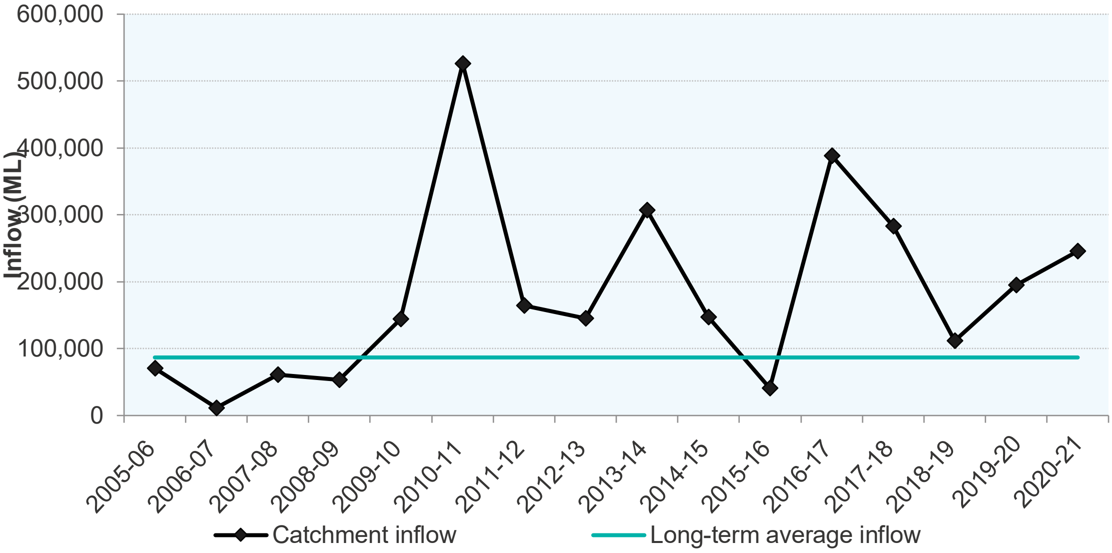
6.22.2 2020–21 water resources overview

In 2020–21, rainfall was:

- above average in most of the basin
- very much above average in a small area north of Darlington
- average south and south-east of the basin, from Cressy over Lake Corangamite to Lake Purrumbete.

Catchment inflows to the basin in 2020–21 were 283% of the long-term average of 86,800 ML, greater than in 2019–20 when inflows were 225% of the long-term average. The amount of water flowing from the Corangamite basin into the Ramsar-listed Western District Lakes represented 98% of the total inflows in 2020–21.

Figure 6-43 Catchment inflows, Corangamite basin



Licensed diversions from Lake Tooliorook were banned from July to December 2020 in the Corangamite basin in 2020–21, compared to no restrictions the previous year.

There were no restrictions on urban water use in the Corangamite basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 3,077 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was almost the same as the 3,075 ML diverted in the previous year.

6.22.2.1 Water for the environment

Environmental watering sites and environmental values in the Corangamite basin that depend on water for the environment include:

- the Western District Lakes, including lakes Corangamite, Gnarpurt, Milangil, Terangpom, Beeac, Colongulac and Cundare, which are internationally significant wetlands listed under the Ramsar Convention and which rely on freshwater inputs from the Corangamite basin to function ecologically. These lakes include Corangamite, Gnarpurt, Milangil, Terangpom, Beeac, Colongulac and Cundare.
- wetlands of national importance including the Kooraweera Lakes, Lough Calvert, Lake Thurrumbong and Cundare Pool
- native fish populations and the Corangamite water skink.

In 2020–21, water for the environment in the Corangamite basin comprised:

- water set aside for the environment through the operation of passing flow conditions on licensed diversions
- all other water in the basin not allocated for consumptive use: this water also provides social, recreational and cultural benefits.

6.22.3 Water balance

The total volumes of water available and supplied from water resources in the Corangamite basin in 2020–21 are shown in Table 6-142.

Table 6-142 Water balance, Corangamite basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	-	-
Volume in storage at the end of the year	1	-	-
Change in storage		**-**	**-**
Inflows			
Catchment inflow	2	245,512	194,972
Rainfall on major storages	1	-	-
Treated wastewater discharged back to river	3	2,085	2,097
Total inflows		**247,597**	**197,069**
Outflows			
Diversions			
Urban diversions		0	0
Licensed diversions from unregulated streams		96	68
Small catchment dams	4	2,981	3,007
Total diversions		***3,077***	***3,075***
Losses			
Evaporation from major storages	1	-	-
Net evaporation from small catchment dams	4	1,274	1,945
In-stream infiltration to groundwater, flows to floodplain and evaporation	5	-	-
Total losses		***1,274***	***1,945***
Water passed at outlet of basin			
River outflows to the Corangamite Lakes		243,246	192,049
River outflows to Barwon Basin via Woady Yaloak Channel		0	0
Total water passed at outlet of basin		***243,246***	***192,049***
Total outflows		**247,597**	**197,069**

6.22.3.1 Notes to the water balance

1. Storage volumes

There are no major storages — storages greater than 1,000 ML — in the Corangamite basin.

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows and the known inflows.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-143 lists the wastewater treatment plants in the Corangamite basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

Table 6-143 Volume and use of recycled water, Corangamite basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Camperdown Industrial	n/a	44	44	100%	0	44	0	0	0	0
Camperdown Municipal	C	334	334	100%	10	324	0	0	0	0
Colac	C	2,152	67	3%	0	0	0	67	2,085	0
Total 2020–21		**2,530**	**445**	**18%**	**10**	**368**	**0**	**67**	**2,085**	**0**
Total 2019–20		2,657	559	21%	10	474	0	75	2,097	1

4. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-144 provides information about small catchment dams in the basin.

Table 6-144 Estimated small catchment dam information, Corangamite basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	9,846	2,058	1,128	3,186
Registered/licensed commercial and irrigation	3,869	923	146	1,069
Total 2020–21	**13,715**	**2,981**	**1,274**	**4,255**
Total 2019–20	13,715	3,008	1,945	4,952

5. In-stream infiltration to groundwater, flows to floodplain and evaporation

An assessment of in-stream infiltration to groundwater, flows to floodplain and evaporation is not made in the Corangamite basin as there are no suitable models available, and this basin is primarily occupied by Lake Corangamite, making it difficult to derive losses across the basin (see chapter 6.1.5.3).

6.22.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in two areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year.

Corangamite – Key compliance points
✓ **There was no net increase in the total entitlement volume from the previous year.**
✓ **The total volume diverted (1,019 ML) was within the volume available for the year (4,743 ML).**

Entitlements in the Corangamite basin provide the basis for how water is shared in the basin. Rights to water in the Corangamite basin are set out in Table 6-145.

Table 6-145 Entitlement volumes, Corangamite basin

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Take and use licences – unregulated surface water	875	875
Licensed small catchment dams – on-waterway	243	243
Licensed small catchment dams – off-waterway	3,625	3,625
Total	**4,743**	**4,743**

Table 6-146 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

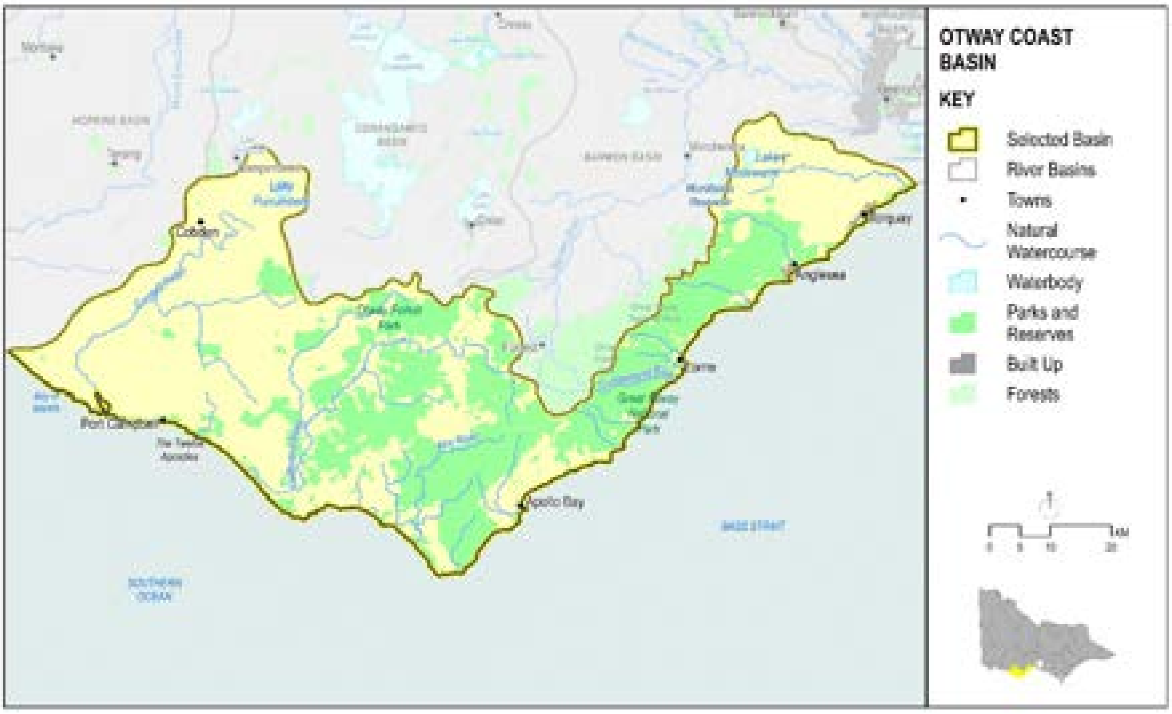
Table 6-146 Available water and take, Corangamite basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Take and use licences – unregulated surface water	-	875	0	875	96
Licensed small catchment dams	-	3,869	0	3,869	923
Total 2020–21	**-**	**4,743**	**0**	**4,743**	**1,019**
Total 2019–20	-	4,761	0	4,761	983

6.23 Otway Coast basin

The Otway Coast basin (Figure 6-44) is in south-west Victoria. It encompasses the numerous small creeks and rivers that flow to the coast from the Otway Ranges between Torquay and Peterborough.

Figure 6-44 Map of the Otway Coast basin



6.23.1 Management arrangements

Management of water in the Otway Coast basin is undertaken by various parties, as shown in Table 6-147.

Table 6-147 Water resource management responsibilities, Otway Coast basin

Authority	Management responsibilities
Southern Rural Water	Manages licensed diversions
Wannon Water	Supplies towns including Port Campbell, Peterborough, Simpson and Cobden
Barwon Water	Supplies the majority of towns in the basin including Lorne, Aireys Inlet, Apollo Bay and towns in the northern part of the basin from Geelong's water supply (which comes from the Barwon basin) Transfers water out of the basin to supply Colac and surrounding towns Operates West Gellibrand Reservoir and other reservoirs used to supply towns
Corangamite Catchment Management Authority	Responsible for waterway and catchment management in the Otway Coast basin

6.23.2 2020–21 water resources overview

In 2020–21, rainfall was:

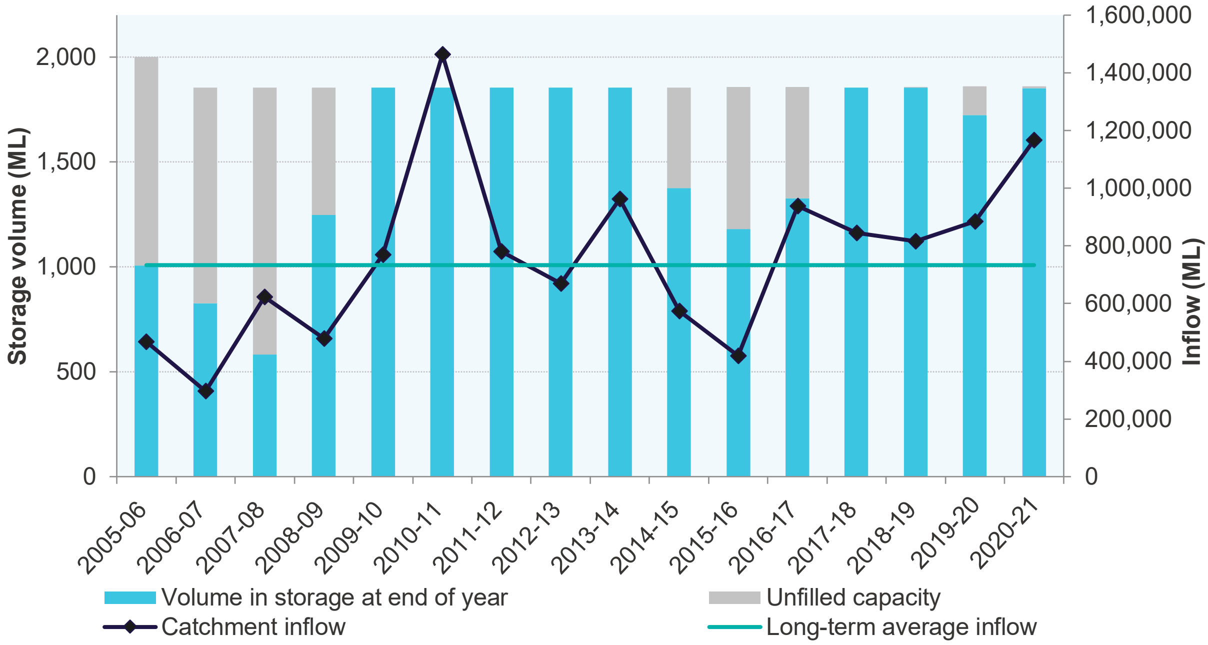
- above average in most of the basin
- very much above average in the south of the basin, in the Apollo Bay area
- very much above average in a small area in the far west of the basin
- average in small areas in the north of the basin, near Otway Forest Park and Great Otway Forest Park.

Catchment inflows to the basin in 2020–21 were 159% of the long-term average of 733,300 ML, greater than in 2019–20 when inflows were 121% of the long-term average.

The amount of water flowing into Bass Strait represented 98% of the catchment inflows in the basin in 2020–21.

West Gellibrand Reservoir was at 93% of capacity on 1 July 2020 and higher (at 100% of capacity) on 30 June 2021.

Figure 6-45 Storage volumes and catchment inflows, Otway Coast basin



Restrictions on licensed diversions from unregulated streams in the Otway Coast basin were restricted on the Carlisle River in 2020–21, compared to no restrictions the previous year. Rosters ranging from stage 1 to stage 3 were in place on the Carlisle River, starting in March 2021 and ending in April 2021. All other streams were unrestricted for the whole of 2020–21.

There were no restrictions on urban water use in the Otway Coast basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 22,449 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was more than the 21,108 ML diverted in the previous year.

6.23.2.1 Water for the environment

Environmental watering sites and environmental values in the Otway Coast basin that depend on water for the environment include:

- Aire River (a heritage river) and, more specifically, the Lower Aire wetlands, which are nationally significant
- the Aire River estuary, which is state-significant
- the upper Aire River, which is a representative river
- Elliot River, Parker River, Grey River, Carisbrook Creek and Smythes Creek, which are ecologically healthy waterways
- native fish communities (such as river blackfish and Australian grayling) and their habitats (such as remnant riparian vegetation)
- lakes Costin and Craven
- endangered, flow-dependent ecological vegetation classes including estuarine wetland and swamp scrub
- the native bird population including the great egret (a Victorian endangered species), Cape Barren goose and Australasian bittern
- native mammals including platypus and swamp antechinus
- macroinvertebrate communities in Elliot River, St Georges River and Wye River.

In 2020–21, water for the environment in the Otway Coast basin comprised:

- water set aside for the environment through the operation of passing flow conditions:
  - on consumptive bulk entitlements held by Barwon Water and Wannon Water
  - on licensed diversions
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

6.23.3 Water balance

The total volumes of water available and supplied from water resources in the Otway Coast basin in 2020–21 are shown in Table 6-148.

Table 6-148 Water balance, Otway Coast basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	1,723	1,855
Volume in storage at the end of the year	1	1,853	1,723
Change in storage		**130**	**(132)**
Inflows			
Catchment inflow	2	1,166,244	884,419
Rainfall on major storages	1	285	336
Treated wastewater discharged back to river	3	170	68
Total inflows		**1,166,700**	**884,823**
Outflows			
Diversions			
Urban diversions		12,713	12,448
Licensed diversions from unregulated streams		43	144
Small catchment dams	4	9,693	8,516
Total diversions		***22,449***	***21,108***
Losses			
Evaporation from major storages	1	188	386
Net evaporation from small catchment dams	4	765	3,297
In-stream infiltration to groundwater, flows to floodplain and evaporation	5	-	-
Total losses		***953***	***3,683***
Water passed at outlet of basin			
River outflows to the ocean		1,143,168	860,164
Total water passed at outlet of basin		***1,143,168***	***860,164***
Total outflows		**1,166,570**	**884,955**

6.23.3.1 Notes to the water balance

1. Storage volumes

The one major — greater than 1,000 ML — on-stream storage in the Otway Coast basin is included in the water balance. Table 6-149 shows how storage volumes changed during the year.

Table 6-149 Storage volumes, Otway Coast basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflows less regulated releases (ML)	End volume in store (ML)
On-stream storage						
West Gellibrand Reservoir	1,860	1,723	285	188	32	1,853
Total 2020–21	**1,860**	**1,723**	**285**	**188**	**32**	**1,853**
Total 2019–20	1,860	1,855	336	386	(83)	1,723

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, the known inflows and the net change in storage volume.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-150 lists the wastewater treatment plants in the Otway Coast basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

Table 6-150 Volume and use of recycled water, Otway Coast basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Aireys Inlet [(1)]	C	0	0	0%	0	0	0	0	0	0
Anglesea	C	469	30	6%	19	0	0	11	0	439
Apollo Bay	C	464	14	3%	0	0	0	14	0	450
Cobden	C	247	105	43%	0	105	0	0	142	0
Lorne	C	313	15	5%	0	0	0	15	0	298
Peterborough	C	21	21	100%	0	21	0	0	0	0
Port Campbell	C	47	47	100%	0	47	0	0	0	0
Simpson	C	28	0	0%	0	0	0	0	28	0
Timboon	C	72	72	100%	0	72	0	0	0	0
Total 2020–21		**1,661**	**304**	**18%**	**19**	**245**	**0**	**40**	**170**	**1,187**
Total 2019–20		1,441	280	19%	30	210	0	40	68	1,093

Note
(1) Wastewater treatment plants at Aireys Inlet were operational but did not produce any recycled water output this year.

4. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-151 provides information about small catchment dams in the basin.

Table 6-151 Estimated small catchment dam information, Otway Coast basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	13,117	4,821	689	5,510
Registered/licensed commercial and irrigation	10,573	4,872	76	4,948
Total 2020–21	**23,690**	**9,693**	**765**	**10,458**
Total 2019–20	23,691	8,516	3,297	11,813

5. In-stream infiltration to groundwater, flows to floodplain and evaporation

An assessment of in-stream infiltration to groundwater, flows to floodplain and evaporation is not made in the Otway Coast basin as there are no suitable models available to make an estimate of the total losses (see chapter 6.1.5.3).

6.23.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Otway Coast – Key compliance points

✓ **There was a net increase of 559 ML in the total entitlement volume from the previous year.**
- 550 ML of take and use licence was issued for a small catchment dam on a waterway due to a surface water sale/auction of volumes in the Curdies system, as identified in the *Western Region Sustainable Water Strategy*.
- There was a 9 ML increase in licensed small catchment dams due to data cleansing.

✓ **The total volume diverted (17,628 ML) was within the volume available for the year (34,664 ML).**

✓ **No individual bulk entitlement holder took more than the annual volume made available to them.**

✓ **Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlements in the Otway Coast basin provide the basis for how water is shared in the basin. Rights to water in the Otway Coast basin are set out in Table 6-152.

Table 6-152 Entitlement volumes, Otway Coast basin

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Aireys Inlet) Conversion Order 1997	317	317
Bulk Entitlement (Apollo Bay) Order 2010	800	800
Bulk Entitlement (Colac) Amendment Order 2003	5,400	5,400
Bulk Entitlement (Gellibrand) Conversion Order 1997	60	60
Bulk Entitlement (Lorne) Conversion Order 1997	510	510
Bulk Entitlement (Otway Coast) Conversion Order 1998	12,580	12,580
Take and use licences – unregulated surface water	4,424	4,424
Licensed small catchment dams – on-waterway	2,515	1,965
Licensed small catchment dams – off-waterway	8,059	8,050
Total	**34,664**	**34,105**

Table 6-153 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

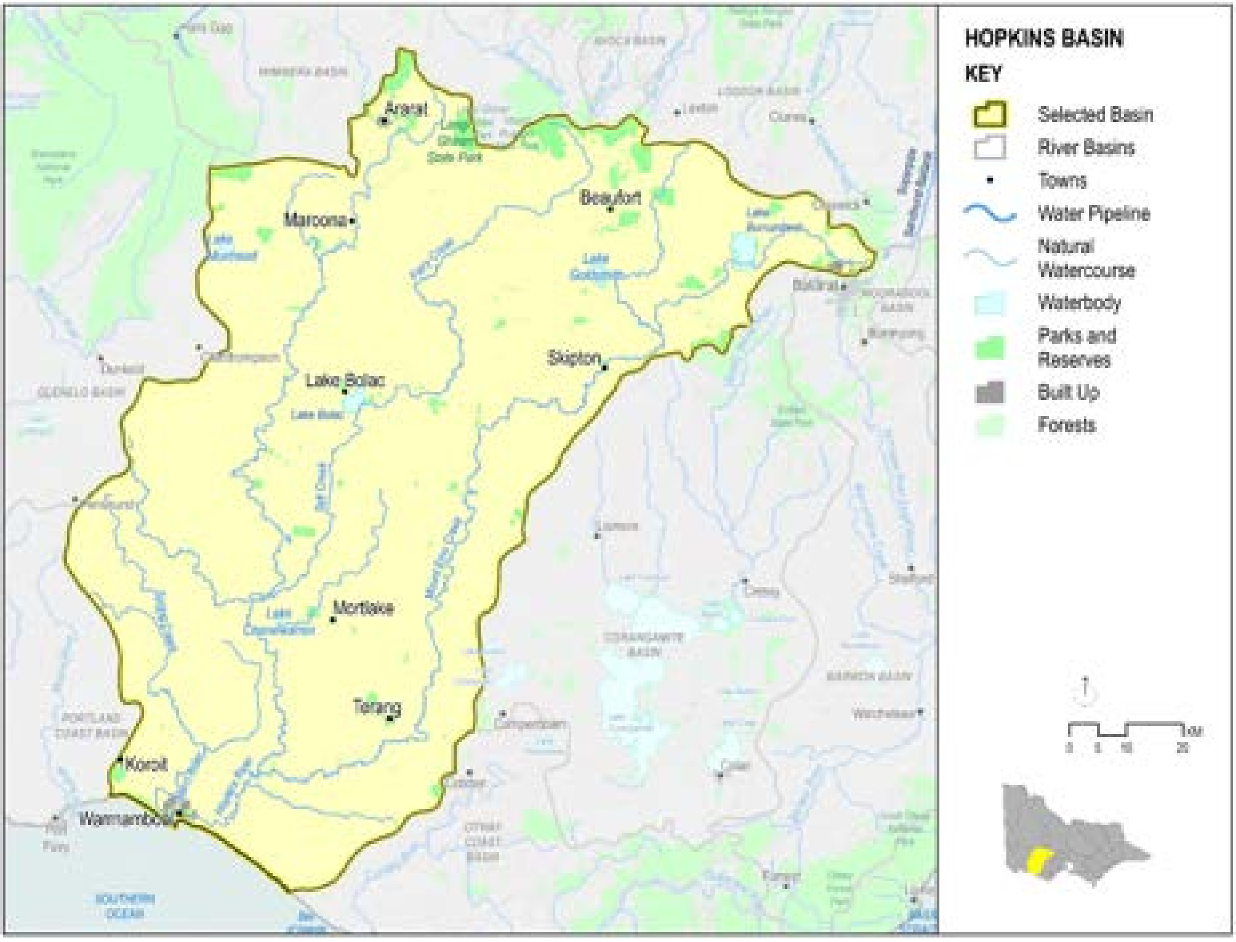
Table 6-153 Available water and take, Otway Coast basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Aireys Inlet	-	317	0	317	0
Apollo Bay	-	800	0	800	367
Colac	-	5,400	0	5,400	3,476
Gellibrand	-	60	0	60	18
Lorne	-	510	0	510	402
Otway system	-	12,580	0	12,580	8,450
Take and use licences – unregulated surface water	-	4,424	0	4,424	43
Licensed small catchment dams	-	10,573	0	10,573	4,872
Total 2020–21	**-**	**34,664**	**0**	**34,664**	**17,628**
Total 2019–20	-	34,159	0	34,159	16,636

6.24 Hopkins basin

The Hopkins basin (Figure 6-46) is in south-western Victoria. The two major rivers within the basin are the Merri River and the Hopkins River.

Figure 6-46 Map of the Hopkins basin



6.24.1 Management arrangements

Management of water in the Hopkins basin is undertaken by various parties, as shown in Table 6-154.

Table 6-154 Water resource management responsibilities, Hopkins basin

Authority	Management responsibilities
Southern Rural Water	Manages groundwater and surface water licensed diversions (except Loddon Highlands WSPA, which is managed by Goulburn-Murray Water)
Wannon Water	Supplies towns and cities in the south of the basin including Warrnambool
GWMWater	Supplies towns and cities in the north of the basin including Ararat
Central Highlands Water	Supplies towns in the north-east of the basin including Beaufort and Skipton
Glenelg Hopkins Catchment Management Authority	Responsible for waterway and catchment management in the whole of the Hopkins basin

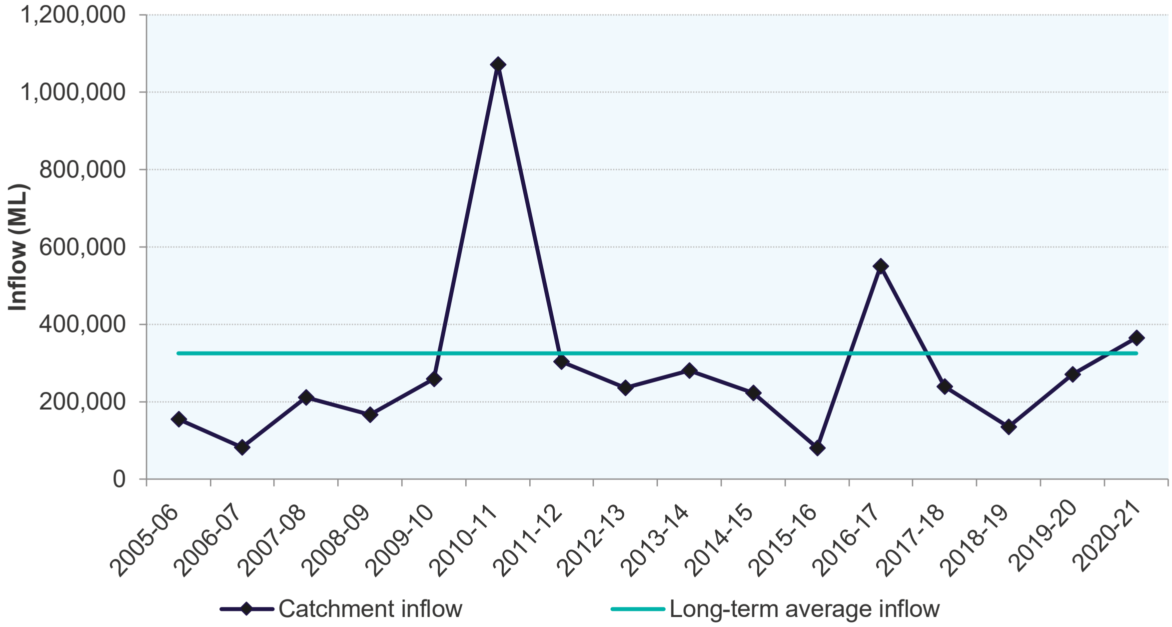
6.24.2 2020–21 water resources overview

In 2020–21, rainfall was:

- above average in most of the basin
- very much above average in the basin's central sections, from Lake Bolac to south of Skipton and north of Mortlake, and in a small area in the south-east of the basin near the Bay of Islands
- average in the far north of the basin, near Ararat.

Catchment inflows to the basin in 2020–21 were 112% of the long-term average annual volume of 325,100 ML, greater than in 2019–20 when inflows were 83% of the long-term average.

Figure 6-47 Catchment inflows, Hopkins basin



Key aspects of restrictions on licensed diversions from unregulated streams in the Hopkins basin in 2020–21 were:

- stage 1 rosters in all streams from October 2020 to the end of May 2021
- stage 2 and 3 rosters in Mount Emu Creek for March and April 2021.

There were no restrictions on urban water use in the Hopkins basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 7,521 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 7,628 ML diverted in the previous year.

6.24.2.1 Water for the environment

Environmental watering sites and environmental values in the Hopkins basin that depend on water for the environment include:

- coastal salt marsh wetlands and the wetlands associated with the Merri River estuary
- the Hopkins River, a major waterway draining the eastern part of the region and entering the Southern Ocean at Warrnambool
- Hopkins estuary, the Merri River and Fiery Creek
- Brucknell Creek and Deep Creek, which provide important fish habitat for species including the Australian grayling and river blackfish
- Mt Emu Creek, which contains reaches with relatively intact remnant riparian vegetation and deep, permanent pools providing drought refuge for threatened species.

In 2020–21, water for the environment in the Hopkins basin comprised:

- water set aside for the environment through the operation of passing flow conditions:
    - on consumptive bulk entitlements held by Central Highlands Water
    - on licensed diversions, particularly for Cudgee and Mt Emu creeks
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

6.24.3 Water balance

The total volumes of water available and supplied from water resources in the Hopkins basin in 2020–21 are shown in Table 6-155.

Table 6-155 Water balance, Hopkins basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	-	-
Volume in storage at the end of the year	1	-	-
Change in storage		**-**	**-**
Inflows			
Catchment inflow	2	365,711	269,866
Rainfall on major storages	1	-	-
Treated wastewater discharged back to river	3	95	64
Total inflows		**365,806**	**269,930**
Outflows			
Diversions			
Urban diversions		155	167
Licensed diversions from unregulated streams		1,377	2,032
Small catchment dams	4	5,989	5,429
Total diversions		***7,521***	***7,628***
Losses			
Evaporation from major storages	1	-	-
Net evaporation from small catchment dams	4	2,849	4,172
In-stream infiltration to groundwater, flows to floodplain and evaporation	5	-	-
Total losses		***2,849***	***4,172***
Water passed at outlet of basin			
River outflows to the ocean		355,436	258,130
Total water passed at outlet of basin		***355,436***	***258,130***
Total outflows		**365,806**	**269,930**

6.24.3.1 Notes to the water balance

1. Storage volumes

There are no major — greater than 1,000 ML — storages in the Hopkins basin.

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows and the known inflows.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-156 lists the wastewater treatment plants in the Hopkins basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

Table 6-156 Volume and use of recycled water, Hopkins basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Ararat	C	706	613	87%	103	501	0	9	0	93
Beaufort	C	58	58	100%	0	58	0	0	0	0
Cardigan Village	C	51	51	100%	0	51	0	0	0	0
Mortlake	A, C	185	90	49%	2	88	0	0	95	0
Snake Valley	C	10	10	100%	10	0	0	0	0	0
Skipton	C	25	25	100%	0	25	0	0	0	0
Terang	C	148	148	100%	0	148	0	0	0	0

Warrnambool	C	5,760	153	3%	37	0	0	116	0	5,607
Willaura	B, C	35	15	43%	13	2	0	0	0	20
Total 2020–21		**6,978**	**1,163**	**17%**	**165**	**873**	**0**	**125**	**95**	**5,720**
Total 2019–20		6,570	1,045	16%	137	854	0	54	64	5,461

4. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-157 provides information about small catchment dams in the basin.

Table 6-157 Estimated small catchment dam information, Hopkins basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	27,942	4,684	2,619	7,303
Registered/licensed commercial and irrigation	8,146	1,305	230	1,535
Total 2020–21	**36,088**	**5,989**	**2,849**	**8,838**
Total 2019–20	36,088	5,429	4,172	9,601

5. In-stream infiltration to groundwater, flows to floodplain and evaporation

An assessment of in-stream infiltration to groundwater, flows to floodplain and evaporation is not made in the Hopkins basin as there are no suitable models available, and the distribution of streamflow gauges across the basin makes it difficult to estimate in-stream losses (see chapter 6.1.5.3).

6.24.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Hopkins – Key compliance points

- ✓ **There was no net increase in the total entitlement volume from the previous year.**
- ✓ **The total volume diverted (2,837 ML) was within the volume available for the year (17,951 ML).**
- ✓ **No individual bulk entitlement holder took more than the annual volume made available to them.**
- ✓ **Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlements in the Hopkins basin provide the basis for how water is shared in the basin. Rights to water in the Hopkins basin are set out in Table 6-158.

GWMWater's bulk entitlement to the Hopkins basin (Willarua, Elmhurst and Buangor) is reported in the Wimmera basin, as it covers water sourced from both basins, most of which is sourced from the Wimmera basin.

Table 6-158 Entitlement volumes, Hopkins basin

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Beaufort) Conversion Order 2005	419	419
Bulk Entitlement (Skipton) Conversion Order 2005	210	210
Take and use licences – unregulated surface water	9,176	9,176
Licensed small catchment dams – on-waterway	2,354	2,314
Licensed small catchment dams – off-waterway	5,792	5,832
Total	**17,951**	**17,951**

Table 6-159 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

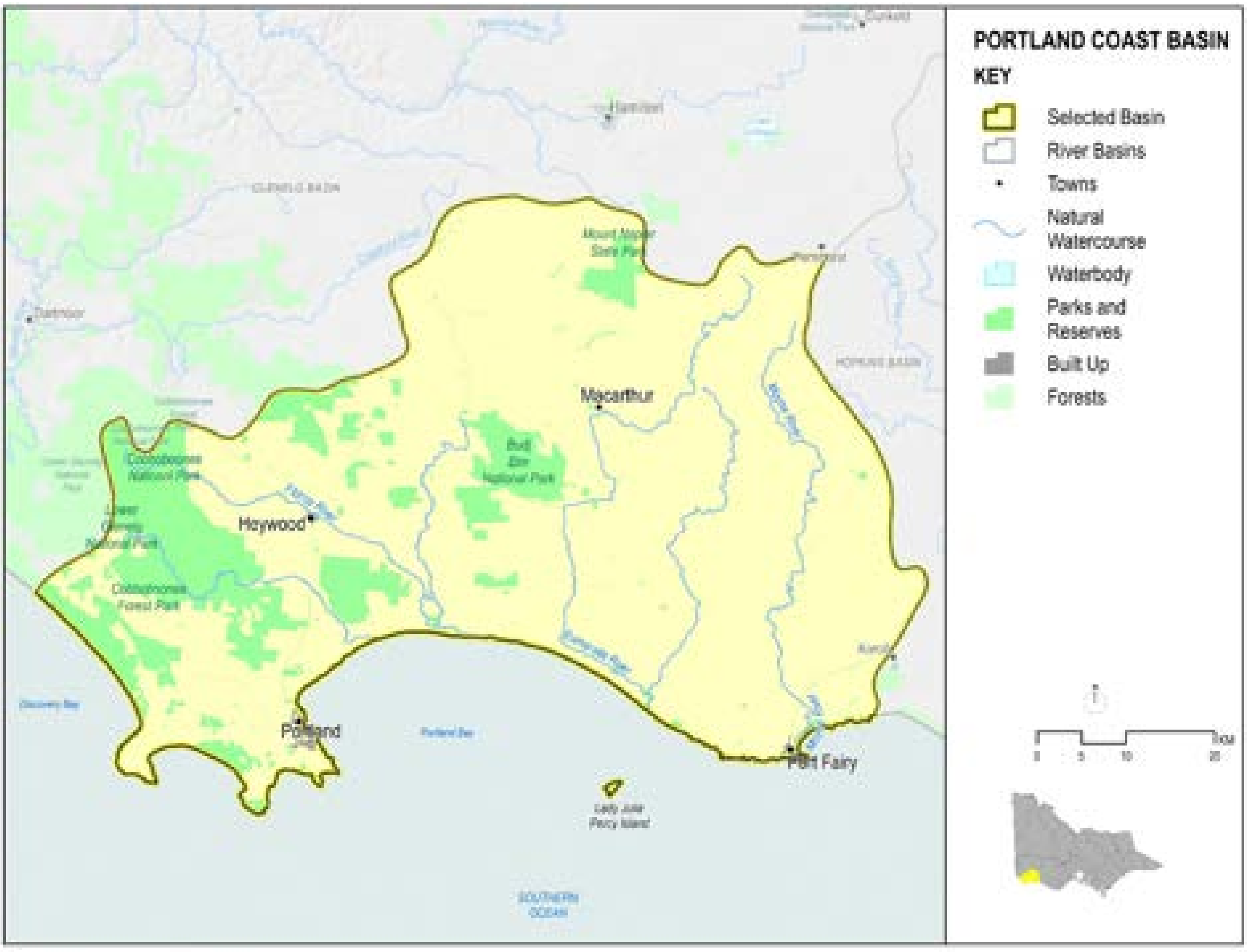
Table 6-159 Available water and take, Hopkins basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Beaufort	-	419	0	419	155
Skipton	-	210	0	210	0
Take and use licences – unregulated surface water	-	9,176	0	9,176	1,377
Licensed small catchment dams	-	8,146	0	8,146	1,305
Total 2020–21	**-**	**17,951**	**0**	**17,951**	**2,837**
Total 2019–20	-	18,046	0	18,046	3,364

6.25 Portland Coast basin

The Portland Coast basin (Figure 6-48) is in south-western Victoria. Major rivers in the basin include the Moyne, Eumeralla, Fitzroy and Surrey rivers.

Figure 6-48 Map of the Portland Coast basin



6.25.1 Management arrangements

Management of water in the Portland Coast basin is undertaken by various parties, as shown in Table 6-160.

Table 6-160 Water resource management responsibilities, Portland Coast basin

Authority	Management responsibilities
Southern Rural Water	Manages licensed diversions
Wannon Water	Supplies groundwater to Koroit, Port Fairy, Heywood and Portland
Glenelg Hopkins Catchment Management Authority	Responsible for waterway and catchment management in the whole Portland Coast basin

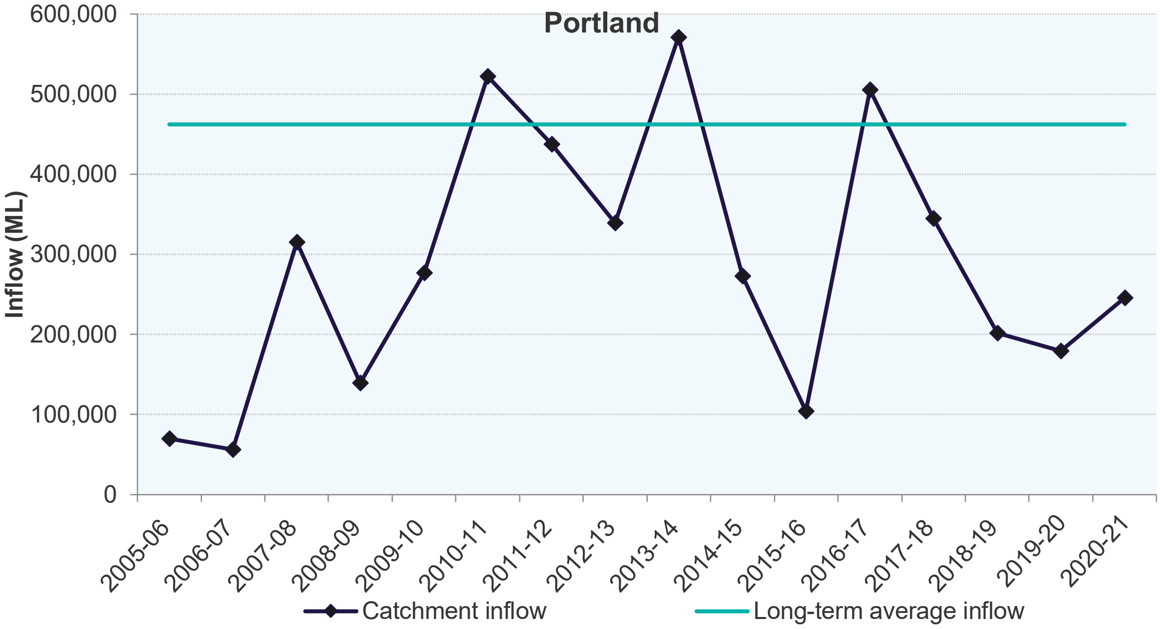
6.25.2 2020–21 water resources overview

In 2020–21, rainfall was:

- average in most of the basin
- above average in the north-east of the basin, from Mount Napier State Park to Port Fairy.

Catchment inflows to the basin in 2020–21 were 53% of the long-term average annual volume of 462,200 ML, more than in 2019–20 when inflows were 39% of the long-term average.

Figure 6-49 Catchment inflows, Portland Coast basin



In July 2020, licensed diversions were unrestricted on all unregulated streams in the Portland Coast basin until November 2020, when a ban was put in place on the Fitzroy River. Bans were put in place on an additional two streams by March 2021, reaching a peak of three streams, one less than in the previous year. These bans were lifted by May 2021 and remained unrestricted for the remainder of 2020–21.

There were no restrictions on urban water use in the Portland Coast basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 1,565 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was more than the 1,322 ML diverted in the previous year.

6.25.2.1 Water for the environment

Environmental watering sites and environmental values in the Portland Coast basin that depend on water for the environment include:

- Lake Condah and the Budj Bim National Heritage Landscape — a site inscribed on the UNESCO World Heritage List — which is a volcanic plain that encompasses the area from Budj Bim to the sea and which supports manna gum woodlands and many rare and threatened aquatic fauna including the Yarra pygmy perch
- the Fitzroy River – Darlots Creek system, where Darlots Creek flows south from Condah to the Fitzroy River at Tyrendarra and into the Southern Ocean via the Fitzroy River estuary. The area contains several threatened species.

Other important rivers in the basin include the Moyne and Surrey rivers and the Eumeralla / Shaw river system.

In 2020–21, water for the environment in the Portland Coast basin comprised:

- water set aside for the environment through the operation of passing flow conditions on licensed diversions, particularly for Condah Drain, Darlots Creek and the Fitzroy, Moyne and Surrey rivers
- all other water in the basin not allocated for consumptive use: this water also provides social, recreational and cultural benefits.

6.25.3 Water balance

The total volumes of water available and supplied from water resources in the Portland Coast basin in 2020–21 are shown in Table 6-161.

Table 6-161 Water balance, Portland Coast basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	-	-
Volume in storage at the end of the year	1	-	-
Change in storage		**-**	**-**
Inflows			
Catchment inflow	2	245,606	179,570
Rainfall on major storages	1	-	-
Treated wastewater discharged back to river	3	280	168
Total inflows		**245,886**	**179,738**
Outflows			
Diversions			
Licensed diversions from unregulated streams		0	0
Small catchment dams	4	1,565	1,322
Total diversions		***1,565***	***1,322***
Losses			
Evaporation from major storages	1	-	-
Net evaporation from small catchment dams	4	855	860
In-stream infiltration to groundwater, flows to floodplain and evaporation	5	-	-
Total losses		***855***	***860***
Water passed at outlet of basin			
River outflows to the ocean		243,466	177,556
Total water passed at outlet of basin		***243,466***	***177,556***
Total outflows		**245,886**	**179,738**

6.25.3.1 Notes to the water balance

1. Storage volumes

There are no major — greater than 1,000 ML — storages in the Portland Coast basin.

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows and the known inflows.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-162 lists the wastewater treatment plants in the Portland Coast basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

Table 6-162 Volume and use of recycled water, Portland basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to the sea / other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Heywood	C	351	71	20%	0	71	0	0	280	0
Port Fairy Domestic	C	709	0	0%	0	0	0	0	0	709
Port Fairy Industrial	n/a	143	0	0%	0	0	0	0	0	143
Portland	C	1,820	0	0%	0	0	0	0	0	1,820
Total 2020–21		**3,023**	**71**	**2%**	**0**	**71**	**0**	**0**	**280**	**2,672**
Total 2019–20		2,706	86	3%	0	86	0	0	168	2,452

n/a Data not available

4. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-163 provides information about small catchment dams in the basin.

Table 6-163 Estimated small catchment dam information, Portland Coast basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	6,593	1,457	829	2,286
Registered/licensed commercial and irrigation	497	108	26	134
Total 2020–21	**7,090**	**1,565**	**855**	**2,420**
Total 2019–20	7,090	1,322	860	2,182

5. In-stream infiltration to groundwater, flows to floodplain and evaporation

An assessment of in-stream infiltration to groundwater, flows to floodplain and evaporation is not made in the Portland Coast basin as there are no suitable models available, and the distribution of streamflow gauges across the basin makes it difficult to estimate in-stream losses (see chapter 6.1.5.3).

6.25.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in two areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year.

Portland – Key compliance points
✓ **There was no net increase in the total entitlement volume from the previous year.**
✓ **The total volume diverted (108 ML) was within the volume available for the year (1,499 ML).**

Entitlements in the Portland Coast basin provide the basis for how water is shared in the basin. Rights to water in the Portland Coast basin are set out in Table 6-164.

Table 6-164 Entitlement volumes, Portland Coast basin

Water entitlement – Portland Coast	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Take and use licences – unregulated surface water	1,003	1,003
Licensed small catchment dams – on-waterway	67	67
Licensed small catchment dams – off-waterway	429	429
Total	**1,499**	**1,499**

Table 6-165 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

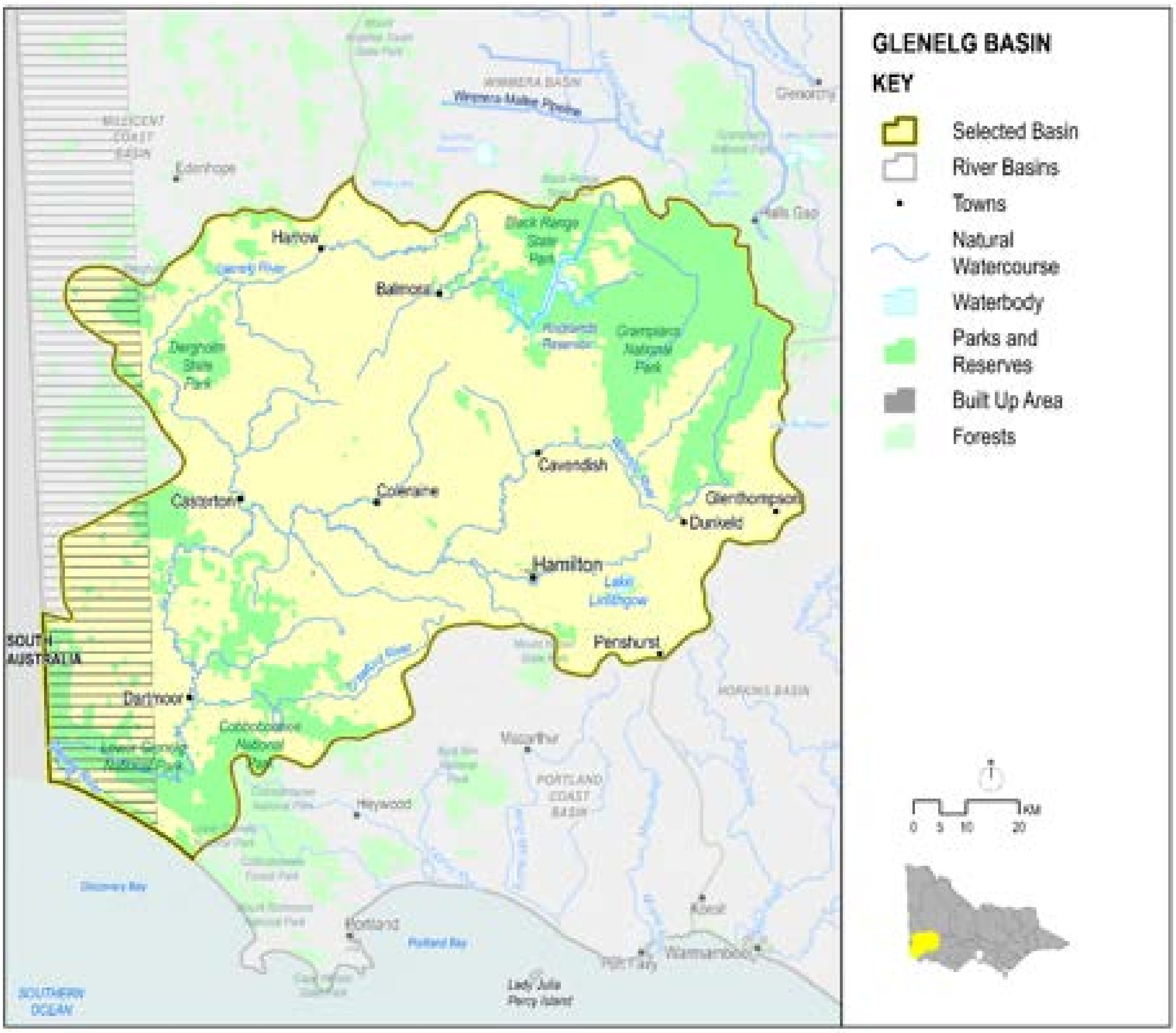
Table 6-165 Available water and take, Portland Coast basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Take and use licences – unregulated surface water	-	1,003	0	1,003	0
Licensed small catchment dams	-	497	0	497	108
Total 2020–21	**-**	**1,499**	**0**	**1,499**	**108**
Total 2019–20	-	1,507	0	1,507	90

6.26 Glenelg basin

The Glenelg basin (Figure 6-50) is in the far west of Victoria. It has four on-stream storages, the largest of which is Rocklands Reservoir.

Figure 6-50 Map of the Glenelg basin



6.26.1 Management arrangements

Management of water in the Glenelg basin is undertaken by various parties, as shown in Table 6-166.

Table 6-166 Water resource management responsibilities, Glenelg basin

Authority	Management responsibilities
Southern Rural Water	Manages licensed diversions for the entire basin except for the Glenelg River north of the bridge on the Casterton–Harrow Road
GWMWater	Manages licensed diversions for the Glenelg River north of the bridge on the Casterton–Harrow Road Supplies groundwater to Harrow Operates the Wimmera–Glenelg system, which includes Rocklands and Moora Moora reservoirs and several other small-diversion weirs in the upper Glenelg and Wannon rivers
Wannon Water	Supplies all other towns in the basin Operates reservoirs in the Hamilton supply system
Glenelg Hopkins Catchment Management Authority	Responsible for waterway and catchment management in the Glenelg basin

6.26.2 2020–21 water resources overview

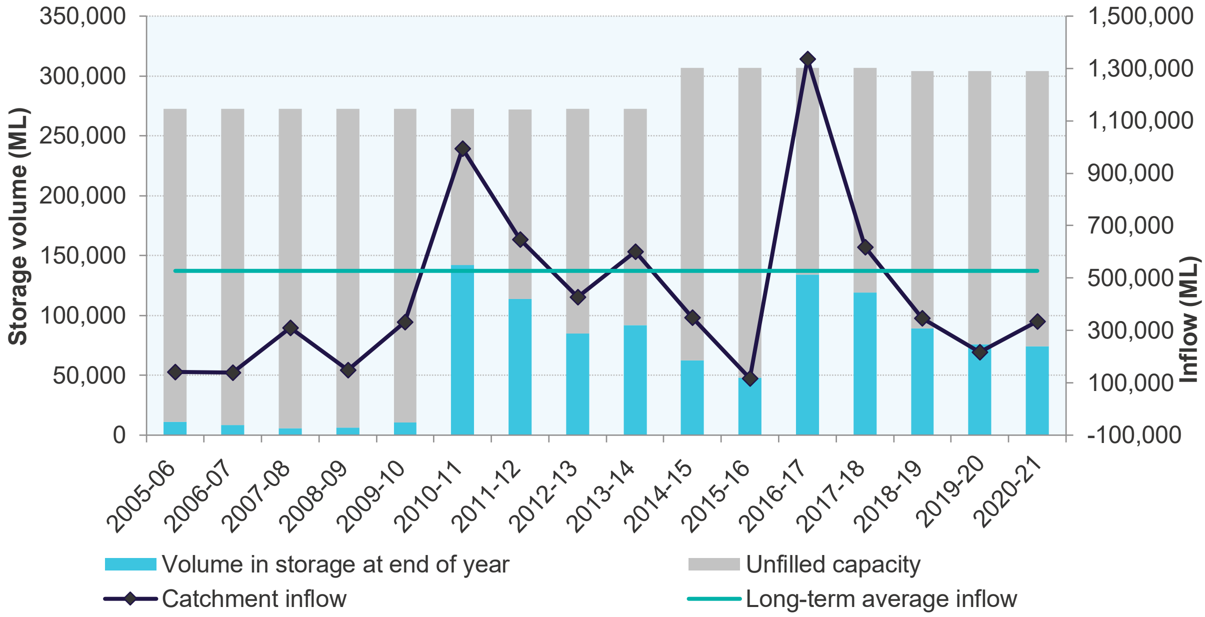
In 2020–21, rainfall was:

- average in most of the basin
- above average in the east of the basin, from Grampians National Park over Cavendish to Hamilton
- below average in the north of the basin, from Harrow to Black Range State Park
- also below-average in small areas in the centre of the basin (between Casterton and Coleraine) and over Dergholm in the far west.

Catchment inflows to the basin in 2020–21 were 63% of the long-term average of 527,300 ML, greater than in 2019–20 when inflows were 41% of the long-term average.

Major storages in the basin were at 25% of capacity on 1 July 2020 and lower (at 24% of capacity) on 30 June 2021.

Figure 6-51 Storage volumes and catchment inflows, Glenelg basin



Key aspects of restrictions on licensed diversions from unregulated streams in the Glenelg basin in 2020–21 were:

- a total ban on diversions from the Crawford River from November 2020 until the end of May 2021
- stage 1 restrictions for Glenelg River and Wannon River for the month of October 2020: these rivers remained unrestricted for the rest of 2020–21
- no restrictions for Grange Burn for the whole of 2020–21.

There were no restrictions on urban water use in the Glenelg basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 17,922 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was more than the 16,490 ML diverted in the previous year.

6.26.2.1 Water for the environment

Environmental watering sites and environmental values in the Glenelg basin that depend on water for the environment include:

- the lower Glenelg River, which is a heritage river and which relies on freshwater inputs from the Glenelg basin to function
- Glenelg spiny crayfish (listed as threatened under the Victorian *Flora and Fauna Guarantee Act 1988*)
- Yarra and Ewens pygmy perch (listed as vulnerable under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* and threatened under the *Flora and Fauna Guarantee Act 1988*)
- variegated pygmy perch (listed as vulnerable under the *Environmental Protection and Biodiversity Conservation Act 1999* and threatened under the *Flora and Fauna Guarantee Act 1988*)
- the Wimmera bottlebrush (*Melaleuca wimmerensis*, formerly known as *Callistemon wimmerensis*), which has been recorded on the Glenelg River. This species is very dependent on flows and is listed as threatened

under the *Flora and Fauna Guarantee Act 1988* and as critically endangered under the *Environmental Protection and Biodiversity Conservation Act 1999*.

In 2020–21, water for the environment in the Glenelg basin comprised:

- a share of water available under the *Wimmera and Glenelg Rivers Environmental Entitlement 2010* which includes 40,560 ML of high-reliability entitlement; water available under this entitlement is shared with the Wimmera basin
- water set aside for the environment through the operation of passing flow conditions:
  - on consumptive bulk entitlements held by GWMWater and Wannon Water
  - as part of the environmental entitlement held by the VEWH
  - on licensed diversions, particularly from the Crawford, Glenelg, Grange Burn and Wannon rivers
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

In 2020–21, a total of 11,694 ML of environmental water was used in the Glenelg basin. This was all delivered in-stream for the Glenelg River. This volume includes 3,122 ML of passing flows delivered in-stream in the Glenelg basin.

6.26.3 Water balance

The total volumes of water available and supplied from water resources in the Glenelg basin in 2020–21 are shown in Table 6-167.

Table 6-167 Water balance, Glenelg basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	75,646	89,238
Volume in storage at the end of the year	1	74,024	75,646
Change in storage		**(1,622)**	**(13,592)**
Inflows			
Catchment inflow	2	333,265	217,010
Rainfall on major storages	1	12,591	11,495
Treated wastewater discharged back to river	3	8	0
Total inflows		**345,864**	**228,505**
Outflows			
Diversions			
Urban diversions		1,691	1,813
Transfers to the Wimmera basin		10,105	9,236
Licensed diversions from unregulated streams		114	124
Small catchment dams	4	6,012	5,317
Total diversions		***17,922***	***16,490***
Losses			
Evaporation from major storages	1	25,698	27,781
Net evaporation from small catchment dams	4	4,811	4,770
In-stream infiltration to groundwater, flows to floodplain and evaporation		25,353	34,066
Total losses		***55,862***	***66,617***
Water passed at outlet of basin			
River outflows to the ocean		273,703	158,990
Total water passed at outlet of basin		***273,703***	***158,990***
Total outflows		**347,487**	**242,097**

6.26.3.1 Notes to the water balance

1. Storage volumes

Major — greater than 1,000 ML — on-stream storages in the Glenelg basin are included in the water balance. Table 6-168 shows how storage volumes changed during the year. Rainfall and evaporation estimates cannot be made for Konongwootong Reservoir.

Table 6-168 Storage volumes, Glenelg basin

Storage	Total capacity (ML) (1)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflows less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Konongwootong Reservoir	1,920	1,812	n/a	n/a	(18)	1,794
Moora Moora Reservoir	6,300	2,680	2,609	3,880	2,091	3,500
Rocklands Reservoir	296,000	71,154	9,982	21,818	9,412	68,730
Total 2020–21	**304,220**	**75,646**	**12,591**	**25,698**	**11,485**	**74,024**
Total 2019–20	304,220	89,238	11,495	27,781	2,694	75,646

Note

(1) Volumes shown are the maximum operating capacities of storages.

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, the known inflows and the net change in storage volume.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-169 lists the wastewater treatment plants in the Glenelg basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

Wannon Water operates all treatment plants in the Glenelg basin. 99% of its wastewater was recycled in 2020–21.

Table 6-169 Volume and use of recycled water, Glenelg basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Casterton	C	89	81	91%	0	81	0	0	8	0
Coleraine	C	30	30	100%	0	30	0	0	0	0
Dunkeld	C	13	13	100%	13	0	0	0	0	0
Hamilton	C	426	426	100%	9	417	0	0	0	0
Total 2020–21		**558**	**550**	**99%**	**22**	**528**	**0**	**0**	**8**	**0**
Total 2019–20		698	698	100%	50	648	0	0	0	0

4. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-170 provides information about small catchment dams in the basin.

Table 6-170 Estimated small catchment dam information, Glenelg basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	32,526	5,538	4,646	10,184
Registered/licensed commercial and irrigation	3,084	474	156	639
Total 2020–21	**35,610**	**6,012**	**4,811**	**10,823**
Total 2019–20	35,610	5,318	4,770	10,087

6.26.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Glenelg – Key compliance points
✓ **There was no net increase in the total entitlement volume from the previous year.**
✓ **The total volume diverted (2,279 ML) was within the volume available for the year (8,608 ML).**
✓ **No individual bulk entitlement holder took more than the annual volume made available to them.**
✓ **Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlements in the Glenelg basin provide the basis for how water is shared in the basin. Rights to water in the Glenelg basin are set out in Table 6-171.

The Wimmera–Glenelg system is unique because the headworks harvest water from both the Glenelg and Wimmera river systems, and the volumes supplied to entitlement holders cannot be disaggregated between the two basins. Therefore, the entitlement volumes and diversions are presented in the Wimmera basin chapter in Table 6-183.

Under GWMWater's Wimmera and Glenelg rivers bulk entitlement, the water corporation operates the Wimmera–Glenelg system headworks to supply water to towns and customers connected to the Wimmera Mallee Pipeline. It includes 3,300 ML for the Glenelg Compensation Flow. It also supplies entitlements held by Coliban Water, Wannon Water and the VEWH.

The *Wimmera and Glenelg Rivers Environmental Entitlement 2010* provides the VEWH with water from the Wimmera–Glenelg system headworks to provide environmental benefits in both the Wimmera and Glenelg basins. In the Glenelg basin, water available under the environmental entitlement is used to support streamflows and is not diverted out of waterways to water environmental assets.

Table 6-171 Entitlement volumes, Glenelg basin

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Coleraine, Casterton, Sandford) Conversion Order 1997	855	855
Bulk Entitlement (Dunkeld System) Conversion Order 1997	170	170
Bulk Entitlement (Glenthompson) Conversion Order 1997	94	94
Bulk Entitlement (Hamilton) Conversion Order 1997	3,435	3,435
Take and use licences – unregulated surface water	963	970
Licensed small catchment dams – on-waterway	66	66
Licensed small catchment dams – off-waterway	3,019	3,019
Total	**8,601**	**8,608**

Table 6-172 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

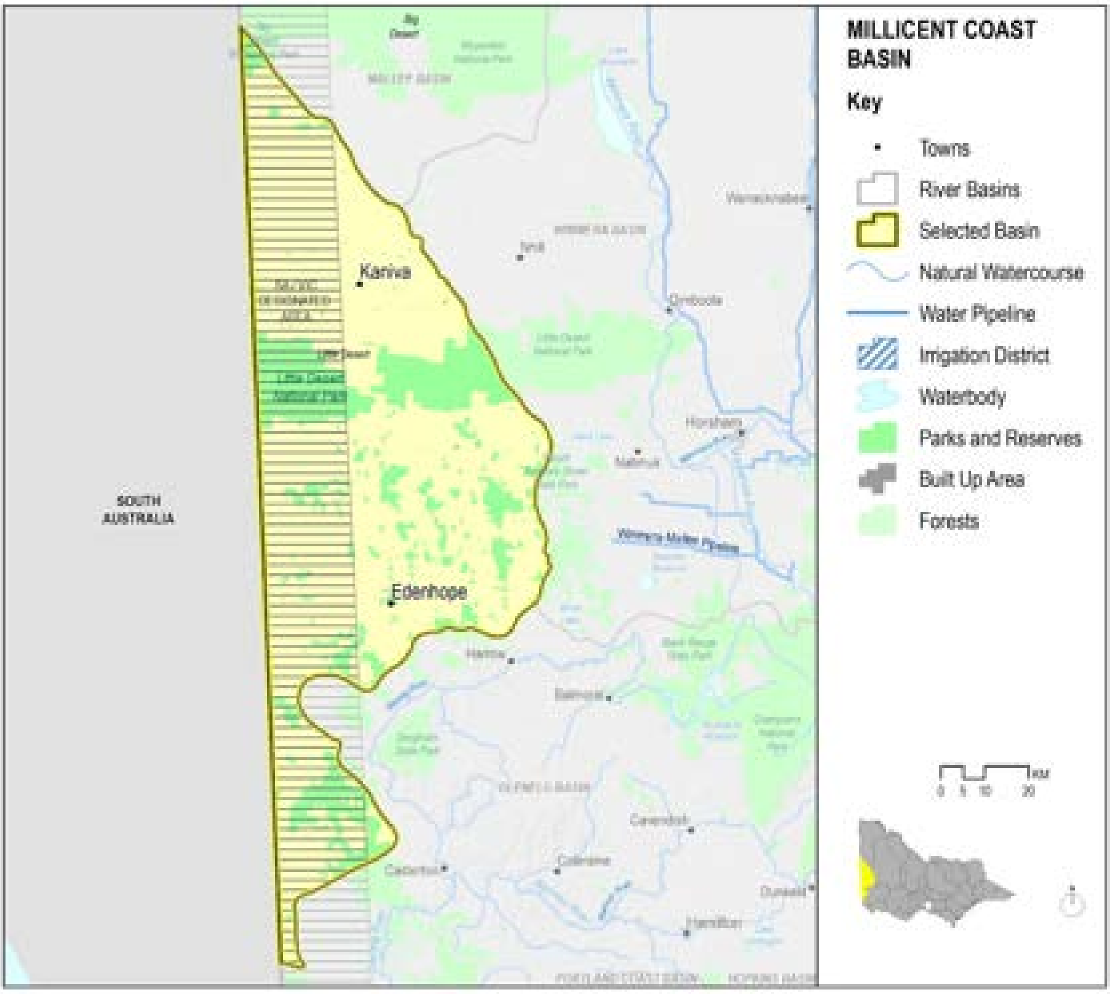
Table 6-172 Available water and take, Glenelg basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Coleraine, Casterton, Sandford	-	855	0	855	65
Dunkeld System	-	170	0	170	29
Glenthompson	-	94	0	94	37
Hamilton	-	3,435	0	3,435	1,560
Take and use licences – unregulated surface water	-	970	0	970	114
Licensed small catchment dams	-	3,084	0	3,084	474
Total 2020–21	**-**	**8,608**	**0**	**8,608**	**2,279**
Total 2019–20	-	8,612	0	8,612	2,350

6.27 Millicent Coast basin

The Millicent Coast basin (Figure 6-52) spans parts of both Victoria and South Australia. The Victorian section of the basin comprises numerous internally draining interdune wetlands located mainly in the south and several minor waterways which flow intermittently and continue into South Australia. Groundwater is the most significant resource in the basin.

Figure 6-52 Map of the Millicent Coast basin



6.27.1 Management arrangements

Management of water in the Millicent Coast basin is undertaken by various parties, as shown in Table 6-173.

Table 6-173 Water resource management responsibilities, Millicent Coast basin

Authority	Management responsibilities
GWMWater	Manages licensed diversions in the Millicent Coast basin Supplies all towns including Kaniva and Edenhope
Wimmera Catchment Management Authority	Responsible for waterway and catchment management in the majority of the Millicent Coast basin
Glenelg Hopkins Catchment Management Authority	Responsible for waterway and catchment management in the southern part of the Millicent Coast basin

6.27.2 2020–21 water resources overview

In 2020–21, rainfall was:

- below average in most of the basin
- average in an area in the centre and east of the basin, south of Kaniva and north of Edenhope
- average south of Edenhope and west of Casterton.

Groundwater taken from the West Wimmera GMA is the main source of water supply in the Millicent Coast basin. Chapter 7.7.1 has information about groundwater licences and use in this area.

Licensed diversions from unregulated streams were unrestricted throughout the year.

There were no restrictions on urban water use in the Millicent Coast basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

6.27.2.1 Water for the environment

The Millicent Coast basin contains numerous wetlands. The largest waterway in the basin, the ephemeral Mosquito Creek, provides streamflows to support Ramsar-listed wetlands in South Australia including Bool and Hacks lagoons.

In 2020–21, water for the environment in the Millicent Coast basin comprised all water in the basin not allocated for consumptive use: this water also provides social, recreational and cultural benefits.

6.27.3 Water balance

Limited information is available for surface water availability and use, so a water balance has not been included for the Millicent Coast basin.

6.27.3.1 Notes to the resource position

Storage volumes

There are no storages in the Millicent Coast basin.

Catchment inflow

There is no reliable streamflow data for the Millicent Coast basin. As such, an estimate of the volume of water leaving the basin was not made. As the Victorian Water Accounts estimate catchment inflow as a back-calculation from outflows, an assessment of the available water in the basin — catchment inflow — has not been made. Any surface water not diverted flows to South Australia.

Recycled water

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-174 lists the wastewater treatment plants in the Millicent Coast basin.

Table 6-174 Volume and use of recycled water, Millicent Coast basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Edenhope [(1)]	C	0	2	0%	2	0	0	0	0	(2)
Kaniva North [(2)]	n/a	0	0	0%	0	0	0	0	0	0
Kaniva South [(2)]	n/a	0	0	0%	0	0	0	0	0	0
Serviceton [(2)]	n/a	0	0	0%	0	0	0	0	0	0
Total 2020–21		**0**	**2**	**0%**	**2**	**0**	**0**	**0**	**0**	**(2)**
Total 2019–20		2	2	100%	2	0	0	0	0	0

Notes

(1) In Edenhope, effluent was carried over from the previous year and recycled in 2020–21.

(2) Wastewater treatment plants at Kaniva North, Kaniva South and Serviceton were operational but did not produce any recycled water output this year.

Small catchment dams

The volume of water harvested, used and lost by small catchment dams (farm dams) is presented in Table 6-175.

Table 6-175 Estimated small catchment dam information, Millicent Coast basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	4,656	164	530	693
Registered/licensed commercial and irrigation	5,071	242	113	356
Total 2020–21	**9,727**	**406**	**643**	**1,049**
Total 2019–20	9,727	247	469	716

In-stream losses

There is no suitable model available to make an estimate of in-stream losses, as there are no streamflow gauges in the Millicent Coast basin (see chapter 6.1.2).

6.27.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in two areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year.

Millicent Coast – Key compliance points
✓ **There was no net increase in the total entitlement volume from the previous year.**
✓ **The total volume diverted (246 ML) was within the volume available for the year (5,075 ML).**

Entitlements in the Millicent Coast basin provide the basis for how water is shared in the basin. Rights to water in the Millicent Coast basin are set out in Table 6-176.

Table 6-176 Entitlement volumes, Millicent Coast basin

Water entitlement – Millicent Coast	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Take and use licences – unregulated surface water	4	4
Licensed small catchment dams – on-waterway	5,071	5,071
Total	**5,075**	**5,075**

Table 6-177 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

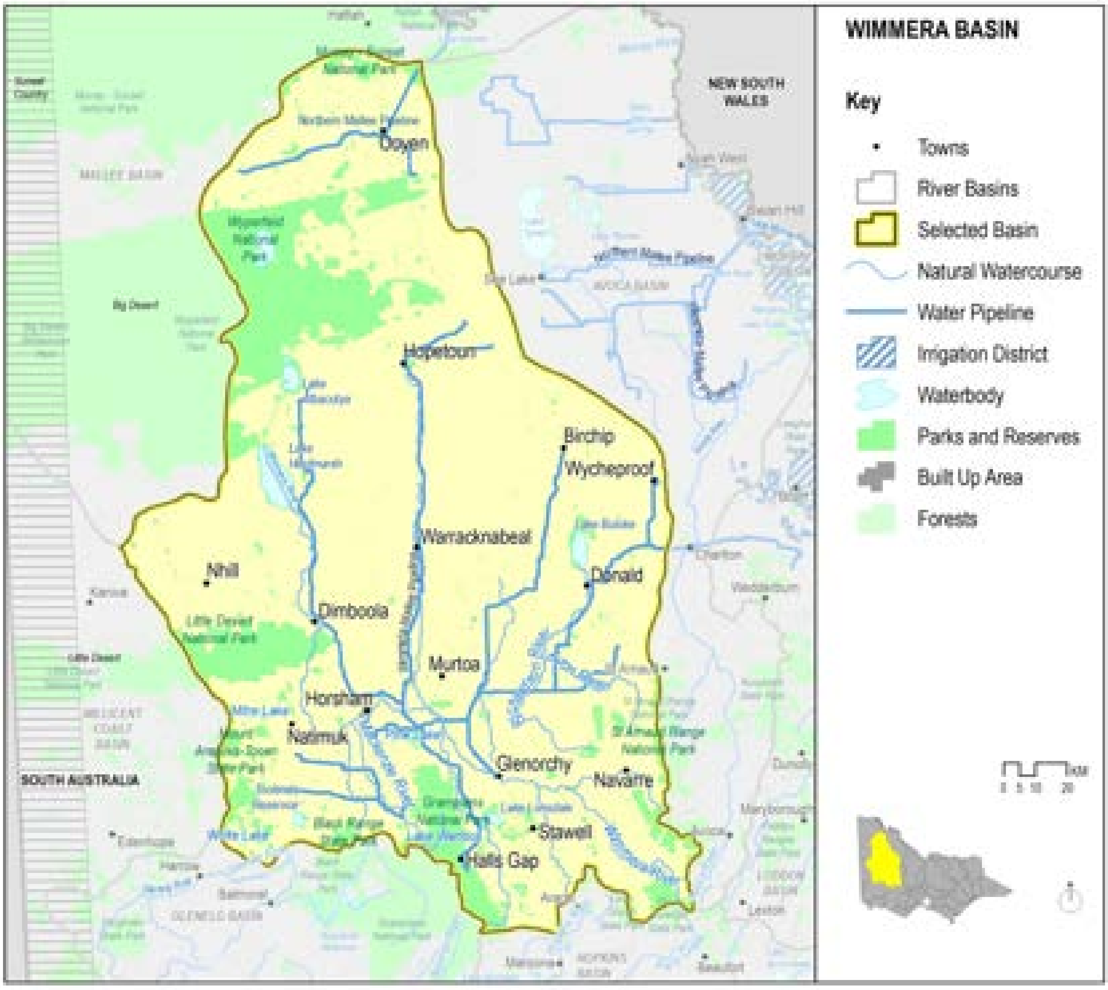
Table 6-177 Available water and take, Millicent Coast basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Take and use licences – unregulated surface water	-	4	0	4	4
Licensed small catchment dams	-	5,071	0	5,071	242
Total 2020–21	**-**	**5,075**	**0**	**5,075**	**246**
Total 2019–20	-	5,075	0	5,075	59

6.28 Wimmera basin

The Wimmera basin (Figure 6-53) is the largest landlocked river basin in Victoria. The Wimmera River's headwaters are near Mount Cole in the Pyrenees Ranges. The river flows westwards across the foothills of the Grampians, and at Horsham, it turns north and flows for about 150 km, terminating at Lake Hindmarsh.

Figure 6-53 Map of the Wimmera basin



6.28.1 Management arrangements

Management of water in the Wimmera basin is undertaken by various parties, as shown in Table 6-178.

Table 6-178 Water resource management responsibilities, Wimmera basin

Authority	Management responsibilities
GWMWater	Manages the Wimmera Mallee supply system, which delivers water to farms in the Wimmera basin Manages licensed diversions Supplies most towns in the Wimmera basin Provides bulk supply to some of Coliban Water's towns in the Loddon basin Operates the Wimmera–Glenelg water headworks system
Central Highlands Water	Supplies Landsborough and Navarre
Coliban Water	Supplies Borung, Korong Vale, Wedderburn and Wychitella in the Loddon basin
Goulburn-Murray Water	Provides GWMWater with bulk supplies for domestic and stock use from the Goulburn system via the Waranga Main Channel
Wimmera Catchment Management Authority	Responsible for waterway and catchment management in the Wimmera River catchment
North Central Catchment Management Authority	Responsible for waterway and catchment management in the east of the basin, including the Avon and Richardson rivers

6.28.2 2020–21 water resources overview

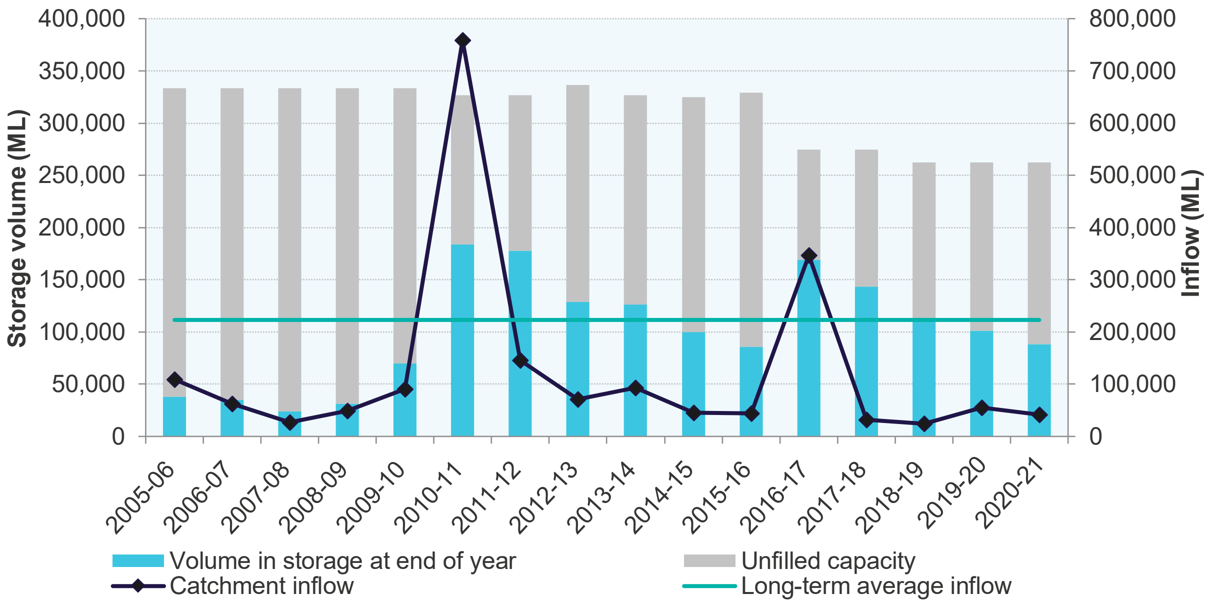
In 2020–21, rainfall was:

- very much below average in the north-east of the basin over Lascelles and Hopetown to Birchip
- below average in the far north, most of the west and parts of the east of the basin
- average in the south-west of the basin in a small area near Arapiles and a large area covering Warracknabeal, Horsham, Halls Gap, Donald and Stawell
- above average in the far south-east of the basin in two areas: south of Halls Gap and from Navarre to Ararat.

Catchment inflows to the basin in 2020–21 were 19% of the long-term average of 223,100 ML, less than in 2019–20 when inflows were 25% of the long-term average.

Major storages in the basin were at 38% of capacity on 1 July 2020 and lower (at 34% of capacity) on 30 June 2021.

Figure 6-54 Storage volumes and catchment inflows, Wimmera basin



Seasonal allocations for the Wimmera–Glenelg system were higher in 2020–21 than in the previous year. The Wimmera Mallee Pipeline Product began the year with a 0% opening seasonal allocation in July 2019, which reached 50% in December 2020 and ended with a final allocation of 57% in April 2021.

Licensed diversions from the Wimmera River were banned for the whole of 2020–21. Licensed diversions for domestic and stock use were not banned.

There were no restrictions on urban water use in the Wimmera basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 20,607 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 22,248 ML diverted in the previous year.

6.28.2.1 Water for the environment

Environmental watering sites and environmental values in the Wimmera basin that depend on water for the environment include:

- the Wimmera River, a heritage river
- platypus, freshwater catfish and river blackfish
- the regionally threatened populations of native fish — river blackfish, southern pygmy perch and mountain galaxias — and platypus (of which there are believed to be less than 10, with this the only population in the catchment) in the MacKenzie River
- the Wimmera bottlebrush (*Melaleuca wimmerensis*, formerly known as *Callistemon wimmerensis*) which is listed as threatened under the *Flora and Fauna Guarantee Act 1988* (the FFG Act) and as critically endangered under the *Environmental Protection and Biodiversity Conservation Act 1999*; this species depends on flows in the MacKenzie River for its survival and recruitment
- the lower Wimmera River, which is listed under the *Heritage Rivers Act 1992* and which flows into Lake Hindmarsh (listed as a nationally significant wetland) and Lake Albacutya (a Ramsar-listed wetland). It

contains Victoria's only self-sustaining population of freshwater catfish (which is an FFG-Act-listed species). The Wimmera River also contains stocked populations of Murray cod and silver perch, which are both FFG-Act-listed species.

In 2020–21, water for the environment in the Wimmera basin comprised:

- the *Wimmera and Glenelg Rivers Environmental Entitlement 2010* held by the VEWH, comprising 40,560 ML of high-reliability entitlement shared with the Glenelg basin, 1,000 ML of entitlement for wetlands supplied from the Wimmera Mallee Pipeline and 1,000 ML of unregulated flow in the Avon-Richardson Rivers to be used to maintain the weir pool at the Rich-Avon Weir
- water set aside for the environment through the operation of passing flow conditions:
  - on consumptive bulk entitlements held by GWMWater
  - on licensed diversions
- a supply by agreement with the CEWH under GWMWater's bulk entitlement comprising 28,000 ML of low-reliability entitlement
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

A total of 6,737 ML of environmental water was used in the Wimmera basin in 2020–21. This volume includes 369 ML of passing flows delivered in-stream.

6.28.3 Water balance

The total volumes of water available and supplied from water resources in the Wimmera basin in 2020–21 are shown in Table 6-179.

Table 6-179 Water balance, Wimmera basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	100,919	113,638
Volume in storage at the end of the year	1	88,441	100,919
Change in storage		**(12,478)**	**(12,719)**
Inflows			
Catchment inflow	2	41,418	54,700
Rainfall on major storages	1	19,006	17,375
Transfer from Glenelg basin		10,105	9,236
Treated wastewater discharged back to river	3	0	0
Total inflows		**70,529**	**81,311**
Outflows			
Diversions			
Urban diversions and domestic and stock use		15,243	17,198
Diversions for irrigation		0	0
Licensed diversions from unregulated streams		422	670
Environmental water diversions		124	94
Supply to designated recreational lakes		2,348	2,264
Small catchment dams	4	2,594	2,116
Total diversions		***20,731***	***22,342***
Losses			
Evaporation from major storages		32,613	39,905
Net evaporation from small catchment dams	4	2,687	2,709
In-stream infiltration to groundwater, flows to floodplain and evaporation		14,838	14,886
Total losses		***50,138***	***57,500***
Water passed at outlet of basin			
River outflows to Lake Buloke		1,415	966
River outflows to Lake Hindmarsh (measured at Tarranyurk)		10,723	13,222
Total water passed at outlet of basin		***12,138***	***14,188***
Total outflows		**83,007**	**94,030**

6.28.3.1 Notes to the water balance

1. Storage volumes

Major — greater than 1,000 ML — on-stream storages in the Wimmera basin are included in the water balance. Table 6-180 shows how storage volumes changed during the year.

Table 6-180 Storage volumes, Wimmera basin

Storage	Total capacity (ML) (1)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflows less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Fyans Lake	18,460	13,586	2,375	4,000	1,459	13,420
Green Lake (1)	5,350	2,368	n/a	n/a	(1,309)	1,059
Lake Bellfield	78,560	48,436	3,243	3,410	(4,129)	44,140
Lake Lonsdale	53,300	6,774	5,539	10,268	435	2,480
Taylors Lake	27,060	10,800	1,009	3,815	5,576	13,570
Toolondo Reservoir	50,530	8,130	1,718	4,701	(1,200)	3,947
Wartook Reservoir	29,300	10,825	5,123	6,419	297	9,825
Total 2020–21	**262,560**	**100,919**	**19,006**	**32,613**	**1,129**	**88,441**
Total 2019–20	262,560	113,638	17,375	39,905	9,811	100,919

Note

(1) Volumes for rainfall and evaporation are not available for this site.

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, the known inflows and the net change in storage volume.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-181 lists the wastewater treatment plants in the Wimmera basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance.

Table 6-181 Volume and use of recycled water, Wimmera basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Birchip (1)	C	27	35	130%	0	35	0	0	0	(8)
Dimboola	C	77	54	70%	0	54	0	0	0	23
Donald	n/a	105	105	100%	0	105	0	0	0	0
Halls Gap	C	73	30	41%	30	0	0	0	0	43
Hopetoun (2)	n/a	0	0	0%	0	0	0	0	0	0
Horsham	C	952	927	97%	218	709	0	0	0	25
Jeparit (2)	n/a	0	0	0%	0	0	0	0	0	0
Minyip (2)	n/a	0	0	0%	0	0	0	0	0	0
Murtoa	C	38	36	95%	0	36	0	0	0	2
Natimuk (2)	n/a	0	0	0%	0	0	0	0	0	0
Nhill (3)	C	93	104	112%	0	104	0	0	0	(11)
Ouyen	C	54	0	0%	0	0	0	0	0	54
Rainbow (2)	n/a	0	0	0%	0	0	0	0	0	0
Rupanyup	C	15	2	13%	0	2	0	0	0	13
Stawell (3)	C	333	536	161%	183	353	0	0	0	(203)
Warracknabeal (3)	C	100	136	136%	136	0	0	0	0	(36)
Wycheproof	C	18	18	100%	0	18	0	0	0	0
Total 2020–21		**1,885**	**1,983**	**105%**	**567**	**1,416**	**0**	**0**	**0**	**(98)**
Total 2019–20		2,110	1,796	85%	494	1,302	0	0	0	314

Notes

(1) In Birchip, the negative discharge to the environment was caused by a calculation error.

(2) Wastewater treatment plants at Hopetoun, Jeparit, Minyip, Natimuk and Rainbow were operational but did not produce any recycled water output this year.

(3) In Nhill, Stawell and Warracknabeal, effluent was carried over from the previous year and recycled in 2020–21.

4. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-182 provides information about small catchment dams in the basin.

Table 6-182 Estimated small catchment dam information, Wimmera basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	29,535	1,933	2,418	4,351
Registered/licensed commercial and irrigation	7,436	661	269	930
Total 2020–21	**36,971**	**2,594**	**2,687**	**5,281**
Total 2019–20	36,971	2,115	2,709	4,824

6.28.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Under GWMWater's Wimmera and Glenelg rivers bulk entitlement, the water corporation operates the Wimmera–Glenelg system headworks to supply water to towns and customers connected to the Wimmera Mallee Pipeline and to supply entitlements held by Coliban Water, Wannon Water and the VEWH.

The Wimmera–Glenelg system is unique because the headworks harvest water from both the Glenelg and Wimmera river systems, and the volumes supplied to entitlement holders cannot be disaggregated between the two basins. The entitlement volumes and diversions are presented in this Wimmera basin chapter and are not presented in the Glenelg basin chapter.

Under GWMWater's Willaura system bulk entitlement, the water corporation operates the Mt William system in the Wimmera basin to supply water to Willaura and to supply water to Wannon Water for Glenthompson.

Wimmera – Key compliance points

- ✓ **There was no net increase in the total entitlement volume from the previous year.**
- ✓ **The total volume diverted (33,614 ML) was within the volume available for the year (170,386 ML).**
- ✓ **No individual bulk entitlement holder took more than the annual volume made available to them.**
- ✓ **Individual bulk entitlement holders complied with all provisions in their entitlements apart from:**
  - ✘ no approved metering plan has been implemented for *Bulk Entitlement (Willaura, Elmhurst and Buangor systems – GWMWater) Conversion Order 2012*
  - ✘ no approved metering plan has been implemented for *Bulk Entitlement (Wimmera and Glenelg Rivers – GWMWater) Conversion Order 2010*.

Entitlements in the Wimmera basin provide the basis for how water is shared in the basin. Rights to water in the Wimmera basin are set out in Table 6-183.

Table 6-183 Entitlement volumes, Wimmera basin

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Landsborough – Navarre) Conversion Order 2003	60	60
Bulk Entitlement (Willaura, Elmhurst and Buangor systems – GWMWater) Conversion Order 2012 (1)		
Urban commitments – GWMWater	408	408
Bulk Entitlement (Willaura system – Wannon Water) Conversion Order 2012	58	58
Subtotal: Bulk Entitlement (Willaura, Elmhurst and Buangor systems – GWMWater) Conversion Order 2012	*466*	*466*
Bulk Entitlement (Wimmera and Glenelg Rivers – GWMWater) Conversion Order 2010 (2)		
Wimmera and Glenelg Rivers – GWMWater Wimmera Mallee Pipeline Product	44,720	44,720
Supply by agreement – CEWH	28,000	28,000
Glenelg compensation flow	3,300	3,300

Recreation [3]	3,090	3,090
Pipeline loss provision	2,960	2,960
Bulk Entitlement (Wimmera and Glenelg Rivers – Coliban Water) Conversion Order 2010	300	300
Bulk Entitlement (Wimmera and Glenelg Rivers – Wannon Water) Conversion Order 2010	2,120	2,120
Wimmera and Glenelg Rivers Environmental Entitlement 2010		
Wimmera and Glenelg Rivers Environmental Entitlement Wetland Product [4]	1,000	1,000
Wimmera and Glenelg Rivers Environmental Entitlement Wimmera Mallee Pipeline Product	40,560	40,560
Subtotal: Wimmera and Glenelg Rivers Environmental Entitlement 2010	*41,560*	*41,560*
Subtotal: Bulk Entitlement (Wimmera and Glenelg Rivers – GWMWater) Conversion Order 2010	*126,050*	*126,050*
Take and use licences – unregulated surface water [5]	2,076	2,078
Licensed small catchment dams – off-waterway	7,436	7,436
Total	**136,087**	**136,089**

Notes
(1) Under GWMWater's Willaura system bulk entitlement, the water corporation operates the Mt William system in the Wimmera basin to supply water to Willaura and to supply water to Wannon Water for Glenthompson. This bulk entitlement also includes the Elmhurst and Buangor systems, which are located in the Hopkins basin.
(2) Under GWMWater's Wimmera and Glenelg rivers bulk entitlement, the water corporation operates the Wimmera Mallee system headworks to supply its own customers and the entitlements held by Coliban Water, Wannon Water, the VEWH and the CEWH.
(3) The Bulk Entitlement (Wimmera and Glenelg Rivers) Conversion Order 2010 provides a 3,090 ML entitlement to supply 11 recreational lakes and weir pools from the Wimmera Mallee Pipeline each year. It supplies recreational lakes throughout the region that historically received water from the channel system before it was decommissioned.
(4) The 1,000 ML for wetlands is supplied from the Wimmera Mallee Pipeline each year; it supplies wetlands throughout the region that historically received water from the channel system before it was decommissioned.
(5) The total volume of licences in the Wimmera basin includes licences for irrigation as well as for domestic and stock use.

Table 6-184 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

Table 6-184 Available water and take, Wimmera basin

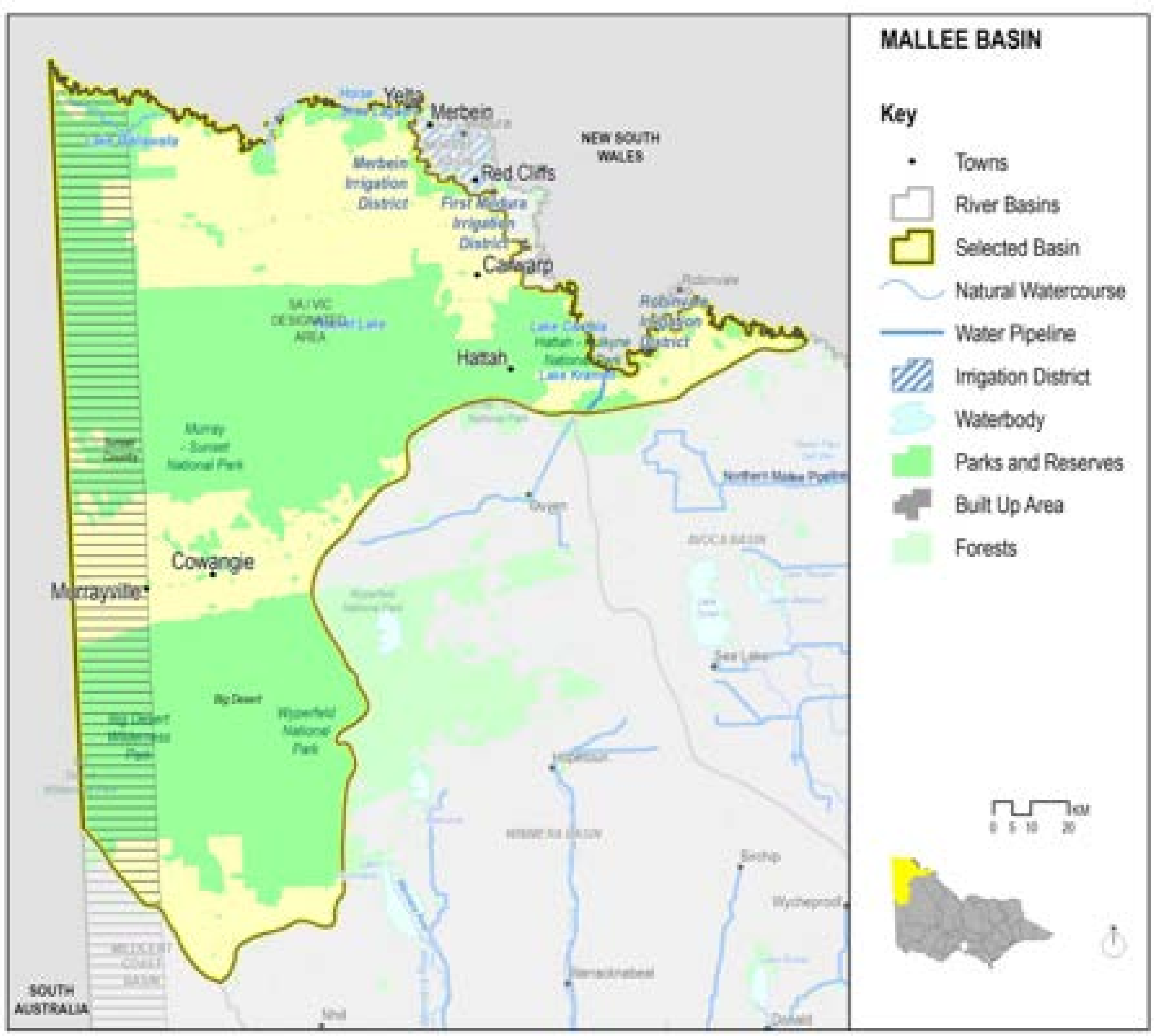
Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Landsborough – Navarre	-	60	0	60	0
Willaura, Elmhurst and Buangor systems – GWMWater					
Urban commitments – GWMWater	-	408	0	408	237
Willaura system – Wannon Water	-	58	0	58	40
Diversion: Willaura, Elmhurst and Buangor systems – GWMWater				*466*	*277*
Wimmera and Glenelg Rivers – GWMWater					
GWMWater Wimmera Mallee Pipeline Product	71,236	25,490	(2,700)	94,026	13,963
Supply by agreement – CEWH	0	0	0	0	0
Glenelg compensation flow	940	33	0	973	0
Recreation	464	0	2,700	3,164	2,348
Pipeline loss allowance	8,794	2,960	0	11,754	679
Wimmera and Glenelg Rivers – Coliban Water [1]	172	171	0	343	240
Wimmera and Glenelg Rivers – Wannon Water	5,912	1,208	0	7,120	84
Wimmera and Glenelg Rivers Environmental Entitlement [2]	19,848	23,119	0	42,967	14,940
Diversion: Wimmera and Glenelg Rivers [3]				*160,349*	*32,254*
Take and use licences – unregulated surface water	-	2,076	0	2,076	422
Licensed small catchment dams	-	7,436	0	7,436	661
Total 2020–21	**107,368**	**63,019**	**0**	**170,386**	**33,614**
Total 2019–20	127,926	49,551	0	177,477	42,660

Notes
(1) Use against this entitlement includes the volume of water supplied under Coliban Water's water allowance.
(2) Use against this environmental entitlement included 14,816 ML of water delivered in-stream — 6,244 ML in the Wimmera basin and 8,572 ML in the Glenelg basin — and 124 ML of water delivered off-stream to the Wimmera Mallee wetlands. The 14,816 ML delivered in-stream in the Wimmera basin is not included in the water balance in Table 6-179 as it does not reflect an actual diversion from the waterway. There are also passing flows of 3,491 ML under this entitlement, which are not included in this table.
(3) The water use reported in this line item represents the bulk diversion to supply primary entitlements under the Wimmera and Glenelg rivers system source bulk entitlement. It includes environment deliveries in-stream (14,816 ML).

6.29 Mallee basin

The Mallee basin (Figure 6-55) has few well-defined waterways. The Murray River forms the northern boundary of the basin, and for water accounting purposes, it is only included in the water balance of the Murray basin (chapter 6.2).

Figure 6-55 Map of the Mallee basin



6.29.1 Management arrangements

Management of water in the Mallee basin is undertaken by various parties, as shown in Table 6-185.

Table 6-185 Water resource management responsibilities, Mallee basin

Authority	Management responsibilities
GWMWater	Supplies groundwater to Murrayville and Cowangie
Lower Murray Water	Supplies water from the Murray River to Red Cliffs, Robinvale, Merbein and the First Mildura irrigation districts and to the Millewa waterworks district, Carwarp and Yelta Manages private diversions on the Victorian side of the Murray downstream of Nyah Supplies from the Murray system, towns along the Murray River from Swan Hill to the South Australian border
Mallee Catchment Management Authority	Responsible for waterway and catchment management in the whole Mallee basin

6.29.2 2020–21 water resources overview

In 2020–21, rainfall was:

- below average in most of the basin
- average in the far north of the basin, north of the Murray Sunset National Park and Hattah
- very much below average at the western edge of the basin covering an area south of Lake Wallawalla, the western side of the Murray Sunset National Park and most of the Big Desert Wilderness Park.

Almost all surface water used in the Mallee basin is sourced from other basins.

There were no restrictions on urban water use in the Mallee basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

6.29.2.1 Water for the environment

Environmental watering sites in the Mallee basin that depend on water for the environment include the internationally significant Hattah Lakes system, the Lindsay-Mulcra Wallpolla Living Murray Icon Site and the lower Murray wetlands including Catfish Billabong in the Merbein Common Flagship Waterway Site.

These water for the environment sites receive environmental water from the Murray River. The Murray basin chapter has more information about water for the environment in the Murray basin.

In 2020–21, water for the environment from within the Mallee basin comprised all water in the basin not allocated for consumptive use: this water also provided social, recreational and cultural benefits.

6.29.3 Water balance

Limited information is available for surface water availability and use, so a water balance has not been included for the Mallee basin.

Storage volumes

There are no storages in the Mallee basin.

Catchment inflow

The Mallee basin has no well-defined streams other than the Murray River, which runs along the entire northern edge of the basin and has only a few small tributaries at various points close to the Murray. Since Murray basin surface water is reported in chapter 6.2, there is no surface water resource information presented for the Mallee basin.

There is no reliable estimate of surface flows in the Mallee basin, to estimate the volume of water leaving the basin.

Recycled water

There are no wastewater treatment plants within the Mallee basin.

Small catchment dams

While there are some small catchment dams in the Mallee basin, no information about them is available, and they are not a significant source of water in the basin. Given the lack of information, the capacity of small catchment dams is assumed to be zero.

6.29.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in two areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year.

Mallee – Key compliance points
✓ **There was no net increase in the total entitlement volume from the previous year.**
✓ **Due to a lack of reliable information, the total volume diverted in the Mallee basin is not estimated.**

Entitlements in the Mallee basin provide the basis for how water is shared in the basin. Rights to water in the Mallee basin are set out in Table 6-186.

Table 6-186 Entitlement volumes, Mallee basin

Water entitlement – Mallee	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Licensed small catchment dams – on-waterway	10	10
Total	**10**	**10**

Table 6-187 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

Table 6-187 Available water and take, Mallee basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Licensed small catchment dams [1]	-	10	0	10	-
Total 2020–21	**-**	**10**	**0**	**10**	**-**
Total 2019–20	-	10	0	10	-

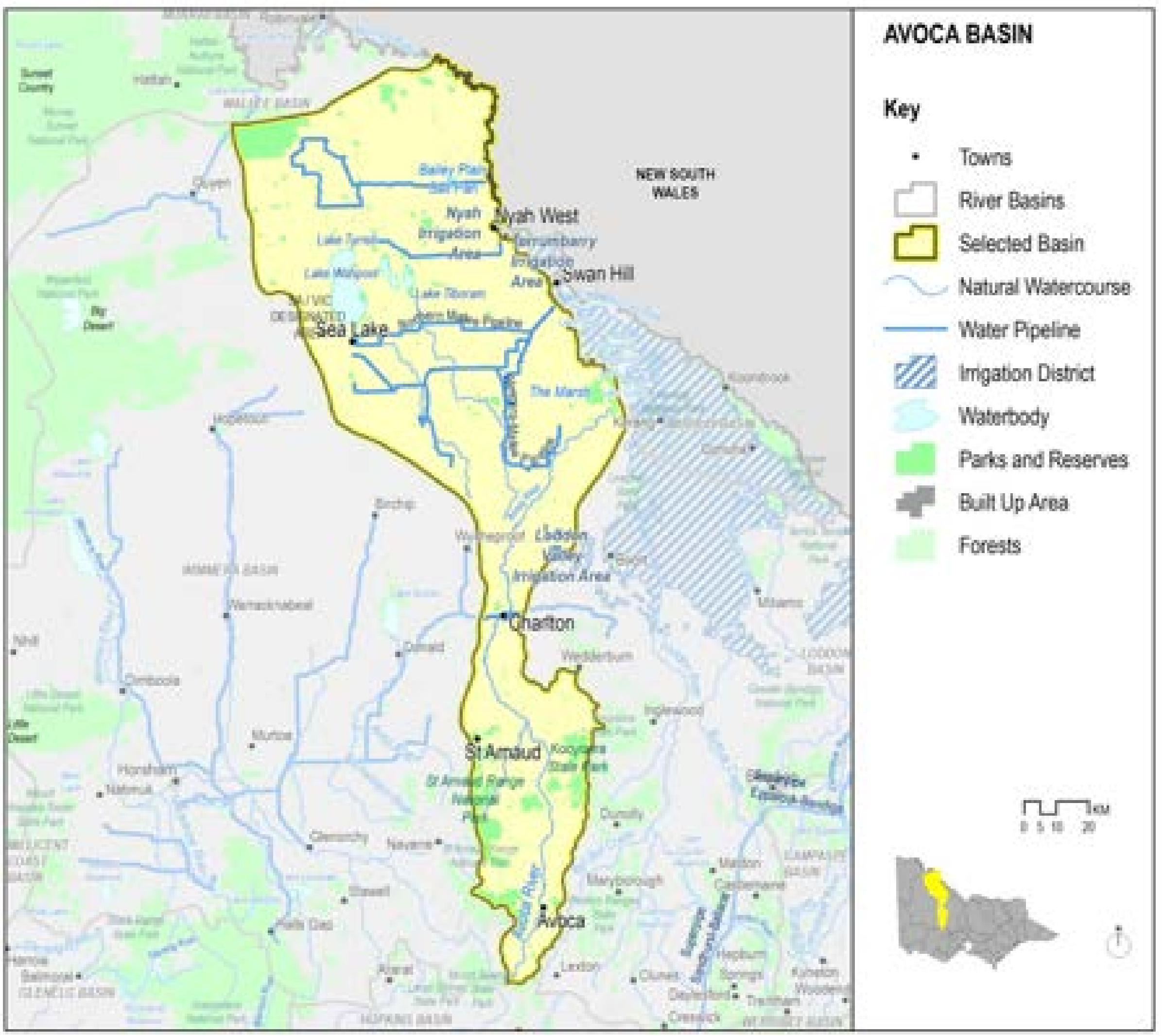
Note

(1) The volume of water taken from small catchment dams in the Mallee has not been estimated due to a lack of information on the basin.

6.30 Avoca basin

The Avoca basin (Figure 0-56) includes the Avoca River, small tributaries (such as Strathfillan Creek and Cherry Tree Creek) and minor watercourses which drain internally (such as Tyrrell Creek, which terminates in Lake Tyrrell). The Avoca River flows into the Kerang Lakes at Lake Bael Bael. For the purposes of these accounts, the Avoca basin excludes Swan Hill and the Torrumbarry Irrigation Area, which are supplied from the Murray River.

Figure 0-56 Map of the Avoca basin



6.30.1 Management arrangements

Management of water in the Avoca basin is undertaken by various parties, as shown in Table 6-188.

Table 6-188 Water resource management responsibilities, Avoca basin

Authority	Management responsibilities
Central Highlands Water	Supplies towns in the southern part of the Avoca basin including Avoca and Redbank
GWMWater	Provides domestic and stock supplies to farms via the Wimmera Mallee Pipeline and the Northern Mallee Pipeline Manages licensed diversions Supplies towns in the northern part of the Avoca basin including St Arnaud, Charlton, Sea Lake and Quambatook with water sourced from outside the Avoca basin
Goulburn-Murray Water	Supplies water from the Goulburn basin in bulk to GWMWater for Quambatook via the Normanville supply system
North Central Catchment Management Authority	Responsible for waterway and catchment management in the Avoca basin

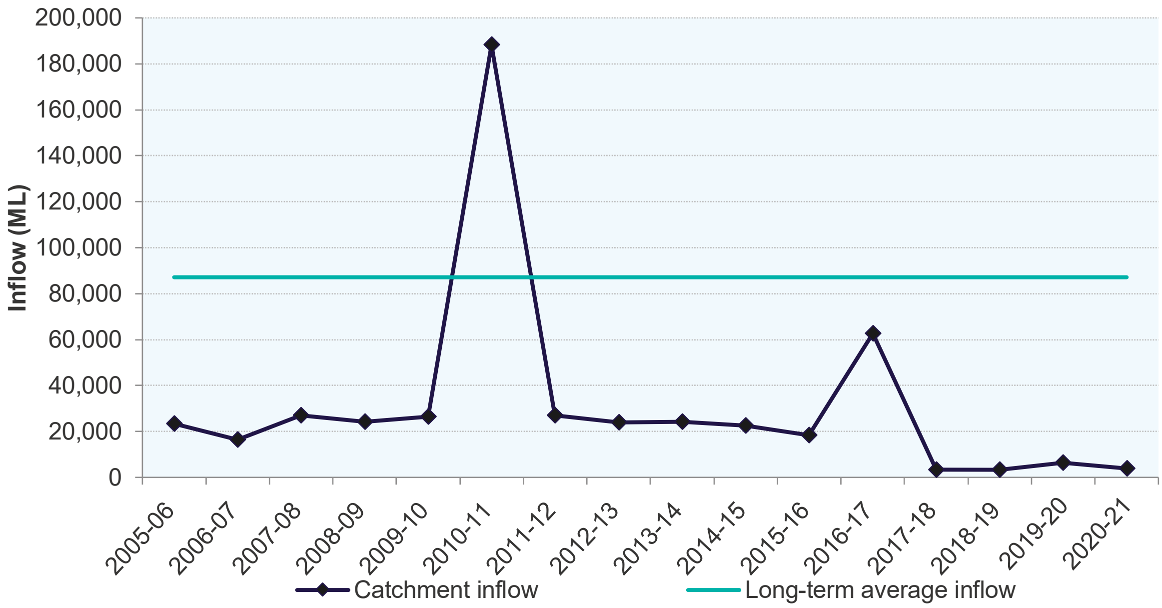
6.30.2 2020–21 water resources overview

In 2020–21, rainfall was:

- very much below average in the north of the basin in a large area covering Mittyack, Piangil, Swan Hill and Nullawil
- below average in the far north of the basin to the north-east corner, covering the Annuello Flora and the Fauna Reserve
- below average from Swan Hill to just north of Charlton
- average in a small area in the far north of the basin over Boundary Bend, in the west over Beveridge Island and in the south from Charlton to St Arnaud
- very much above average in the far south area of the basin, just south of St Arnaud to Lexton.

Catchment inflows to the basin in 2020–21 were 4% of the long-term average annual volume of 87,100 ML, slightly less than in 2019–20 when inflows were 7% of the long-term average. Similar to the previous year, only a small volume of water (6 ML) outflowed to the terminal lakes in the basin.

Figure 6-57 Storage volumes and catchment inflows, Avoca basin



Irrigation diversions from the Avoca River were banned from July 2020 to January 2021. Diversions were unrestricted from February to the end of June 2021.

There were no restrictions on urban water use in the Avoca basin in 2020–21, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2020–21, 1,138 ML of water was diverted for consumptive uses: town, domestic and stock and farm dam extractions. This was an increase from the 989 ML reported in the previous year.

6.30.2.1 Water for the environment

Environmental watering sites and environmental values in the Avoca basin that depend on water for the environment include:

- the Avoca River, with red gums and a floodplain system in the lower Avoca and grassy woodland in the upper Avoca.
- the lower Avoca grasslands, a unique, largely intact mosaic of floodplain associated with grassland and grassy woodland communities and significant flora and fauna values.

In 2020–21 water for the environment in the Avoca basin comprised:

- water set aside for the environment through the operation of passing flow conditions:
  - on consumptive bulk entitlements held by Central Highlands Water
  - on licensed diversions
- all other water in the basin not allocated for consumptive uses: this water also provides social, recreational and cultural benefits.

6.30.3 Water balance

The total volumes of water available and supplied from water resources in the Avoca basin in 2020–21 are shown in Table 6-189.

Table 6-189 Water balance, Avoca basin

Water account component	Note	2020–21 (ML)	2019–20 (ML)
Major on-stream storage			
Volume in storage at the start of the year	1	-	-
Volume in storage at the end of the year	1	-	-
Change in storage		**-**	**-**
Inflows			
Catchment inflow	2	3,789	6,431
Rainfall on major storages		-	-
Treated wastewater discharged back to river	3	0	0
Total inflows		**3,789**	**6,431**
Outflows			
Diversions			
Urban diversions		28	32
Licensed diversions from unregulated streams		33	92
Small catchment dams	4	1,077	852
Total diversions		***1,138***	***976***
Losses			
Evaporation from major storages		-	-
Net evaporation from small catchment dams	4	1,065	1,056
In-stream infiltration to groundwater, flows to floodplain and evaporation		1,580	4,380
Total losses		***2,645***	***5,436***
Water passed at outlet of basin			
Avoca River flow at Sandhill Lake Road (outflow to terminal lakes)		6	19
Avoca River overflow from the terminal lakes to the Kerang Lakes		0	0
Total water passed at outlet of basin		***6***	***19***
Total outflows		**3,789**	**6,431**

6.30.3.1 Notes to the water balance

1. Storage volumes

There are no major — greater than 1,000 ML — storages in the Avoca basin.

2. Catchment inflow

Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows and the known inflows.

3. Treated wastewater discharged back to river

Water recycled at wastewater treatment plants can be used to supplement water available in the basin. Table 6-190 lists the wastewater treatment plants in the Avoca basin. Water discharged to the environment from treatment plants is included as an inflow to the water balance. In 2020–21, no water was discharged to the environment in the Avoca basin.

Table 6-190 Volume and use of recycled water, Avoca basin

Wastewater treatment plant	Class of water	Volume of treated wastewater produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment (ML)	Volume discharged to the sea / other (ML)
					Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Avoca	C	38	38	100%	0	38	0	0	0	0
Charlton (1)	n/a	0	0	0%	0	0	0	0	0	0
Sea Lake (1)	n/a	0	0	0%	0	0	0	0	0	0
St Arnaud	C	103	86	83%	30	56	0	0	0	17
Total 2020–21		**141**	**124**	**88%**	**30**	**94**	**0**	**0**	**0**	**17**
Total 2019–20		125	121	97%	35	86	0	0	0	4

Note
n/a – data not available
(1) Wastewater treatment plants at Charlton and Sea Lake were operational but did not output any recycled water this year.

4. Small catchment dams

Water harvested, used and lost by small catchment dams (farm dams) is included in the water balance. Table 6-191 provides information about small catchment dams in the basin.

Table 6-191 Estimated small catchment dam information, Avoca basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Net evaporation (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	9,484	593	866	1,459
Registered/licensed commercial and irrigation	5,183	484	199	683
Total 2020–21	**14,667**	**1,077**	**1,065**	**2,142**
Total 2019–20	14,667	852	1,056	1,908

6.30.4 Compliance against entitlements

Compliance against water entitlements is reported for this basin in three areas:

- **entitlement issued:** the volume of entitlements issued in a basin does not exceed formal caps or has not increased without appropriate approvals
- **water taken:** the volume of water taken during the year does not exceed the volume considered to be available for consumptive and/or in-stream use during that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Avoca – Key compliance points

✓ **There was no net increase in the total entitlement volume from the previous year.**
✓ **The total volume diverted (545 ML) was within the volume available for the year (7,737 ML).**
✓ **No individual bulk entitlement holder took more than the annual volume made available to them.**
✓ **Individual bulk entitlement holders complied with all provisions in their entitlements.**

Entitlement volumes provide the basis for how water is shared in the basin. Rights to water in the basin are set out in Table 6-192.

Table 6-192 Entitlement volumes, Avoca basin

Water entitlement	Annual entitlement volume (ML) 30 June 2021	Annual entitlement volume (ML) 30 June 2020
Bulk Entitlement (Amphitheatre) Conversion Order 2003	25	25
Bulk Entitlement (Avoca) Conversion Order 2003	233	233
Bulk Entitlement (Redbank) Conversion Order 2003	20	20
Take and use licences – unregulated surface water	2,275	2,289
Licensed small catchment dams – on-waterway	5,183	5,183
Total	7,737	7,751

Table 6-193 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

Table 6-193 Available water and take, Avoca basin

Water entitlement	Available water (ML)				Water taken (ML)
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Amphitheatre	-	25	0	25	9
Avoca	-	233	0	233	19
Redbank	-	20	0	20	0
Take and use licences – unregulated surface water	-	2,275	0	2,275	33
Licensed small catchment dams	-	5,183	0	5,183	484
Total 2020–21	**-**	**7,737**	**0**	**7,737**	**545**
Total 2019–20	-	8,028	0	8,028	518

7. Groundwater catchment accounts

7.1 Overview

7.1.1 Introduction

This chapter presents water accounts by groundwater catchment.

The groundwater catchment accounts are compiled from information obtained from:

- the Victorian Water Register
- the Victorian Water Measurement Information System
- data from water corporations and major users of water
- management plans, groundwater catchment statements, annual reports and related documents.

7.1.2 Groundwater resources

In 2012, the Victorian Government developed a framework for the management and reporting of groundwater resources. The framework comprises:

- groundwater management basins
- groundwater catchments
- groundwater management units (GMUs), of which there are two types:
  - **water supply protection areas (WSPAs)**: areas declared to protect groundwater or surface water resources through the development of statutory management plans
  - **groundwater management areas (GMAs)**: defined for the purposes of management, most commonly areas where no new groundwater entitlement is available. They may be intensively developed or have the potential to be.

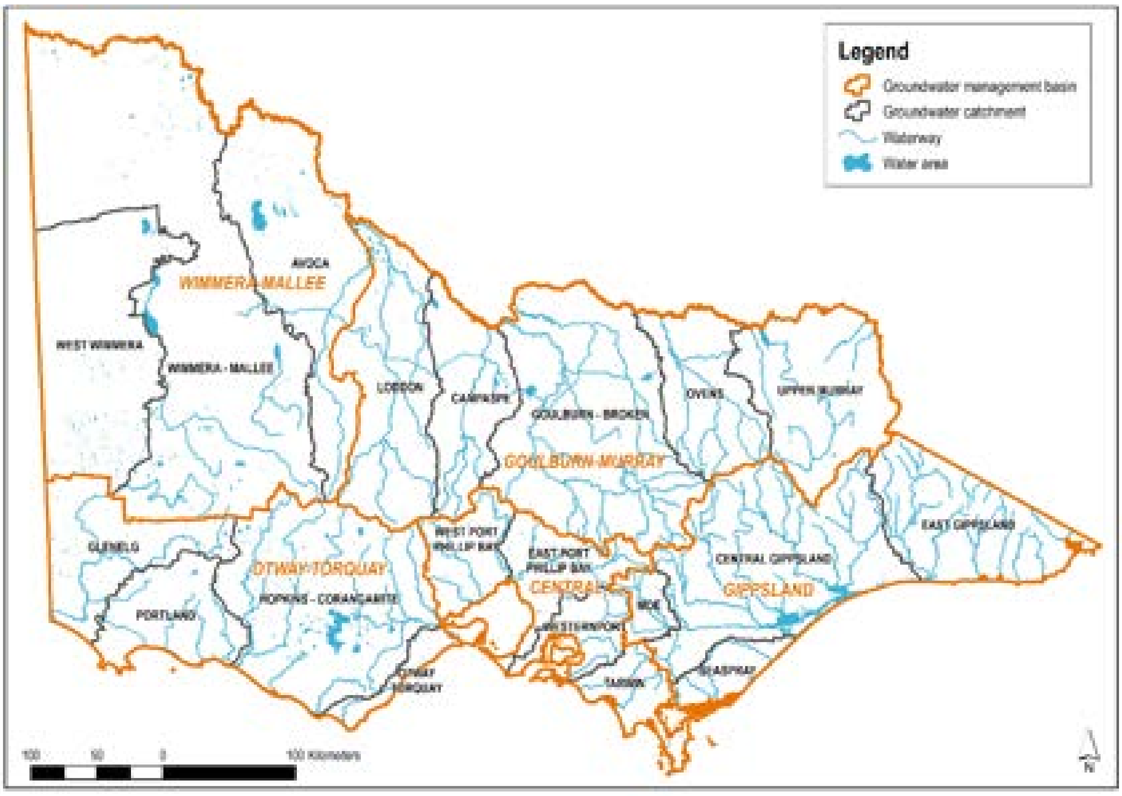
There are five groundwater management basins in Victoria. These are partly based on an understanding of the groundwater geological basins but are also aligned with water corporations' administrative boundaries.

For management and reporting purposes, each groundwater management basin has several groundwater catchments (Figure 7-1). There are 20 groundwater catchments in total. A groundwater catchment approximates the surface water basin, with adjustments based on knowledge and assumptions about groundwater flow divides.

The Victorian groundwater management basins and their catchments used for reporting purposes are:

- the **Goulburn–Murray groundwater management basin** in the north and north-east, covering the Loddon, Campaspe, Goulburn–Broken, Ovens and Upper Murray groundwater catchments
- the **Gippsland groundwater management basin** in the south-east, covering the East Gippsland, Central Gippsland, Moe and Seaspray groundwater catchments
- the **Central groundwater management basin** in the south, covering the West Port Phillip Bay, East Port Phillip Bay, Westernport and Tarwin groundwater catchments
- the **Otway–Torquay groundwater management basin** in the south-west, covering the Glenelg, Portland, Hopkins–Corangamite and Otway–Torquay groundwater catchments
- the **Wimmera–Mallee groundwater management basin** in the north-west, covering the Wimmera–Mallee, West Wimmera and Avoca groundwater catchments.

Figure 7-1 Groundwater management basins and catchments



Within groundwater catchments, there are smaller management units — GMUs — which are either WSPAs or GMAs. Groundwater resources that are licensed and used outside a WSPA or GMA are reported as '*outside management units*'. Generally, a groundwater catchment includes several GMUs where the geographical boundaries of the GMU are contained within and/or aligned with the groundwater catchment boundaries. There are exceptions: for example, a GMU might span several groundwater catchments (such as the West Goulburn GMA, which is in both the Goulburn–Broken and Campaspe groundwater catchments).

Groundwater access and use are managed through licensing. The total volume of groundwater that may be licensed and taken in a GMU is set by the **permissible consumptive volume** (PCV). PCVs are declared by the Minister for Water through an order published in the *Victoria Government Gazette*. Management arrangements at the GMU level are set out in either a statutory groundwater management plan or a local management plan.

Chapter 1.1.2 has more information about groundwater resources in Victoria, and chapter 1.3.2 provides detail about the management of groundwater resources.

7.1.3 Groundwater catchment reporting – method

Information about groundwater in 2020–21 is presented in this chapter for each of the 20 groundwater catchments. There are three parts to each groundwater catchment subchapter:

- **management arrangements**, which summarises management arrangements and GMUs in the groundwater catchment
- **2020–21 groundwater resources overview**, which provides a snapshot of the resource condition in the groundwater catchment in 2020–21 by summarising groundwater level trends, restrictions and water use
- **groundwater use and compliance**, which details the licensed volume and use in the groundwater catchment in 2020–21.

7.1.3.1 Licensed groundwater volumes and use

The 'Licensed groundwater volumes and use' table in each 'Groundwater compliance and use' part shows the total volume of water available for extraction during the water year and licensed use in GMUs and outside management units.

Urban use is reported by town name and represents the licensed volume held and used by urban water corporations to supply towns within their service area. Urban water corporations hold take and use licences, except for one bulk entitlement held by Barwon Water in the Otway–Torquay groundwater catchment.

The estimated domestic and stock use is based on the number of domestic and stock bores in each GMU and outside GMUs in each groundwater catchment. The estimating method is explained below.

The components of the table — licensed entitlement (ML/year), carryover, licensed volume allocated, net trade, total water available and water extracted – are explained below.

- **Licensed entitlement (ML/year),** which represents the volume of entitlement as of 30 June of each water year.
- **Carryover,** which represents any water carried over from 2019–20 that could be taken in 2020–21. Carryover is only available if the Minister of Water has made a declaration under section 62A of the *Water Act 1989*.
- **Licensed volume allocated[6],** which represents the volume of water able to be taken and used under licences during the water year. It comprises the entitlement volume that is affected by restriction and/or trade. The licensed volume allocated can be different to the licensed entitlement volume because:
    - a restriction on water use might be in place in the GMU; for example, in 2020–21, take and use licence holders in the Deutgam WSPA were restricted to 50% of their licence volume (that is, for every 100 ML in their licence, they could use or trade 50 ML of water)
    - licences may have been cancelled or temporarily traded during the year, so the allocation volume may be greater or less than the entitlement volume; for example, temporary trade of licences can occur between GMUs in Victoria, which would affect the allocation volume issued to licences within those GMUs.
- **Net trade**, which represents the volume of water that has been traded in for use within the GMU less water traded out of the GMU.
- **Total water available,** which represents the volume of water that was available under licences to be taken in 2020–21. This item is the sum of the first three components: carryover, water allocated and the net of the in/out trade of water. Total water available is distinct from the PCV. A PCV represents the maximum volume that can be licensed and used in a GMU as declared by the Minister for Water, whereas total available water represents the overall volume that is available to licence holders in each individual year. The available volume may change from year to year due to carryover and/or trade.
- **Water extracted:** this item represents the volume of water taken and used during the water year under the licensed entitlement.

Most groundwater extractions are metered. Groundwater use in the Shepparton Irrigation Region GMA is largely not metered; rather, it is estimated at the end of each season using a method that considers annual use by a subset of Shepparton Irrigation Region GMA licensed groundwater users that are metered, the volume of metered groundwater use in the Katunga Water Supply Protection Area, and spring rainfall.

7.1.3.2 Estimated domestic and stock use

An estimate of groundwater extracted for domestic and stock use is made per GMU each year. This use is permitted under section 8 of the *Water Act 1989*, which provides rights to take water for domestic and stock purposes from surface and groundwater under certain circumstances without a take and use licence.

Estimated domestic and stock use is calculated based on an assumed usage per registered bore per year. In areas managed by Goulburn-Murray Water and GWMWater, 2 ML usage per bore per year is assumed. In the area managed by Southern Rural Water, 1.5 ML usage per bore per year is assumed, except for Nepean GMA and Stratford GMA, with 1 ML and 2 ML per bore per year respectively assumed.

The number of domestic and stock bores recorded for each GMU includes all bores registered in the Water Measurement Information System (WMIS) that are less than 30 years old, as this is the expected life of a bore. Domestic and stock bores are assigned to GMUs based on the spatial location and/or depth of the bore.

Some water for domestic and stock use is taken under a take and use licence. This use is not reported in this line item as it is recorded within the licensed entitlement extraction volume.

7.1.3.3 Compliance

Compliance against groundwater entitlements is reported in these accounts in three areas:

- **entitlement issued:** the volume of entitlements (not applicable for domestic and stock water use) issued in a GMU (either a WSPA or a GMA) does not exceed the PCV
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders in that year
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

PCV compliance is also not assessed in the following five GMUs.

- Upper Ovens WSPA: a PCV is not required because the management plan prevents additional entitlements or an increase in entitlement volume from being issued, except by trade.

[6] Under the *Water Act 1989* licences may be restricted. Licences do not receive an allocation.

- Shepparton Irrigation Region GMA: there is no PCV as there is no limit on the total volume of shallow groundwater entitlement available.
- West Goulburn GMA: there is no PCV, but there are individual zone caps set; the total recorded use in the West Goulburn GMA in 2019–20 was 1,277 ML, 42% of the total licensed volume.
- South West Limestone GMA: the PCV has not been gazetted. The South West Limestone GMA includes the area of the former Nullawarre WSPA, Yangery WSPA, Hawkesdale GMA and Heywood GMA and the areas outside the former GMUs but included within the South West Limestone GMA area. The PCVs for the four GMUs have not been revoked and still apply. PCV volumes are Nullawarre 22,741 ML, Yangery 14,352 ML, Hawkesdale 16,161 ML and Heywood 8,500 ML
- Stratford GMA: current compliance assessment criteria are not applicable. Coal mine licences physically in the area are not assigned to the Stratford GMA.

For West Wimmera GMA, Wy Yung GMA, Nepean GMA, Rosedale GMA, Stratford GMA and Wa De Lock GMA, the PCV that applies is the sum of the PCVs for all zones within each GMA.

7.2 Groundwater management unit compliance reporting for 2020–21

A summary of licensed groundwater use against available water and the PCV for 2020–21 is presented in Table 7-1 below for each GMU.

Victoria —key compliance points	
✓	**The licensed entitlement volume did not exceed the gazetted PCV for each relevant GMU.** • In 2020–21, this was true for all GMUs where compliance is assessed: as noted in 7.1.3.3, compliance was not assessed in one WSPA and four GMAs.
✓	**The total volume of licensed water used in each GMU was within the volume available for the year.**
✓	**Individual bulk entitlement holders complied with all provisions in their entitlements.**

Table 7-1 Licensed and available groundwater volumes

Groundwater management unit	Entitlement volume (ML)		Water available and taken under licences 2020–21 (ML)					Compliance		
	PCV	Licensed entitlement	Carryover	Water allocated	Net trade	Total water available	Water taken	% of PCV	% of available water	Licence volume available under PCV (ML)
	A	B	C	D	E	F =C+D+E	G	H =G/A	I =G/B	J =A-B
Goulburn-Murray Water										
Water supply protection areas										
Katunga (1)	60,577	60,203	0	41,974		**41,974**	**26,133**	**43%**	**62%**	**374**
Loddon Highlands (2)	20,697	20,502	3,002	19,778	0	**22,781**	**4,534**	**22%**	**20%**	**195**
Lower Campaspe Valley (3)	55,875	55,860	12,591	41,895		**54,486**	**33,050**	**59%**	**61%**	**15**
Upper Ovens (4)	n/a	3,605	0	3,563	(458)	**3,105**	**919**	**n/a**	**30%**	**n/a**
Groundwater management areas										
Barnawartha	2,100	375	-	375	0	**375**	**3**	**0%**	**1%**	**1,725**
Broken	3,732	2,986	0	2,993	0	**2,993**	**507**	**14%**	**17%**	**746**
Central Victorian Mineral Springs	6,024	5,076	-	5,092	0	**5,092**	**872**	**14%**	**17%**	**948**
Eildon	1,496	645	0	645	0	**645**	**180**	**12%**	**28%**	**852**
Kiewa	3,852	3,109	-	3,115	0	**3,115**	**397**	**10%**	**13%**	**743**
Lower Ovens (5)	25,200	19,877	0	19,877	0	**19,877**	**5,712**	**23%**	**29%**	**5,323**
Mid Goulburn	12,470	12,375	2,298	12,375	0	**14,673**	**2,531**	**20%**	**17%**	**95**
Mid Loddon	34,037	33,927	9,764	33,927	0	**43,691**	**17,515**	**51%**	**40%**	**110**
Shepparton Irrigation Region (6) (7)	n/a	185,737	-	185,737	0	**185,737**	**91,567**	**n/a**	**49%**	**n/a**
Strathbogie	1,660	1,373	-	1,446	0	**1,446**	**469**	**28%**	**32%**	**287**
Upper Goulburn	8,568	6,119	-	6,119	0	**6,119**	**868**	**10%**	**14%**	**2,449**
Upper Murray	7,674	3,532	-	3,532	0	**3,532**	**466**	**6%**	**13%**	**4,142**
West Goulburn (8)	n/a	3,037	301	3,061	0	**3,362**	**920**	**n/a**	**27%**	**n/a**
Outside management units										
Goulburn-Murray Water	n/a	14,680	-	14,697	0	**14,697**	**2,839**	**n/a**	**19%**	**n/a**
GWMWater										
Groundwater management areas										
Murrayville	11,005	9,755	2,641	9,755	0	**12,396**	**6,151**	**56%**	**50%**	**1,250**
West Wimmera (9) (10)	57,409	53,358	12,537	49,240	0	**61,777**	**23,843**	**42%**	**39%**	**4,051**
Outside management units										
Grampians Wimmera Mallee Water	n/a	9,601	-	9,601	0	**9,601**	**1,117**	**n/a**	**12%**	**n/a**
Southern Rural Water										
Water supply protection areas										
Condah	7,475	7,470	0	7,470	0	**7,470**	**2,413**	**32%**	**32%**	**5**

Deutgam (11)	5,100	5,082	(43)	2,584	0	**2,541**	**338**	**7%**	**13%**	**18**
Glenelg (18)	33,262	16,092	0	15,992	0	**15,992**	**5,797**	**17%**	**36%**	**17,170**
Koo Wee Rup	12,915	12,566	0	12,745	0	**12,745**	**3,123**	**24%**	**25%**	**349**
Sale	21,238	21,203	0	21,103	(15)	**21,088**	**10,697**	**50%**	**51%**	**35**
Warrion	14,086	14,075	(43)	14,118	0	**14,075**	**2,586**	**18%**	**18%**	**11**
Yarram	25,690	25,688	0	25,688	0	**25,688**	**9,677**	**38%**	**38%**	**2**
Groundwater management areas										
Bungaree	5,334	5,293	0	5,356	0	**5,356**	**1,826**	**34%**	**34%**	**41**
Cardigan	3,967	3,889	0	3,889	0	**3,889**	**785**	**20%**	**20%**	**78**
Colongulac	4,695	4,404	0	4,404	0	**4,404**	**853**	**18%**	**19%**	**291**
Corinella	2,550	662	0	662	0	**662**	**14**	**1%**	**2%**	**1,888**
Cut Paw Paw	3,650	523	0	523	0	**523**	**0**	**0%**	**0%**	**3,127**
Denison (12)	18,502	18,499	(25)	18,970	0	**18,945**	**4,175**	**23%**	**22%**	**3**
Frankston	3,200	2,542	0	2,542	0	**2,542**	**534**	**17%**	**21%**	**658**
Gellibrand (13)	0	0	0	0	0	**0**	**0**	**n/a**	**n/a**	**n/a**
Gerangamete (14)	239	238	0	238	0	**238**	**65**	**27%**	**27%**	**1**
Giffard	5,689	5,689	0	5,689	0	**5,689**	**2,366**	**42%**	**42%**	**1**
Glenormiston	2,698	2,636	(5)	2,641	0	**2,636**	**1,180**	**44%**	**45%**	**62**
Jan Juc (15)	14,250	14,250	0	14,250	0	**14,250**	**245**	**2%**	**2%**	**0**
Lancefield	1,485	1,378	0	1,378	0	**1,378**	**148**	**10%**	**11%**	**108**
Leongatha	6,500	1,803	0	1,803	0	**1,803**	**29**	**0%**	**2%**	**4,697**
Merrimu	451	8	0	10	0	**10**	**0**	**0%**	**0%**	**443**
Moe	8,200	3,762	0	3,882	(120)	**3,762**	**416**	**5%**	**11%**	**4,438**
Moorabbin	2,700	2,624	0	2,624	0	**2,624**	**667**	**25%**	**25%**	**76**
Nepean (9)	6,110	6,110	0	6,110	0	**6,110**	**2,953**	**48%**	**48%**	**1**
Newlingrook	1,977	1,958	0	1,958	0	**1,958**	**21**	**1%**	**1%**	**20**
Orbost	1,217	1,217	0	1,217	0	**1,217**	**59**	**5%**	**5%**	**1**
Paaratte	4,606	3,159	0	3,159	0	**3,159**	**281**	**6%**	**9%**	**1,447**
Portland	7,795	7,794	0	7,794	0	**7,794**	**2,257**	**29%**	**29%**	**1**
Rosedale (9) (16)	22,372	22,272	0	14,283	(50)	**14,233**	**6,319**	**28%**	**44%**	**100**
South West Limestone (17) (18)	n/a	81,189	23,566	81,297	0	**104,863**	**24,651**	**n/a**	**24%**	**n/a**
Stratford (9) (16)	27,686	37,434	0	25,191	0	**25,191**	**24,019**	**n/a**	**95%**	**n/a**
Tarwin	1,300	58	0	58	0	**58**	**6**	**0%**	**11%**	**1,242**
Wa De Lock (9) (12)	30,795	29,124	0	29,364	0	**29,364**	**4,110**	**13%**	**14%**	**1,671**
Wandin Yallock	3,027	3,025	(1)	3,026	0	**3,025**	**425**	**14%**	**14%**	**2**
Wy Yung (9)	7,463	7,462	0	8,005	0	**8,005**	**367**	**5%**	**5%**	**1**
Outside management units (12)										
Southern Rural Water	n/a	71,372	(4)	73,676	185	**73,857**	**11,882**	**n/a**	**16%**	**n/a**
Total 2020–21	**n/a**	**948,278**	**66,579**	**892,493**	**(458)**	**958,614**	**345,878**	**n/a**	**36%**	**61,290**
Total 2019–20	n/a	948,037	60,902	938,966	(168)	999,699	406,438	**n/a**	41%	**61,060**

Notes

(1) Licences in the Katunga WSPA were restricted to 70% of entitlement, as per the rules in the management plan.
(2) Licences in the Loddon Highlands WSPA Newlyn zone were restricted to 75% of entitlement. Those in the Blampied Zone would start the year with a 75% allocation, which later increased to 100% after the resource had recovered sufficiently, as per the rules in the management plan.
(3) Licences in the Lower Campaspe Valley WSPA (Barnadown, Elmore-Rochester, Bamawn and Echuca zones) were restricted to 75% of entitlement, as per the rules of the management plan.
(4) The Minister approved the revocation of the PCV on 3 March 2013. A PCV is not required for the Upper Ovens WSPA because the management plan prevents additional entitlements or an increase in entitlement volume from being issued, except by trade.
(5) A moratorium on granting new licences has been applied in the Lower Ovens GMA while the management plan is being reviewed.
(6) There is no PCV for the Shepparton Irrigation Region GMA.
(7) Groundwater use in the Shepparton Irrigation Region GMA is estimated at the end of each season using a method that considers annual use by a subset of Shepparton Irrigation Region GMA licensed groundwater users that are metered, the volume of metered groundwater use in the Katunga WSPA and spring rainfall.
(8) There is no PCV for the West Goulburn GMA, but there are individual zone caps set: recorded use in the West Goulburn GMA in 2020–21 was 920 ML, 30% of the total licensed volume.
(9) The PCV figure reported is the sum of the PCVs for each of the zones within the respective GMAs for West Wimmera GMA, Wy Yung GMA, Nepean GMA, Rosedale GMA, Stratford GMA and Wa De Lock GMA. No PCV has been set for the whole of each area.
(10) Licences in West Wimmera GMA (Neuarpur subzone 1) were restricted to 80% of entitlement, as per the rules of the management plan.
(11) Licences in the Deutgam WSPA were restricted to 50% of entitlement.
(12) The volumes of use in Denison GMA, Wa De Lock GMA and the outside management units include metered extractions for salinity control (Denison GMA 446 ML, Wa De Lock GMA 195 ML and outside management units 871 ML).

(13) The Gellibrand PCV of 0 ML was gazetted at the end of 2018–19.
(14) The PCV for the Gerangamete GMA decreased to 239 ML in 2019–20.
(15) PCV are set for zones and aquifers in the Jan Juc GMA but not for the whole GMA. The PCV for Zone 1 all formations is 250 ML, for Zone 2 Upper Eastern View formation is 4,000 ML and for Zone 2 Lower Eastern View formation is 35,000 ML — all in any five-year period — and for zone 2 all formations below the Lower Eastern formation is 0 ML. The Jan Juc bulk entitlement, which applies to Zone 2 Lower Eastern View formation, provides for a five-year total extraction of 35,000 ML with a maximum annual extraction of 10,000 ML. The PCV reported is a notional volume (14,250 ML) sum of the annual limits.
(16) The reported values of licensed entitlement and metered use for the Rosedale and Stratford GMAs include metered extractions for the Latrobe Valley coal mines (Rosedale GMA 9,304 ML entitlement and 1,265 ML use, and Stratford GMA 36,207 ML entitlement and 23,964 ML use). These coal mine licences are in the Rosedale and Stratford physical areas, but the licence volume and extraction are not assigned to or assessed against the GMAs. For this reason, the licence volume in the Stratford GMA is shown as exceeding the PCV.
(17) There is no PCV set for the South West Limestone GMA. The entitlements and use relate to the area defined in the South West Limestone Groundwater Management Area Plan No. LEGL./15-199, which covers and includes the following GMAs and respective PCVs: Nullawarre 22,741 ML, Yangery 14,352 ML, Hawkesdale 16,161 ML and Heywood 8,500 ML.
(18) Some licences (approximately 14,000 ML) that are registered as in the South West Limestone GMA are located in the Glenelg WSPA. This is where these two areas overlap. It is noted therefore that the licence volume for Glenelg WSPA should be approximately 30,000 ML, rather than 16,092 ML.

7.3 Goulburn–Murray groundwater management basin

The Goulburn–Murray groundwater management basin is in north-east Victoria. It borders the Gippsland management basin to the south-east, the Central and Otway–Torquay management basins to the south and the Wimmera–Mallee management basin to the west.

The hydrogeology of the region can be broadly subdivided into two distinct geological areas: the southern highlands of bedrock with sedimentary valleys and the northern plains with layers of sedimentary aquifers.

In the south, the highlands feature exposed bedrock and valleys of eroded material that form the Quaternary Aquifer. This thin, shallow aquifer is comprised of sand, colluvium, fluvial sands, gravels, clay and silts and is found in upland valleys (such as Alexandra, Yea and Flowerdale). Water is also held in the Mesozoic and Palaeozoic bedrock, which is comprised of fractured sedimentary rock. Bedrock is close to the surface near Jamieson, Mansfield, Marysville, Kilmore and Seymour and to the east is increasingly buried deeper. These groundwater resources are generally low-yielding unless a fracture in the rock is intercepted.

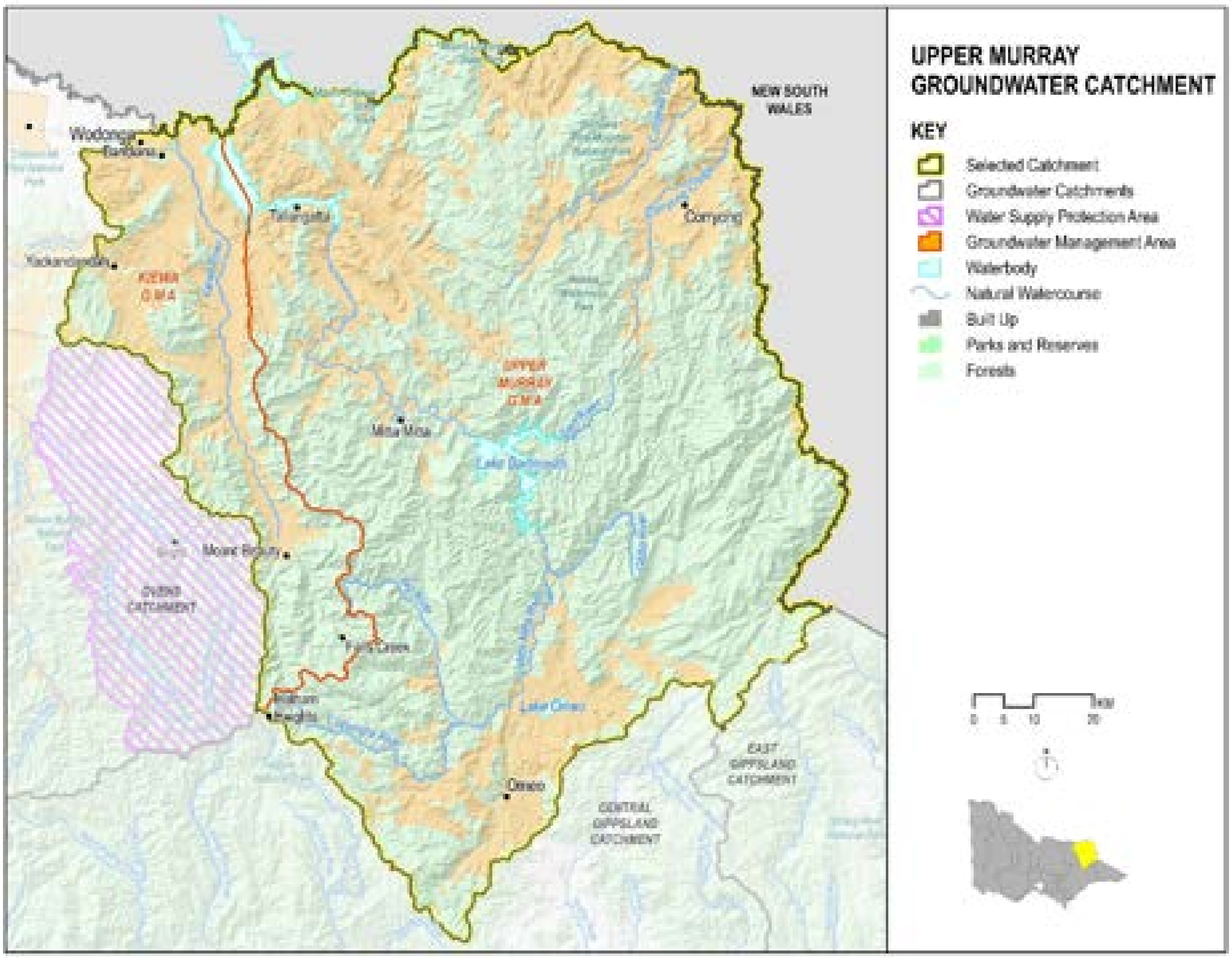
In the north, the plain of the Goulburn–Murray groundwater management basin gradually thickens into several geological layers.

- The Upper Tertiary Quaternary Aquifer of the Shepparton formation is made of layered clay, sands and silt. It appears north of Seymour and runs to Nathalia, Barmah and Numurkah. Along the Murray, the Upper Tertiary Quaternary Aquifer overlies the Calvil Formation Upper Tertiary Aquifer fluvial, containing fluvial sand, gravel and clay. These are major groundwater resources in the region.
- The lower tertiary aquifers of the Renmark formation appear in pockets to the north, near Nathalia and Barmah. They comprise sand, gravel, clay, silt and minor coal. These are major groundwater resources in the region.
- Cretaceous and Permian sediments made of fractured rock, sand and minor coal appear from Shepparton to parts of the north near Nathalia and Numurkah.
- Mesozoic and Palaeozoic bedrock comprises fractured sedimentary rock.

7.3.1 Upper Murray groundwater catchment

The Upper Murray groundwater catchment is in north-eastern Victoria (Figure 7-2). It extends from the Victorian Alps to the Murray River.

Figure 7-2 Upper Murray groundwater catchment



7.3.1.1 Management arrangements

Groundwater resources in the Upper Murray groundwater catchment are managed by Goulburn-Murray Water, which is responsible for developing and implementing groundwater management plans. Goulburn-Murray Water also issues licences for groundwater use and bore construction, and it administers domestic and stock use. The Upper Murray groundwater catchment is part of the Murray–Darling Basin, and groundwater management arrangements are subject to the requirements of the Murray–Darling Basin Plan.

The Upper Murray groundwater catchment contains the Upper Murray and Kiewa GMAs. Groundwater resources supply licensed entitlements, domestic and stock use and urban use to Dinner Plain.

7.3.1.2 2020–21 groundwater resources overview

Groundwater level trends for 2020–21 across the Upper Murray groundwater catchment were stable from July 2020 to June 2021 (Table 7-2).

Table 7-2 Groundwater level trends, Upper Murray groundwater catchment

Groundwater management unit	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Groundwater management area					
Kiewa	stable	stable	stable	**stable**	**declining**
Upper Murray	stable	stable	stable	**stable**	**stable**

In 2020–21, 1,714 ML of water was extracted for consumptive purposes, which was more than the 1,669 ML extracted in the previous year. Of this volume, 47 ML was for urban use, and 850 ML was estimated to be for domestic and stock use.

7.3.1.3 Groundwater compliance and use

Compliance against water entitlements is reported for this groundwater catchment in two areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders.

Upper Murray – Key compliance points	
✓	**The volume of entitlements in the catchment did not exceed relevant PCVs.**
✓	**The total volume extracted under licences (864 ML) was within the volume available for the year (6,647 ML).**

Groundwater licence and use volumes in the Upper Murray groundwater catchment are shown in Table 7-3, including licensed groundwater entitlements (urban and non-urban use) and domestic and stock bores. Groundwater provides the urban water supply to Dinner Plain. Some groundwater licences incorporate domestic and stock use, and in these cases, the use is reported in the licensed volume in Table 7-3.

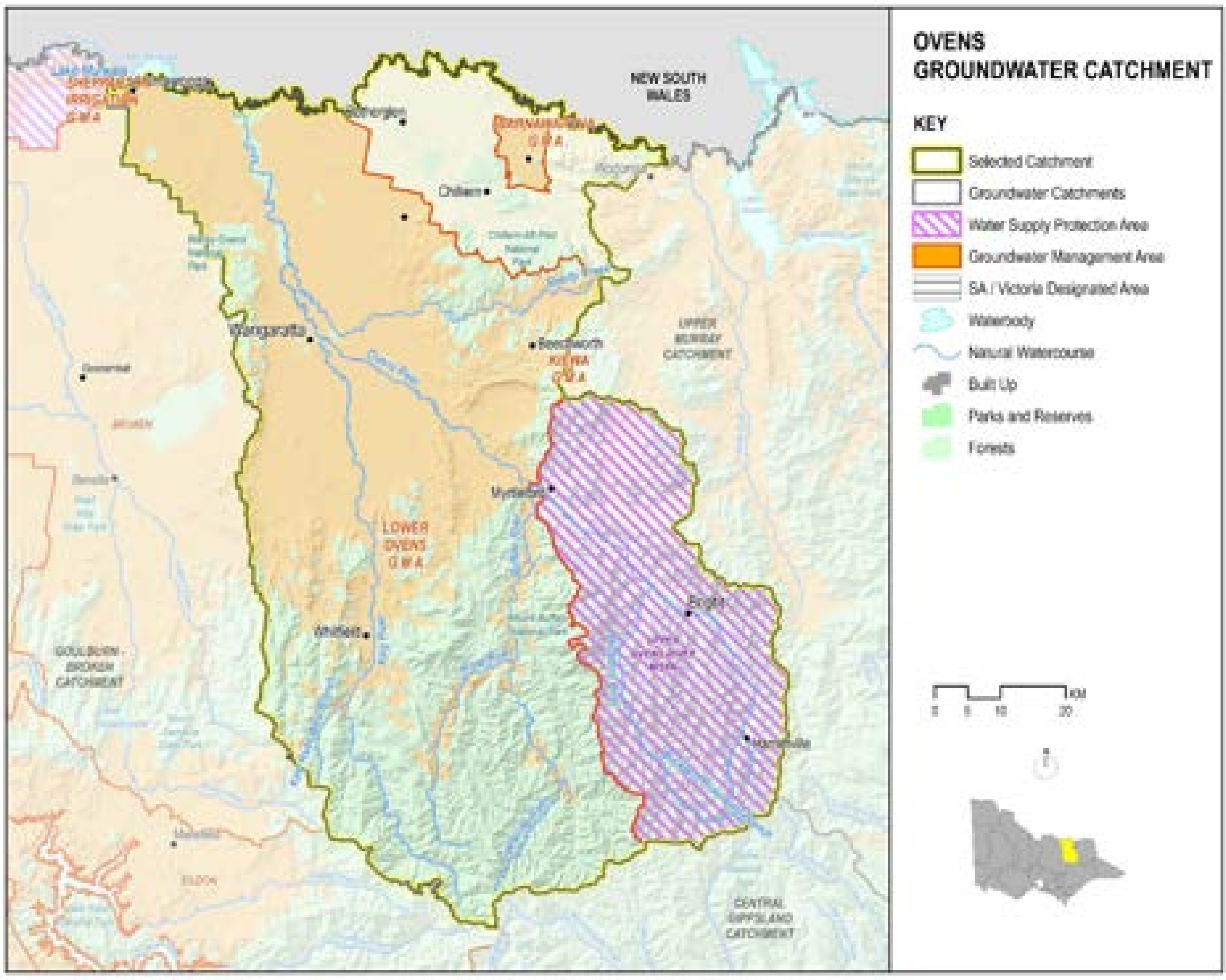
Table 7-3 Licensed groundwater volumes and use, Upper Murray groundwater catchment

Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML)	Total water available (ML)	Water extracted (ML)
Kiewa GMA	Licensed use (non-urban)	3,109	0	3,115	0	**3,115**	**397**
	Domestic & stock	-	-	-	-	-	**450**
Upper Murray GMA	Licensed use (non-urban)	3,412	0	3,412	0	**3,412**	**420**
	Dinner Plain urban	120	0	120	0	**120**	**47**
	Domestic & stock	-	-	-	-	-	**400**
Total 2020–21		**6,641**	**0**	**6,647**	**0**	**6,647**	**1,714**
Total 2019–20		6,647	0	6,647	0	6,647	1,669

7.3.2 Ovens groundwater catchment

The Ovens groundwater catchment is in northern Victoria (Figure 7-3). It extends from the Great Dividing Range in the south to the Murray River in the north.

Figure 7-3 Ovens groundwater catchment



7.3.2.1 Management arrangements

Groundwater resources in the Ovens groundwater catchment are managed by Goulburn-Murray Water, which is responsible for developing and implementing groundwater management plans. Goulburn-Murray Water also issues licences for groundwater use, bore construction and surface water diversions, and administers domestic and stock use. The Ovens groundwater catchment is part of the Murray–Darling Basin, and groundwater management arrangements are subject to the requirements of the Murray–Darling Basin Plan.

The Ovens groundwater catchment contains the Barnawartha GMA, Lower Ovens GMA and Upper Ovens WSPA. The area not covered by GMUs is reported as outside management units. The Upper Ovens WSPA Management Plan manages surface water and groundwater (all depths) in the unconsolidated sedimentary aquifer as a highly connected system with surface water. Groundwater resources supply licensed entitlements and domestic and stock use. Groundwater can be used as an urban supply for Wangaratta and four other towns in the area.

7.3.2.2 2020–21 groundwater resources overview

Groundwater level trends for 2020–21 varied across the Ovens groundwater catchment (Table 7-4). Groundwater level trends in the Barnawartha GMA were declining for the whole year, whereas in the Upper Ovens River WSPA and Lower Ovens GMA groundwater level trends were classified as stable for the whole of 2020–21.

Table 7-4 Groundwater level trends, Ovens groundwater catchment

Groundwater management unit	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Water supply protection area					
Upper Ovens (1)	stable	stable	rising	**stable**	**rising**
Groundwater management area					
Barnawartha	declining	declining	declining	**declining**	**declining**
Lower Ovens	stable	stable	stable	**stable**	**declining**

In 2020–21, 9,805 ML of water was extracted for consumptive purposes, which was less than the 11,949 ML extracted in the previous year. Of this volume, 226 ML was for urban use, and 2,528 ML was estimated to be for domestic and stock use.

7.3.2.3 Groundwater compliance and use

Compliance against water entitlements is reported for this groundwater catchment in two areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders.

Ovens – Key compliance points

✓ **The volume of entitlements in the catchment did not exceed relevant PCVs.**

- The Upper Ovens WSPA PCV has not been gazetted, so PCV compliance could not be assessed for this GMU. A PCV is not required for the Upper Ovens WSPA because the management plan prevents additional entitlements or an increase in entitlement volume from being issued, except by trade.

✓ **The total volume extracted under licences (7,294 ML) was within the volume available for the year (25,712 ML).**

Groundwater licence and use volumes in the Ovens groundwater catchment are shown in Table 7-5. Groundwater is an urban supply option for Barnawartha and a backup urban supply for Bright, Chiltern, Springhurst and Wangaratta. Several groundwater licences incorporate domestic and stock use: in these cases, the use is reported in the licensed volume in Table 7-5.

Table 7-5 Licensed groundwater volumes and use, Ovens groundwater catchment

Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML)	Total water available (ML)	Water extracted (ML)
Barnawartha GMA	Licensed use (non-urban)	82	0	82	0	**82**	**3**
	Barnawartha urban	293	0	293	0	**293**	**0**
	Domestic & stock	-	-	-	-	-	**64**
Lower Ovens GMA	Licensed use (non-urban)	19,177	0	19,177	0	**19,177**	**5,470**
	Springhurst urban	20	0	20	0	**20**	**0**
	Wangaratta urban	680	0	680	0	**680**	**243**
	Domestic & stock	-	-	-	-	-	**1,982**
Upper Ovens WSPA (1)	Licensed use (non-urban)	3,530	0	3,488	(388)	**3,100**	**919**
	Bright urban	75	0	75	(70)	**5**	**0**
	Domestic & stock	-	-	-	-	-	**270**
Outside management units	Licensed use (non-urban)	2,330	0	2,330	0	**2,330**	**661**
	Chiltern urban	25	0	25	0	**25**	**0**
	Domestic & stock	-	-	-	-	-	**212**
Total 2020–21		**26,212**	**0**	**26,170**	**(458)**	**25,712**	**9,822**
Total 2019–20 (2)		26,197	0	26,019	(168)	25,851	11,949

Notes

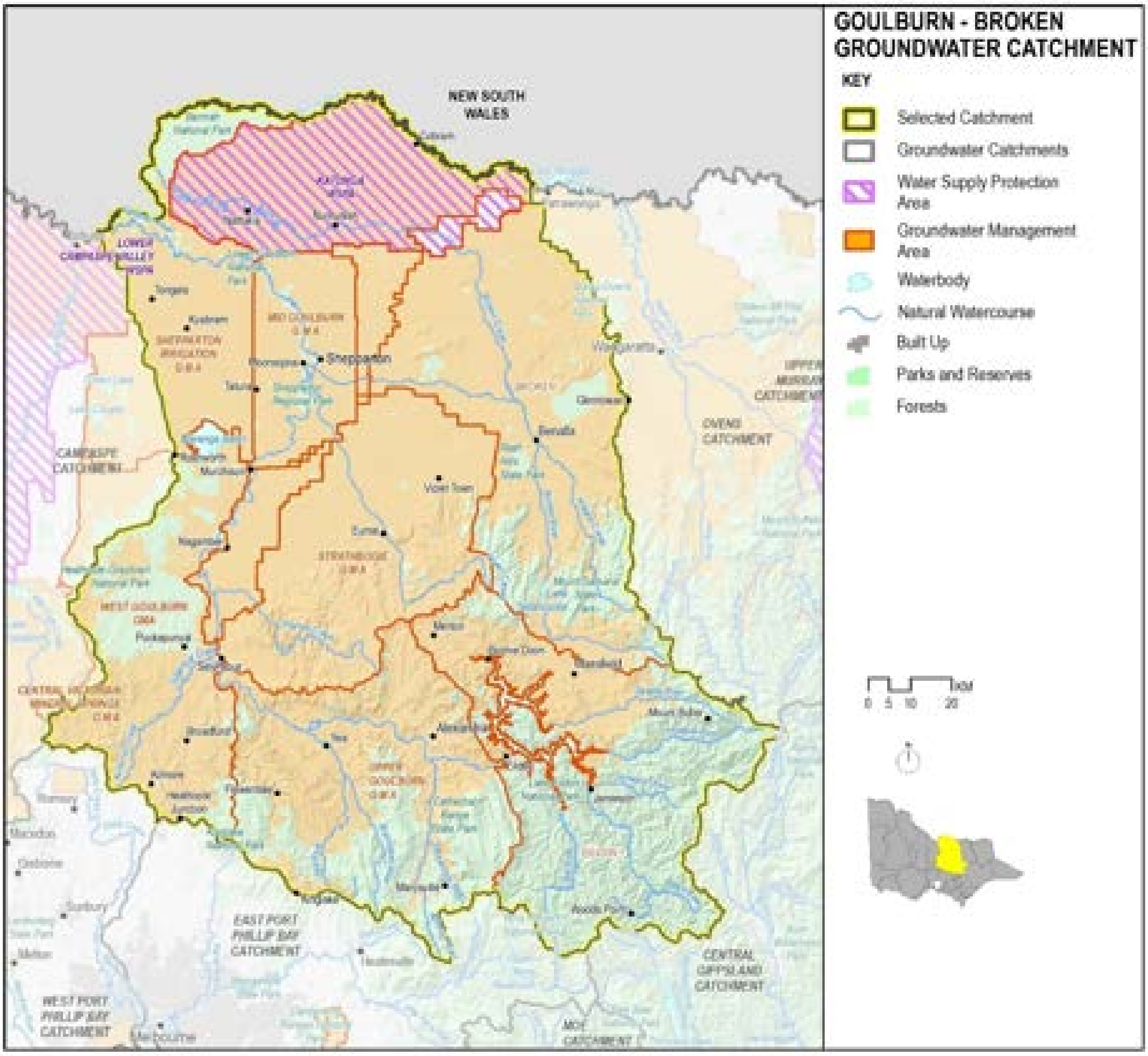
(1) A PCV is not required for the Upper Ovens WSPA because the management plan prevents additional entitlements or an increase in entitlement volume from being issued, except by trade.

(2) The 2019–20 Ovens Water extracted total has been corrected from the previous accounts.

7.3.3 Goulburn–Broken groundwater catchment

The Goulburn–Broken groundwater catchment is in northern Victoria (Figure 7-4). It includes two distinct geological regions: the highlands of bedrock with sedimentary valleys in the south and the plains with layers of sedimentary aquifers in the north.

Figure 7-4 Goulburn–Broken groundwater catchment



7.3.3.1 Management arrangements

Groundwater resources in the Goulburn–Broken groundwater catchment are managed by Goulburn-Murray Water, which is responsible for developing and implementing groundwater management plans. Goulburn-Murray Water also issues licences for groundwater use, bore construction and surface water diversions, and it administers domestic and stock use. The Goulburn–Broken groundwater catchment is part of the Murray–Darling Basin, and groundwater management arrangements are subject to the requirements of the Murray–Darling Basin Plan.

The Goulburn–Broken groundwater catchment contains the Mid Goulburn GMA, Shepparton Irrigation Region GMA, Strathbogie GMA, Upper Goulburn GMA, Broken GMA, Eildon GMA, West Goulburn GMA and Katunga WSPA. The area not covered by GMUs is reported as outside management units. The Shepparton Irrigation Region GMA and West Goulburn GMA extend into the Campaspe groundwater catchment.

Groundwater resources supply licensed entitlements (irrigation), domestic and stock use and urban use in Goorambat, Katunga and Strathmerton.

7.3.3.2 2020–21 groundwater resources overview

Licensed use in Katunga WSPA was restricted to 70% of the entitlement volume for the whole of 2020–21.

Groundwater level trends in the Goulburn–Broken catchment in 2020–21 were declining for most of the GMUs (Table 7-6). The groundwater level trends were stable in Strathbogie GMA and rising in Upper Goulburn GMA for the whole of 2020–21. All of the northern GMUs (Shepparton Irrigation Region, Mid Goulburn and Broken GMA and Katunga WSPA) and West Goulburn GMA were declining for the whole or most of the water year.

Although there are no observation bores currently monitoring groundwater levels in the Eildon GMA, historical records indicate that groundwater levels in both aquifers of this GMA are generally within five metres of the ground surface and fluctuate in response to rainfall. Goulburn-Murray Water reported that rainfall in the Eildon GMA in 20209–21 was above average.

Table 7-6 Groundwater level trends, Goulburn–Broken groundwater catchment

Groundwater management unit	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Water supply protection area					
Katunga	declining	declining	declining	**declining**	**declining**
Groundwater management area					
Broken	declining	declining	declining	**declining**	**declining**
Mid Goulburn	declining	declining	declining	**declining**	**declining**
Shepparton Irrigation Region (1)	declining	declining	declining	**declining**	**declining**
Strathbogie	stable	stable	stable	**stable**	**stable**
Upper Goulburn	rising	rising	rising	**rising**	**rising**
West Goulburn (2)	stable	declining	declining	**declining**	**stable**

Notes
(1) The Shepparton Irrigation Region GMA extends into the Campaspe groundwater catchment.
(2) The West Goulburn GMA extends into the Campaspe groundwater catchment.

In 2020–21, 121,888 ML of water was extracted for consumptive purposes, which was less than the 149,939 ML extracted in the previous year. Of this volume, 2 ML was for urban use, and 6,836 ML was estimated to be for domestic and stock use.

7.3.3.3 Groundwater compliance and use

Compliance against water entitlements is reported for this groundwater catchment in two areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders.

Goulburn–Broken – Key compliance points

✓ **The volume of entitlements in the catchment did not exceed relevant PCVs.**

- The Shepparton Irrigation Region GMA and West Goulburn GMA PCVs have not been gazetted, so PCV compliance could not be assessed for these GMUs. There is no PCV for the Shepparton Irrigation Region GMA as there is no limit on the total volume of shallow groundwater entitlement available. There is no PCV for the West Goulburn GMA, but there are individual zone caps set. Total recorded use in the West Goulburn GMA in 2020–21 was 920 ML, 30% of the total licensed volume.

✓ **The total volume extracted under licences (115,092 ML) was within the volume available for the year (240,599 ML).**

Groundwater licence and use volumes in the Goulburn–Broken groundwater catchment are shown in Table 7-7. Several groundwater licences incorporate domestic and stock use: in these cases, the use is reported in the licensed volume in Table 7-7. Groundwater provides urban supply to Goorambat, Katunga and Strathmerton.

Table 7-7 Licensed groundwater volumes and use, Goulburn–Broken groundwater catchment

Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML) (ML)	Total water available	Water extracted (ML)
Broken GMA	Licensed use (non-urban)	2,962	0	2,969	0	**2,969**	**507**
	Goorambat urban	24	0	24	0	**24**	**0**
	Domestic & stock	-	-	-	-	-	**686**
Eildon GMA	Licensed use (non-urban)	645	0	645	0	**645**	**180**
	Domestic & stock	-	-	-	-	-	**606**
Katunga WSPA	Licensed use (non-urban)	60,013	0	41,841		**41,841**	**26,091**
	Katunga urban	110	0	77	0	**77**	**42**
	Strathmerton urban	80	0	56	0	**56**	**0**
	Domestic & stock	-	-	-	-	-	**1,492**
Mid Goulburn GMA	Licensed use (non-urban)	12,375	2,298	12,375	0	**14,673**	**2,531**
	Domestic & stock	-	-	-	-	-	**254**
Shepparton Irrigation Region GMA (1) (2)	Licensed use (non-urban)	168,811	0	168,811	0	**168,811**	**83,223**
	Domestic & stock	-	-	-	-	-	**1,806**
Strathbogie GMA	Licensed use (non-urban)	1,373	0	1,446	0	**1,446**	**469**
	Domestic & stock	-	-	-	-	-	**446**
Upper Goulburn GMA	Licensed use (non-urban)	6,119	0	6,119	0	**6,119**	**868**
	Domestic & stock	-	-	-	-	-	**1,016**
West Goulburn GMA (3) (4)	Licensed use (non-urban)	2,780	275	2,804	0	**3,080**	**920**
	Domestic & stock	-	-	-	-	-	**122**
Outside management units	Licensed use (non-urban)	859	0	859	0	**859**	**261**
	Domestic & stock	-	-	-	-	-	**408**
Total 2020–21		**256,150**	**2,574**	**238,025**		**240,599**	**121,928**
Total 2019–20 (5)		256,020	2,544	256,589		259,134	149,939

Notes

(1) The Shepparton Irrigation Region GMA extends into the Campaspe groundwater catchment, and an additional 16,925 ML of entitlement volume is reported in the Campaspe groundwater catchment account (Table 7-9). The total entitlement volume for the Shepparton Irrigation Region GMA as of 30 June 2021 was 185,737 ML.
Groundwater use in the Shepparton Irrigation Region GMA is estimated at the end of each season using a method that considers annual use by a subset of Shepparton Irrigation Region GMA licensed groundwater users that are metered, the volume of metered groundwater use in the Katunga WSPA and spring rainfall. This volume has been split between the Campaspe and Goulburn–Broken groundwater catchments as a proportion of the entitlement volume.

(2) There is no PCV for the Shepparton Irrigation Region GMA as there is no limit on the total volume of shallow groundwater entitlement available.

(3) There is no PCV for the West Goulburn GMA, but there are individual zone caps set. Total recorded use in the West Goulburn GMA in 2020–21 was 920 ML, 30% of the total licensed volume.

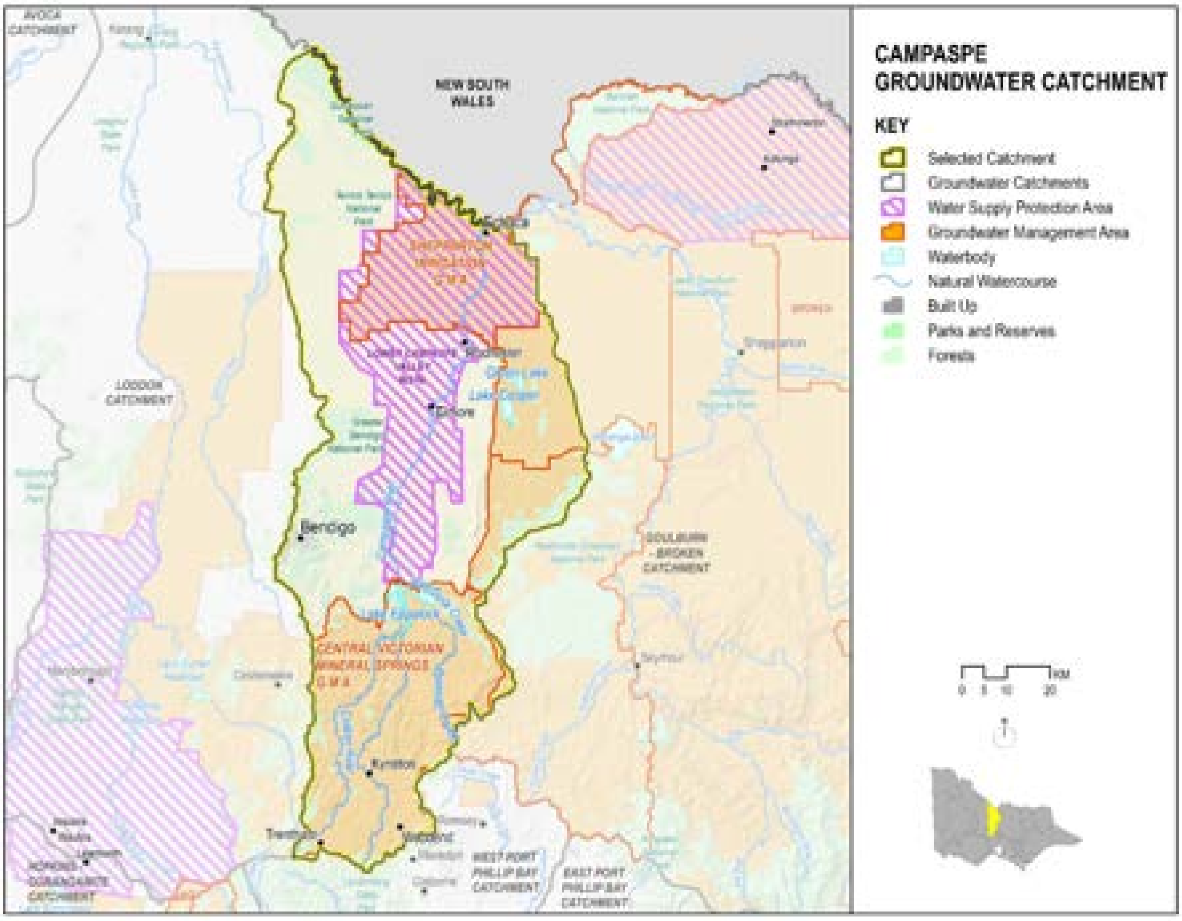
(4) The West Goulburn GMA extends into the Campaspe groundwater catchment, and an additional 257 ML of entitlement volume is reported in the Campaspe groundwater catchment account (Table 7-9). The total entitlement volume for the West Goulburn GMA as of 30 June 2021 was 3,037 ML.

(5) The 2019–20 'Water extracted' total has been corrected from the previous accounts.

7.3.4 Campaspe groundwater catchment

The Campaspe groundwater catchment is in northern Victoria (Figure 7-5). It extends from the Great Dividing Range at Woodend and Trentham in the south to the Murray River near Echuca in the north.

Figure 7-5 Campaspe groundwater catchment



7.3.4.1 Management arrangements

Groundwater resources in the Campaspe groundwater catchment are managed by Goulburn-Murray Water, which is responsible for developing and implementing groundwater management plans. Goulburn-Murray Water also issues licences for groundwater use, bore construction and surface water diversions, and it administers domestic and stock use. The Campaspe groundwater catchment is part of the Murray–Darling Basin, and groundwater management arrangements are subject to the requirements of the Murray–Darling Basin Plan.

The Campaspe groundwater catchment contains the Lower Campaspe Valley WSPA, Shepparton Irrigation Region GMA, West Goulburn GMA and Central Victorian Mineral Springs GMA. The area not covered by GMUs is reported as outside management units. The Shepparton Irrigation Region GMA and West Goulburn GMA extend into the Goulburn–Broken groundwater catchment. The Central Victorian Mineral Springs GMA straddles this catchment and the Loddon and West Port Phillip Bay groundwater catchments. Groundwater resources supply licensed entitlement (irrigation), domestic and stock use and urban use to Elmore and Trentham.

7.3.4.2 2020–21 groundwater resources overview

In the Lower Campaspe Valley WSPA, the allocations for the Barnadown, Elmore-Rochester, Bamawn and Echuca zones were reduced to 75% for 2020–21.

Groundwater level trends for 2020–21 were generally declining across GMUs in the catchment (Table 7-8). Levels in the Lower Campaspe Valley WSPA, Shepparton Irrigation Region GMA and West Goulburn GMA were declining for most of 2020–21. The Central Victorian Mineral Springs GMA was the exception, which had rising groundwater level trends for the whole year.

Table 7-8 Groundwater level trends, Campaspe groundwater catchment

Groundwater management unit	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Water supply protection area					
Lower Campaspe Valley	declining	declining	declining	**stable**	**declining**
Groundwater management area					
Central Victorian Mineral Springs (1)	rising	rising	rising	**rising**	**stable**
Shepparton Irrigation Region (2)	declining	declining	declining	**declining**	**declining**
West Goulburn GMA (3)	stable	declining	declining	**declining**	**stable**

Notes
(1) The Central Victorian Mineral Springs GMA extends into the Loddon groundwater catchment.
(2) The Shepparton Irrigation Region GMA extends into the Goulburn–Broken groundwater catchment.
(3) The West Goulburn GMA extends into the Goulburn–Broken groundwater catchment.

In 2020–21, 45,854 ML of water was extracted for consumptive purposes, which was less than the 56,850 ML extracted in the previous year. Of this volume,150 ML was for urban use, and 2,854 ML was estimated to be for domestic and stock use.

7.3.4.3 Groundwater compliance and use

Compliance against water entitlements is reported for this groundwater catchment in two areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders.

Campaspe – Key compliance points

✓ **The volume of entitlements in the catchment did not exceed relevant PCVs.**

- The Shepparton Irrigation Region GMA and West Goulburn GMA PCVs have not been gazetted, so PCV compliance could not be assessed for these GMUs. There is no PCV for the Shepparton Irrigation Region GMA as there is no limit on the total volume of shallow groundwater entitlement available. There is no PCV for the West Goulburn GMA, but there are individual zone caps set. Total recorded use in the West Goulburn GMA in 2020–21 was 920 ML, 30% of the total licensed volume.

✓ **The total volume extracted under licences (43,000 ML) was within the volume available for the year (78,854 ML).**

Groundwater licence and use volumes in the Campaspe groundwater catchment are shown in Table 7-9. Several groundwater licences incorporate domestic and stock use: in these cases, the use is reported in the licensed volume in Table 7-9. In the Campaspe catchment, groundwater is an option for urban supply to Elmore and Trentham.

Table 7-9 Licensed groundwater volumes and use, Campaspe groundwater catchment

Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML)	Total water available (ML)	Water extracted (ML)
Central Victorian Mineral Springs GMA (1)	Licensed use (non-urban)	2,203	0	2,215	0	**2,215**	**188**
	Trentham urban	103	0	103	0	**103**	**9**
	Domestic and stock use	-	-	-	-	-	**1,320**
Lower Campaspe Valley WSPA	Licensed use (non-urban)	55,576	12,520	41,682		**54,202**	**32,910**
	Elmore urban	284	71	213	0	**284**	**141**
	Domestic and stock use	-	-	-	-	-	**744**
Shepparton Irrigation Region GMA (2) (3)	Licensed use (non-urban)	16,925	0	16,925	0	**16,925**	**8,344**
	Domestic and stock use	-	-	-	-	-	**188**
West Goulburn GMA (4) (5)	Licensed use (non-urban)	257	26	257	0	**283**	**0**
	Domestic and stock use	-	-	-	-	-	**12**
Outside management units	Licensed use (non-urban)	4,824	0	4,842	0	**4,842**	**1,409**
	Domestic and stock use	-	-	-	-	-	**590**
Total 2020–21		**80,173**	**12,616**	**66,238**	**0**	**78,854**	**45,854**
Total 2019–20 (6)		79,589	11,537	77,622	0	89,159	56,850

Notes

(1) The Central Victorian Mineral Springs GMA extends into the Loddon groundwater catchment, and an additional 2,770 ML of entitlement volume is reported in the Loddon groundwater catchment account (Table 7-11). The total entitlement volume for the Central Victorian Mineral Springs GMA as of 30 June 2021 was 5,076 ML.

(2) The Shepparton Irrigation Region GMA extends into the Goulbourn-Broken groundwater catchment, and an additional 168,811 ML of entitlement volume is reported in the Goulburn–Broken catchment account (Table 7-7). The total entitlement volume for the Shepparton Irrigation Region GMA as of 30 June 2021 was 185,737 ML.
Groundwater use in the Shepparton Irrigation Region GMA is estimated at the end of each season using a method that considers annual use by a subset of Shepparton Irrigation Region GMA licensed groundwater users that are metered, the volume of metered groundwater use in the Katunga WSPA and spring rainfall. This volume has been split between the Campaspe and Goulburn–Broken groundwater catchments as a proportion of the entitlement volume.

(3) There is no PCV for the Shepparton Irrigation Region GMA as there is no limit on the total volume of shallow groundwater entitlement available.

(4) There is no PCV for the West Goulburn GMA, but there are individual zone caps set. Total recorded use in the West Goulburn GMA in 2020–21 was 920 ML, 30% of total licensed volume.

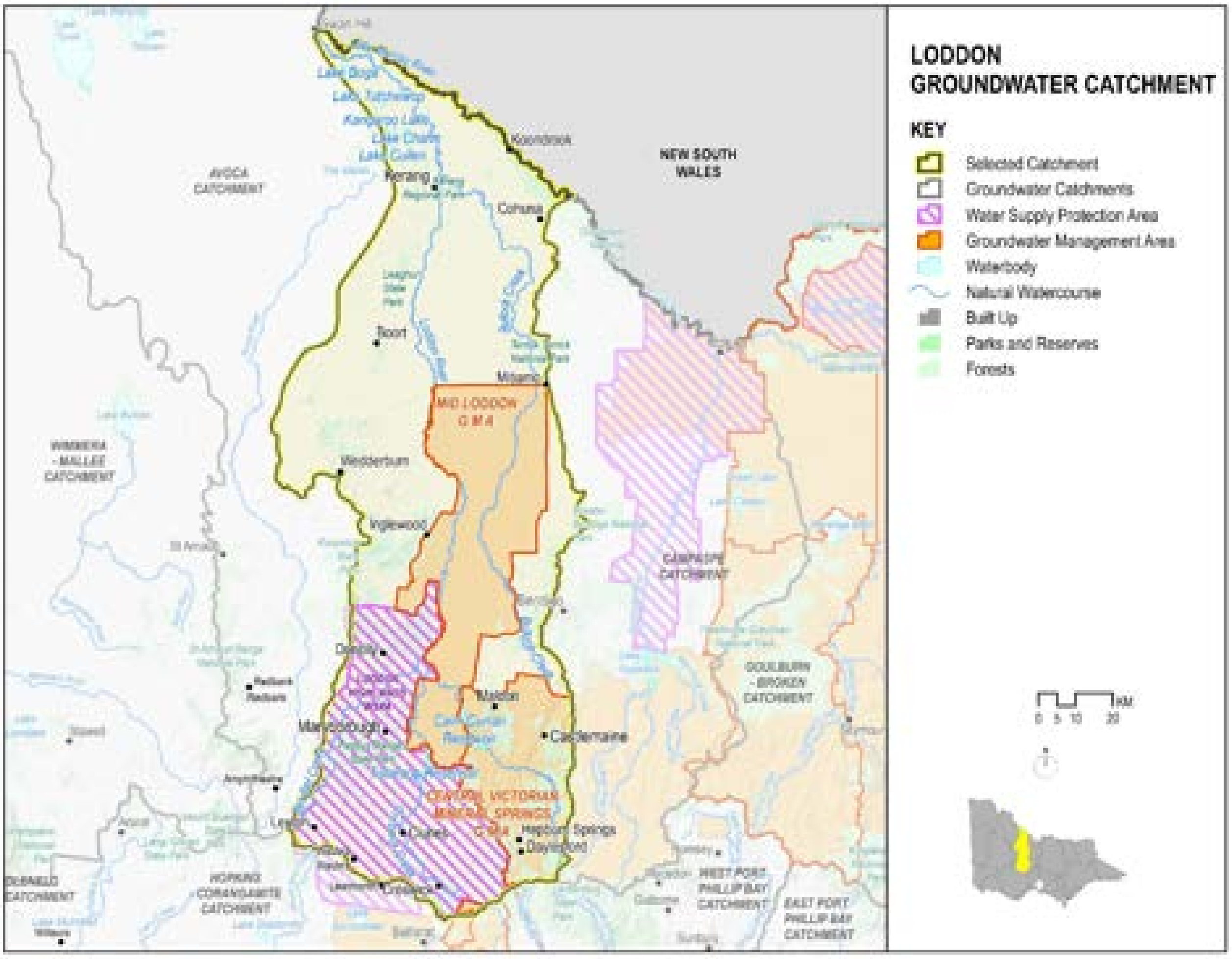
(5) The West Goulburn GMA extends into the Goulburn–Broken groundwater catchment and an additional 2,780 ML of entitlement volume is reported in the Goulburn–Broken catchment account (Table 7-7). The total entitlement volume for the West Goulburn GMA as of 30 June 2021 was 3,037 ML.

(6) The 2019–20 ‘Water extracted’ total has been corrected from the previous accounts.

7.3.5 Loddon groundwater catchment

The Loddon groundwater catchment is in northern Victoria (Figure 7-6). It covers an area between Creswick and Swan Hill.

Figure 7-6 Loddon groundwater catchment



7.3.5.1 Management arrangements

Groundwater resources in the Loddon groundwater catchment are managed by Goulburn-Murray Water, which is responsible for developing and implementing groundwater management plans. Goulburn-Murray Water also issues licences for groundwater use, bore construction and surface water diversions, and it administers domestic and stock use. The Loddon catchment is part of the Murray–Darling Basin, and groundwater management arrangements are subject to the requirements of the Murray–Darling Basin Plan.

The Loddon groundwater catchment includes the Mid Loddon GMA, Loddon Highlands WSPA and Central Victorian Mineral Springs GMA. The area not covered by GMUs is reported as outside management units. The Loddon Highlands WSPA extends into the Hopkins–Corangamite groundwater catchment. The Central Victorian Mineral Springs GMA extends into the Campaspe and West Port Phillip Bay groundwater catchments. Groundwater resources supply licensed entitlements, domestic and stock use and urban use to eight towns. Groundwater resources from the Loddon groundwater catchment also supply Avoca, although it is outside the groundwater catchment.

7.3.5.2 2020–21 groundwater resources overview

In the Loddon Highlands WSPA, licensed diversions from all zones except the Blampied and Newlyn zones were able to take 100% of their entitlement volume in 2020–21. Licensed diversions from the Newlyn Zone were restricted to 75% of entitlement volume for the whole year. The Blampied Zone was restricted to 75% from August 2020, with the restriction being lifted in early January 2021.

Groundwater level trends in the catchment in 2020–21 were rising for all but one GMU (Table 7-10). The Central Victorian Mineral Springs GMA and Loddon Highlands WSPA groundwater level trends were generally rising for the whole year. The groundwater level trends in the Mid Loddon GMA were declining for most of the year.

Table 7-10 Groundwater level trends, Loddon groundwater catchment

Groundwater management unit	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Water supply protection area					
Loddon Highlands	rising	rising	rising	**rising**	**declining**
Groundwater management area					
Mid Loddon	declining	declining	stable	**declining**	**declining**
Central Victorian Mineral Springs (1)	rising	rising	rising	**rising**	**stable**

Note
(1) The Central Victorian Mineral Springs GMA extends into the Campaspe groundwater catchment.

In 2020–21, 25,342 ML of water was extracted for consumptive purposes, which was less than the 30,218 ML extracted in the previous year. Of this volume, 792 ML was for urban use, and 2,036 ML was estimated to be for domestic and stock use.

7.3.5.3 Groundwater compliance and use

Compliance against water entitlements is reported for this groundwater catchment in two areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders.

Loddon – Key compliance points
✓ **The volume of entitlements in the catchment did not exceed relevant PCVs.**
✓ **The total volume extracted (23,231 ML) was within the volume available for the year (75,962 ML).**

Groundwater licence and use volumes in the Loddon groundwater catchment are shown in Table 7-11. In the Loddon groundwater catchment, all management zones in the Loddon Highlands WSPA had an allocation of 100% except for the Newlyn Zone, which had an allocation of 75% in 2020–21. Several groundwater licences incorporate domestic and stock use: in these cases, the use is reported in the licensed volume in Table 7-11. Groundwater is an urban supply option for eight towns.

Table 7-11 Licensed groundwater volumes and use, Loddon groundwater catchment

Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML)	Total water available (ML)	Water extracted (ML)
Central Victorian Mineral Springs GMA (1)	Licensed use (non-urban)	2,497	0	2,501	5	**2,506**	**631**
	Daylesford urban	273	0	273	(5)	**268**	**43**
	Domestic & stock	-	-	-	-	-	**792**
Loddon Highlands WSPA (2)	Licensed use (non-urban)	18,787	2,669	17,645	0	**20,314**	**3,858**
	Avoca urban (3)	250	38	250	0	**288**	**163**
	Clunes urban	350	53	350	0	**403**	**193**
	Forest Hill urban	350	53	263	0	**315**	**157**
	Learmonth urban	98	15	98	0	**113**	**30**
	Lexton urban	30	5	30	0	**35**	**22**
	Maryborough urban	570	161	1,076	0	**1,237**	**80**
	Waubra urban	65	10	65	0	**75**	**28**
	Domestic & stock	-	-	-	-	-	**708**
Mid Loddon GMA	Licensed use (non-urban)	33,927	9,764	33,927	0	**43,691**	**17,515**
	Domestic & stock	-	-	-	-	-	**304**
Outside management units	Licensed use (non-urban)	6,718	0	6,718	0	**6,718**	**510**
	Domestic & stock	-	-	-	-	-	**232**
Total 2020–21		**63,915**	**12,766**	**63,196**	**0**	**75,962**	**25,267**
Total 2019–20 (4)		63,919	10,580	63,704	(5)	74,279	30,218

Notes

(1) The Central Victorian Mineral Springs GMA extends into the Campaspe groundwater catchment, and an additional 2,306 ML of entitlement volume is reported in the Campaspe groundwater catchment account (Table 7-9). The total entitlement volume for the Central Victorian Mineral Springs GMA as of 30 June 2021 was 5,076 ML.
(2) The Loddon Highlands WSPA extends into the Hopkins–Corangamite groundwater catchment, and an additional 2 ML of entitlement volume is reported in the Hopkins–Corangamite groundwater catchment account (Table 7-31). The total entitlement volume for the Loddon Highlands WSPA as of 30 June 2021 was 20,502 ML.
(3) Avoca is in the Avoca groundwater catchment, but the bores that supply it are in the Loddon groundwater catchment.
(4) The 2019–20 Loddon Water extracted total has been corrected from the previous accounts.

7.4 Gippsland groundwater management basin

The Gippsland groundwater management basin is in eastern Victoria and contains the East Gippsland, Central Gippsland, Seaspray and Moe groundwater catchments. It is a large sedimentary basin that extends offshore beneath Bass Strait.

The upper aquifers of the Gippsland groundwater management basin occur along the river valleys, floodplains and near the coast. They consist of coarse sand and thick gravel sediments at shallow depths. They also feature the clay aquitard of the Haunted Hill Formation, which overlies most of the sedimentary basin. The upper aquifers occur at or near the ground surface, so they receive recharge directly from rainfall or floods and discharge to streams and lakes.

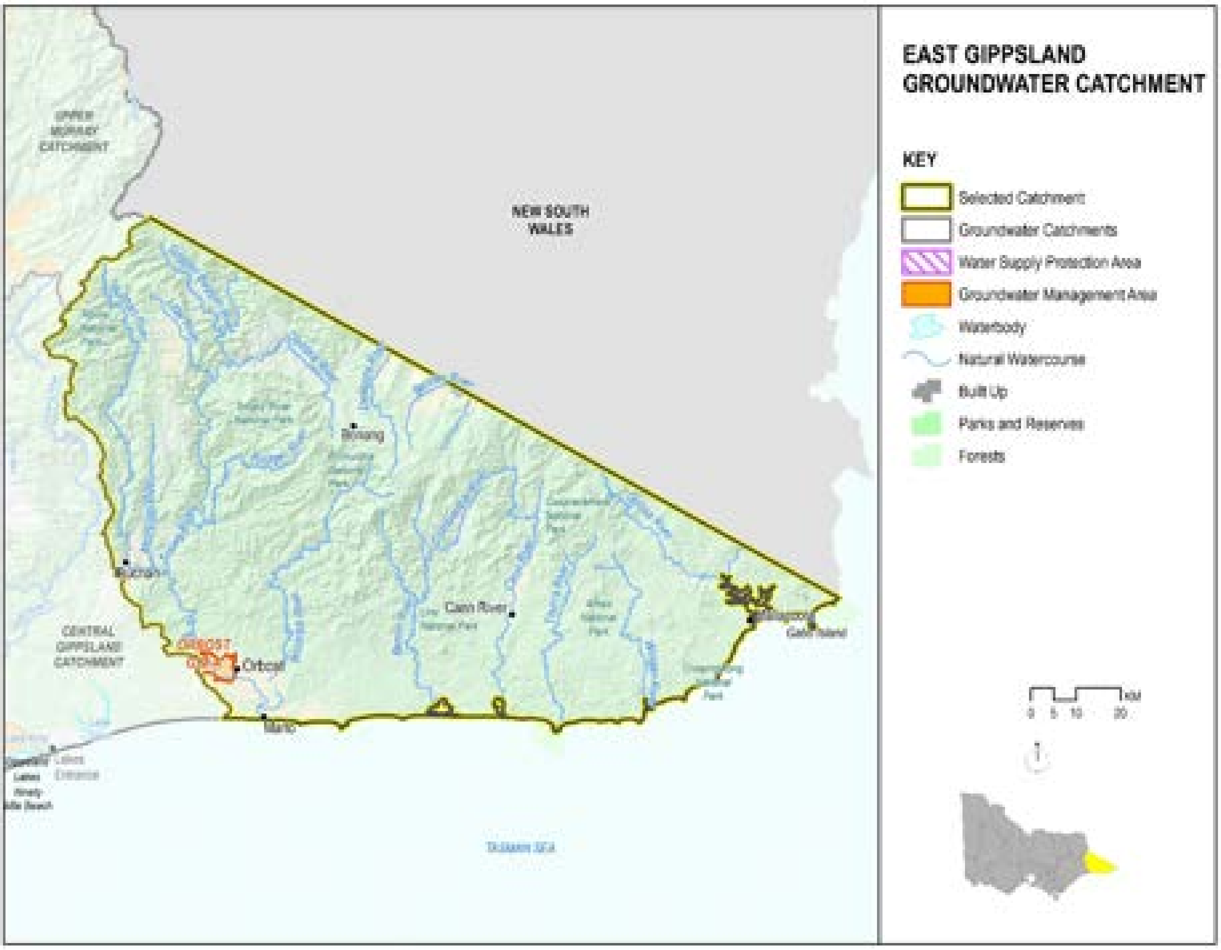
Middle aquifers cover a large part of the Gippsland groundwater management basin from Moe to Bairnsdale. They comprise thick seams of sand aquifers separated by aquitards. The aquitards are generally clay or coal seams in the north-west of the Gippsland groundwater management basin and limestone in the east and centre of the region. Recharge occurs from leakage through the overlying and surrounding sediments and discharge to the limestone aquitards to the east of the region and along the coast.

Lower aquifers extend across the Gippsland groundwater management basin and well offshore. They comprise thick sand sediments that rise to the surface in the west and along the basin margin but are very deep along the coast and offshore. These aquifers are overlain by upper and middle aquifers together with thick silt, clay, coal and limestone aquitards and are underlain by bedrock. Where the lower aquifers occur at or near the surface, they receive direct recharge from rainfall and river leakage: in the deeper areas of the basin, recharge occurs by downward leakage. Discharge occurs offshore in Bass Strait.

7.4.1 East Gippsland groundwater catchment

The East Gippsland groundwater catchment (Figure 7-7) is the easternmost groundwater catchment in Victoria.

Figure 7-7 East Gippsland groundwater catchment



7.4.1.1 Management arrangements

Groundwater resources in the East Gippsland groundwater catchment are managed by Southern Rural Water, which is responsible for developing and implementing groundwater management plans. Southern Rural Water also issues licences for groundwater use, bore construction and surface water diversions, and it administers domestic and stock use.

The East Gippsland groundwater catchment contains Orbost GMA. The area not covered by Orbost GMA is reported as outside management units. Groundwater supplies licensed entitlements (irrigation), domestic and stock use and urban use to Mallacoota.

7.4.1.2 2020–21 groundwater resources overview

The groundwater level trend for 2020–21 is shown in Table 7-12. The Orbost GMA level trend was declining from July to December 2020, and there was insufficient information for the last six months to determine a trend.

Table 7-12 Groundwater level trends, East Gippsland groundwater catchment

Groundwater management unit	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Groundwater management area					
Orbost	declining	declining	INS-DATA	**INS-DATA**	**declining**

In 2020–21, 332 ML of water was extracted for consumptive purposes, which was less than the 634 ML extracted in the previous year. Of this volume, 85 ML was for urban use, and 89 ML was estimated to be for domestic and stock use.

7.4.1.3 Groundwater compliance and use

Compliance against water entitlements is reported for this groundwater catchment in two areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders.

East Gippsland – Key compliance points	
✓	**The volume of entitlements in the catchment did not exceed relevant PCVs.**
✓	**The total volume extracted under licences (246 ML) was within the volume available for the year (2,295 ML).**

Groundwater licence and use volumes in the East Gippsland groundwater catchment are shown in Table 7-13. Some groundwater licences incorporate domestic and stock use, and in these cases, the use is reported in the licensed volume in Table 7-13. Within the East Gippsland catchment, groundwater provides urban water supply to Mallacoota.

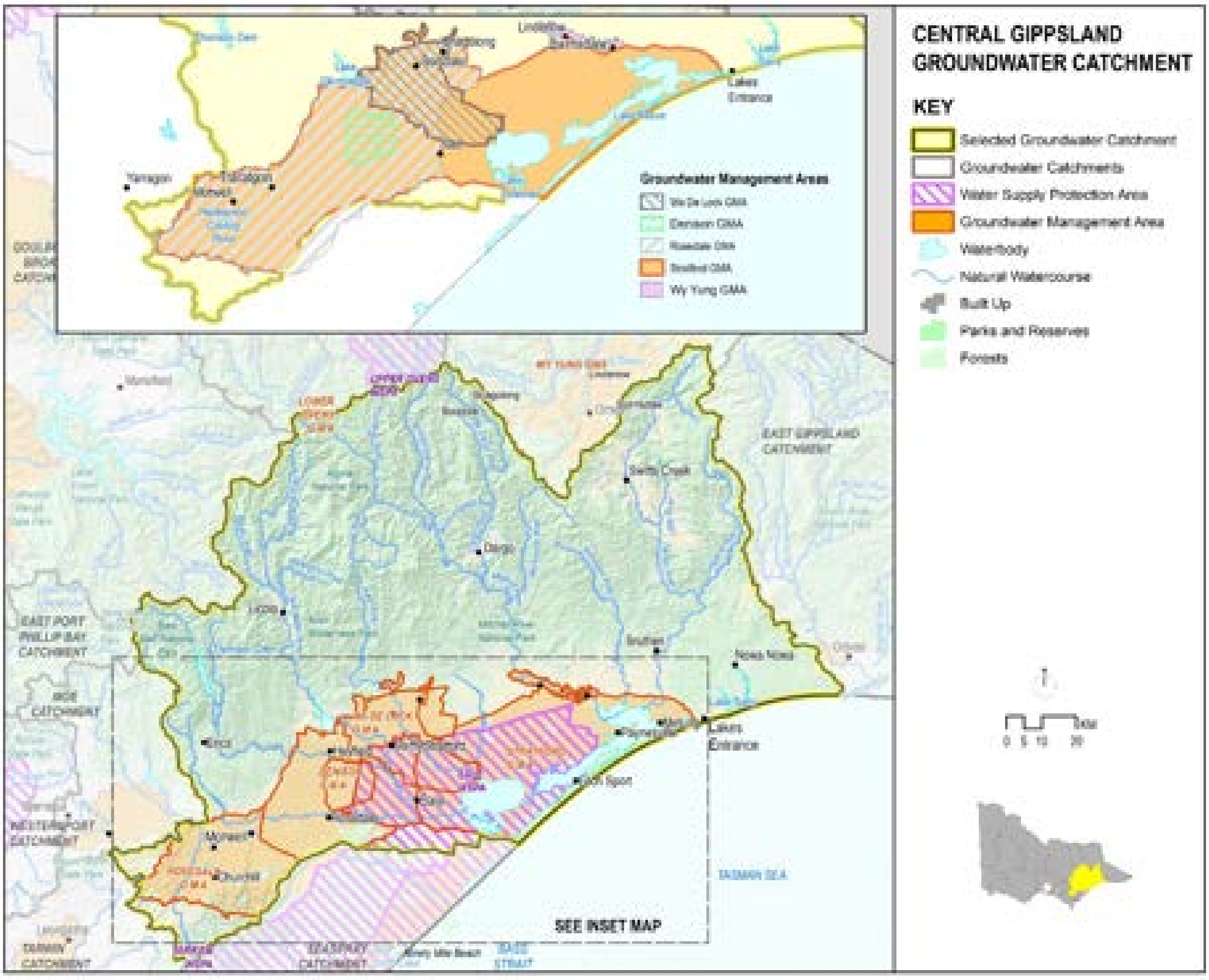
Table 7-13 Licensed groundwater volumes and use, East Gippsland groundwater catchment

Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML)	Total water available (ML)	Water extracted (ML)
Orbost GMA	Licensed use (non-urban)	1,217	0	1,217	0	**1,217**	**59**
	Domestic and stock use	-	-	-	-	-	**5**
Outside management unit	Licensed use (non-urban)	708	0	858	0	**858**	**100**
	Mallacoota urban	220	0	220	0	**220**	**87**
	Domestic and stock use	-	-	-	-	-	**84**
Total 2020–21		**2,145**	**0**	**2,295**	**0**	**2,295**	**334**
Total 2019–20		2,145	0	2,248	70	2,318	634

7.4.2 Central Gippsland groundwater catchment

The Central Gippsland groundwater catchment (Figure 7-8) is in the state's east, and it contains the Gippsland Lakes.

Figure 7-8 Central Gippsland groundwater catchment



7.4.2.1 *Management arrangements*

Groundwater resources in the Central Gippsland groundwater catchment are managed by Southern Rural Water, which is responsible for developing and implementing groundwater management plans. Southern Rural Water also issues licences for groundwater use, bore construction and surface water diversions, and it administers domestic and stock use.

The Central Gippsland groundwater catchment contains the Rosedale GMA, Wa De Lock GMA, Denison GMA, Sale WSPA, Stratford GMA, Moe GMA, Yarram WSPA and Wy Yung GMA. The area not covered by GMUs is reported as outside management units. The Stratford GMA and Yarram WSPA extend into the Seaspray groundwater catchment. The Moe GMA straddles this catchment and the Moe groundwater catchment.

Groundwater resources supply licensed entitlements, domestic and stock use and some urban use. While most groundwater use in Central Gippsland groundwater catchment is for irrigation purposes, groundwater resources also supply four towns in the area and power generators in the Latrobe Valley.

7.4.2.2 *2020–21 groundwater resources overview*

Groundwater level trends for the Central Gippsland groundwater catchment in 2020–21 were declining in four and stable in three GMUs (Table 7-14). Moe GMA, Stratford GMA, Sale and Yarram WSPA were mostly all declining for the whole year. Rosedale GMA, Wa De Lock GMA and Wy Yung GMA groundwater level trends were stable for the whole of 2020–21.

Table 7-14 Groundwater level trends, Central Gippsland groundwater catchment

Groundwater management unit	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Water supply protection area					
Sale	stable	declining	declining	**declining**	**declining**
Yarram (1)	declining	declining	declining	**declining**	**declining**
Groundwater management area					
Moe	declining	declining	declining	**declining**	**declining**
Rosedale (2)	stable	stable	stable	**stable**	**stable**
Stratford (3)	stable	declining	declining	**declining**	**declining**
Wa De Lock	stable	stable	stable	**stable**	**declining**
Wy Yung	stable	stable	stable	**stable**	**declining**

Notes
(1) Yarram WSPA water levels are influenced by offshore oil and gas extraction.
(2) The Moe GMA extends into the Moe groundwater catchment.
(3) The Rosedale GMA includes dewatering by the three coal mines and use by other licence holders. The Stratford GMA includes dewatering by the three Latrobe Valley coal mines.

In 2020–21, 58,517 ML of water was extracted for consumptive purposes, which was less than the 66,760 ML extracted in the previous year. Of this volume, 1,852 ML was for urban use, and 1,829 ML was estimated to be for domestic and stock use.

7.4.2.3 Groundwater compliance and use

Compliance against water entitlements is reported for this groundwater catchment in two areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders.

Central Gippsland – Key compliance points	
✓	**The volume of entitlements in the catchment did not exceed relevant PCVs.** • PCV compliance could not be assessed for the Stratford GMA because current compliance assessment criteria are not applicable in that GMA: coal mine licences physically in the area are not assigned to the GMA.
✓	**The total volume extracted under licences (56,732 ML) was within the volume available for the year (144,163 ML).**

Groundwater licence and use volumes in the Central Gippsland groundwater catchment are shown in Table 7-15. Some groundwater licences incorporate domestic and stock use, and in these cases, the use is reported in the licensed volume in Table 7-15. Groundwater provides urban water supply to Boisdale, Briagolong, Lindenow and Sale.

Table 7-15 Licensed groundwater volumes and use, Central Gippsland groundwater catchment

Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML)	Total water available (ML)	Water extracted (ML)
Denison GMA (1)	Licensed use (non-urban)	18,499	(25)	18,970	0	**18,945**	**4,175**
	Domestic and stock use	-	-	-	-	-	**107**
Moe GMA (2)	Licensed use (non-urban)	33	0	33	0	**33**	**9**
	Domestic and stock use	-	-	-	-	-	**0**
Rosedale GMA (3)	Licensed use (non-urban)	22,272	0	14,283	(50)	**14,233**	**6,319**
	Domestic and stock use	-	-	-	-	-	**167**
Sale WSPA	Licensed use (non-urban)	17,723	0	18,193	(15)	**18,178**	**8,867**
	Sale urban	3,480	0	2,910	0	**2,910**	**1,830**
	Domestic and stock use	-	-	-	-	-	**345**
Stratford GMA (3) (4) (5) (6)	Licensed use (non-urban)	37,072	0	24,829	0	**24,829**	**23,964**
	Domestic and stock use	-	-	-	-	-	**24**
Wa De Lock GMA (1)	Licensed use (non-urban)	28,928	0	29,167	0	**29,167**	**4,044**
	Boisdale urban	37	0	37	0	**37**	**0**
	Briagolong urban	160	0	160	0	**160**	**66**
	Domestic and stock use	-	-	-	-	-	**380**
Wy Yung GMA	Licensed use (non-urban)	7,462	0	8,005	0	**8,005**	**367**
	Domestic and stock use	-	-	-	-	-	**11**
Yarram WSPA (7)	Licensed use (non-urban)	6,889	0	6,897	1	**6,898**	**4,178**
	Domestic and stock use	-	-	-	-	-	**102**
Outside management units (1)	Licensed use (non-urban)	19,320	0	20,533	65	**20,598**	**2,912**
	Lindenow urban	171	0	171	0	**171**	**0**
	Domestic and stock use	-	-	-	-	-	**695**
Total 2020–21		**162,045**	**(25)**	**144,187**	**1**	**144,163**	**58,561**
Total 2019–20		162,172	0	162,099	(70)	162,029	66,760

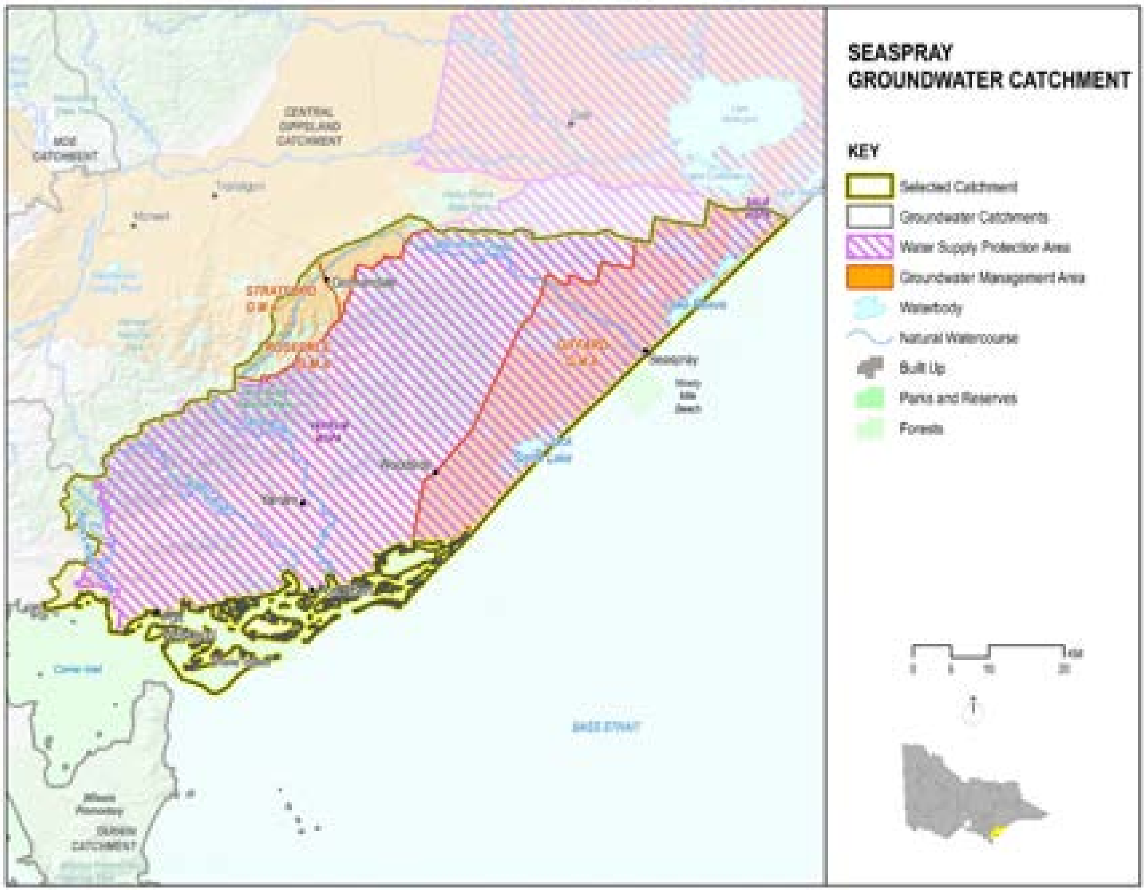
Notes

(1) The volumes of use in Denison GMA, Wa De Lock GMA and outside management units include metered extractions for salinity control (Denison GMA 446 ML, Wa De Lock GMA 195 ML and outside management units 871 ML).
(2) The Moe GMA extends into the Moe groundwater catchment, and an additional 3,729 ML of entitlement volume is reported in the Moe catchment account (Table 7-19). The total entitlement volume for the Moe GMA as of 30 June 2021 was 3,762 ML.
(3) The use volume reported in the Rosedale and Stratford GMAs includes metered extractions from Latrobe Valley coal mines (Rosedale GMA 1,265 ML and Stratford GMA 23,964 ML).
(4) The Stratford GMA extends into the Seaspray groundwater catchment, and an additional 362 ML of entitlement volume is reported in the Seaspray catchment account (Table 7-17). The total entitlement volume for the Stratford WSPA as of 30 June 2021 was 37,434 ML.
(5) Compliance against the PCV for Stratford GMA is not assessed because current compliance assessment criteria are not applicable in Stratford GMA: coal mine licences physically in the area are not assigned to the GMA.
(6) Estimated domestic and stock use for Stratford GMA is calculated using a factor of 2 ML per bore.
(7) The Yarram WSPA extends into the Seaspray groundwater catchment, and an additional 18,799 ML of entitlement volume is reported in the Seaspray catchment account (Table 7-17). The total entitlement volume for the Yarram WSPA as of 30 June 2021 was 25,688 ML.

7.4.3 Seaspray groundwater catchment

The Seaspray groundwater catchment (Figure 7-9) is in the Gippsland groundwater management basin in Victoria's south-east.

Figure 7-9 Seaspray groundwater catchment



7.4.3.1 Management arrangements

Groundwater resources in the Seaspray groundwater catchment are managed by Southern Rural Water, which is responsible for developing and implementing groundwater management plans. Southern Rural Water also issues licences for groundwater use, bore construction and surface water diversions, and administers domestic and stock use.

The Seaspray groundwater catchment contains the Giffard GMA, Yarram WSPA and Stratford GMA. The area not covered by GMUs is reported as outside management units. The Stratford GMA and the Yarram WSPA extend into the Central Gippsland groundwater catchment. Groundwater resources supply licensed entitlements, domestic and stock use and urban use to Yarram. Groundwater use in the Seaspray groundwater catchment is mostly for irrigation.

7.4.3.2 2020–21 groundwater resources overview

The groundwater level trends were mostly declining for all GMUs in the Seaspray groundwater catchment for 2020–21 (Table 7-16).

Table 7-16 Groundwater level trends, Seaspray groundwater catchment

Groundwater management unit	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Water supply protection area					
Yarram (1)	declining	declining	declining	**declining**	**declining**
Groundwater management area					
Giffard	stable	declining	declining	**declining**	**declining**
Stratford (2)	stable	declining	declining	**declining**	**declining**

Notes

(1) Yarram WSPA water levels are influenced by offshore oil and gas extraction.
(2) Stratford GMA includes dewatering by the three Latrobe Valley coal mines.

In 2020–21, 8,548 ML of water was extracted for consumptive purposes, which was more than the 7,848 ML extracted in the previous year. Of this volume, 464 ML was estimated to be for domestic and stock use. There was no urban use in 2020–21.

7.4.3.3 Groundwater compliance and use

Compliance against water entitlements is reported for this groundwater catchment in two areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders.

Seaspray – Key compliance points
✓ **The volume of entitlements in the catchment did not exceed relevant PCVs.**
• PCV compliance could not be assessed for the Stratford GMA because current compliance assessment criteria are not applicable in that GMA: coal mine licences physically in the area are not assigned to the GMA.
✓ **The total volume extracted under licences (8,084 ML) was within the volume available for the year (25,858 ML).**

Groundwater licence and use volumes in the Seaspray groundwater catchment are shown in Table 7-17. Some groundwater licences incorporate domestic and stock use, and in these cases, the use is reported in the licensed volume in Table 7-17. Groundwater supplies are available for Yarram.

Table 7-17 Licensed groundwater volumes and use, Seaspray groundwater catchment

Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML)	Total water available (ML)	Water extracted (ML)
Giffard GMA	Licensed use (non-urban)	5,689	0	5,689	0	**5,689**	**2,366**
	Domestic & stock	-	-	-	-	-	**117**
Stratford GMA (1) (2)	Licensed use (non-urban)	362	0	362	0	**362**	**55**
	Domestic & stock	-	-	-	-	-	**0**
Yarram WSPA (3)	Licensed use (non-urban)	18,585	0	18,577	(1)	**18,576**	**5,498**
	Yarram urban	214	0	214	0	**214**	**0**
	Domestic & stock	-	-	-	-	-	**234**
Outside management units	Licensed use (non-urban)	518	0	1,018	0	**1,018**	**165**
	Domestic & stock	-	-	-	-	-	**113**
Total 2020–21		**25,367**	**0**	**25,859**	**(1)**	**25,858**	**8,548**
Total 2019–20		25,867	0	25,859	0	25,859	7,848

Notes

(1) The Stratford GMA extends into the Central Gippsland groundwater catchment, and an additional 37,072 ML of entitlement volume is reported in the Central Gippsland catchment account (Table 7-15). The total entitlement volume for the Stratford WSPA as of 30 June 2021 was 37,434 ML.

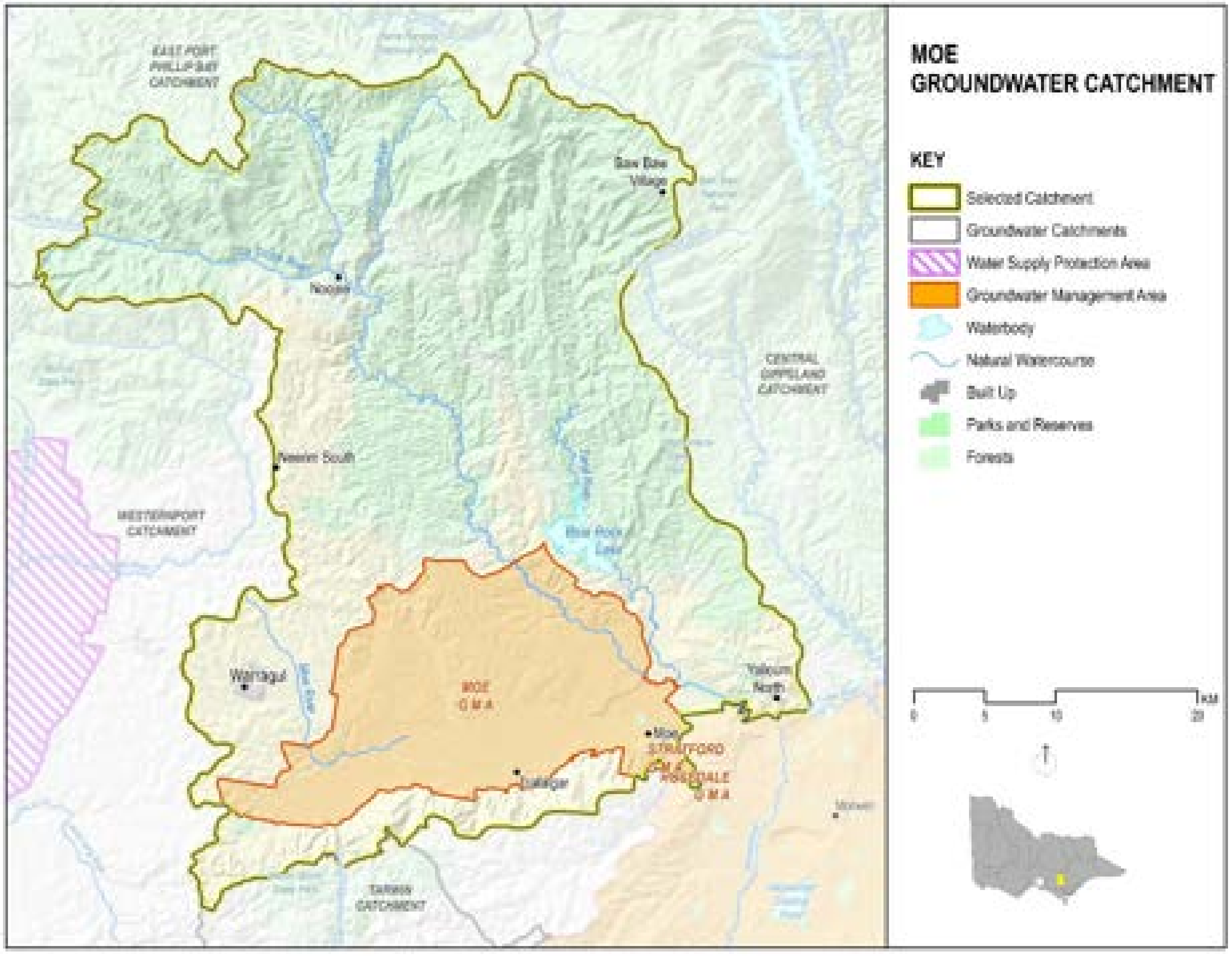
(2) Compliance against the PCV for Stratford GMA is not assessed because current compliance assessment criteria are not applicable in Stratford GMA: coal mine licences physically in the area are not assigned to the GMA.

(3) The Yarram WSPA extends into the Central Gippsland groundwater catchment, and an additional 6,889 ML of entitlement volume is reported in the Central Gippsland catchment account (Table 7-15). The total entitlement volume for the Yarram WSPA as of 30 June 2021 was 25,688 ML.

7.4.4 Moe groundwater catchment

The Moe groundwater catchment (Figure 7-10) is in central Gippsland, east of Melbourne.

Figure 7-10 Moe groundwater catchment



7.4.4.1 Management arrangements

Groundwater resources in the Moe groundwater catchment are managed by Southern Rural Water, which is responsible for developing and implementing groundwater management plans. Southern Rural Water also issues licences for groundwater use, bore construction and surface water diversions, and administers domestic and stock use.

The Moe groundwater catchment contains the Moe GMA. The area not covered by Moe GMA is reported as outside management units. The Moe GMA straddles this catchment and the Central Gippsland groundwater catchment. Groundwater resources supply licensed entitlements, domestic and stock use and urban use to Trafalgar. While most groundwater licensed in the Moe groundwater catchment is used for irrigation, some is used for dairy-wash purposes.

7.4.4.2 2020–21 groundwater resources overview

Moe GMA's groundwater level trend was declining throughout 2020–21 (Table 7-18).

Table 7-18 Moe groundwater level trend

Groundwater management unit	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Groundwater management area					
Moe [(1)]	declining	declining	declining	**declining**	**declining**

Note

(1) The Moe GMA extends into the Central Gippsland groundwater catchment.

In 2020–21, 1,069 ML of water was extracted for consumptive purposes, which was less than the 1,164 ML extracted in the previous year. Of this volume, 231 ML was estimated to be for domestic and stock use. There was no urban use in 2020–21.

7.4.4.3 Groundwater entitlements and use

Compliance against water entitlements is reported for this groundwater catchment in two areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders.

Moe – Key compliance points	
✓	**The volume of entitlements in the catchment did not exceed relevant PCVs.**
✓	**The total volume extracted under licences (838 ML) was within the volume available for the year (5,206 ML).**

Groundwater licence and use volumes in the Moe groundwater catchment are shown in Table 7-19. Some groundwater licences incorporate domestic and stock use, and in these cases, the use is reported in the licensed volume in Table 7-19. Groundwater supplies are available for Yarragon.

Table 7-19 Licensed groundwater volumes and use, Moe groundwater catchment

Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML)	Total water available (ML)	Water extracted (ML)
Moe GMA (1)	Licensed use (non-urban)	3,629	0	3,749	(120)	**3,629**	**407**
	Yarragon urban	100	0	100	0	**100**	**0**
	Domestic & stock	-	-	-	-	-	**123**
Outside management unit	Licensed use (non-urban)	1,478	0	1,358	120	**1,478**	**430**
	Domestic & stock	-	-	-	-	-	**108**
Total 2020–21		**5,206**	**0**	**5,206**	**0**	**5,206**	**1,069**
Total 2019–20		5,206	0	5,210	0	5,210	1,164

Note

(1) The Moe GMA extends into the Central Gippsland groundwater catchment, and an additional 33 ML of entitlement volume is reported in the Central Gippsland groundwater catchment account (Table 7-15). The total entitlement volume for the Moe GMA as of 30 June 2021 was 3,762 ML.

7.5 Central groundwater management basin

The Central groundwater management basin comprises the Port Phillip, Westernport and Tarwin groundwater management basins, which are grouped for management purposes. These basins are in south-central Victoria, encompassing the area around Port Phillip Bay and extending into South Gippsland. The basin includes the Tarwin, Westernport, East Port Phillip Bay and West Port Phillip Bay groundwater catchments.

The basin's upper aquifers occur along the river valleys, near the coast and on the plains west of Melbourne. Sand and gravel aquifers underlie productive farmland along the river valleys and floodplains of Bacchus Marsh, Werribee and near Yarra Glen. Near Koo Wee Rup, the upper aquifer is mostly formed of clay and generally acts as an aquitard except in the south-eastern area where it occurs at the surface. Recharge to the upper aquifers occurs directly from rainfall, and discharge is to streams and the bays.

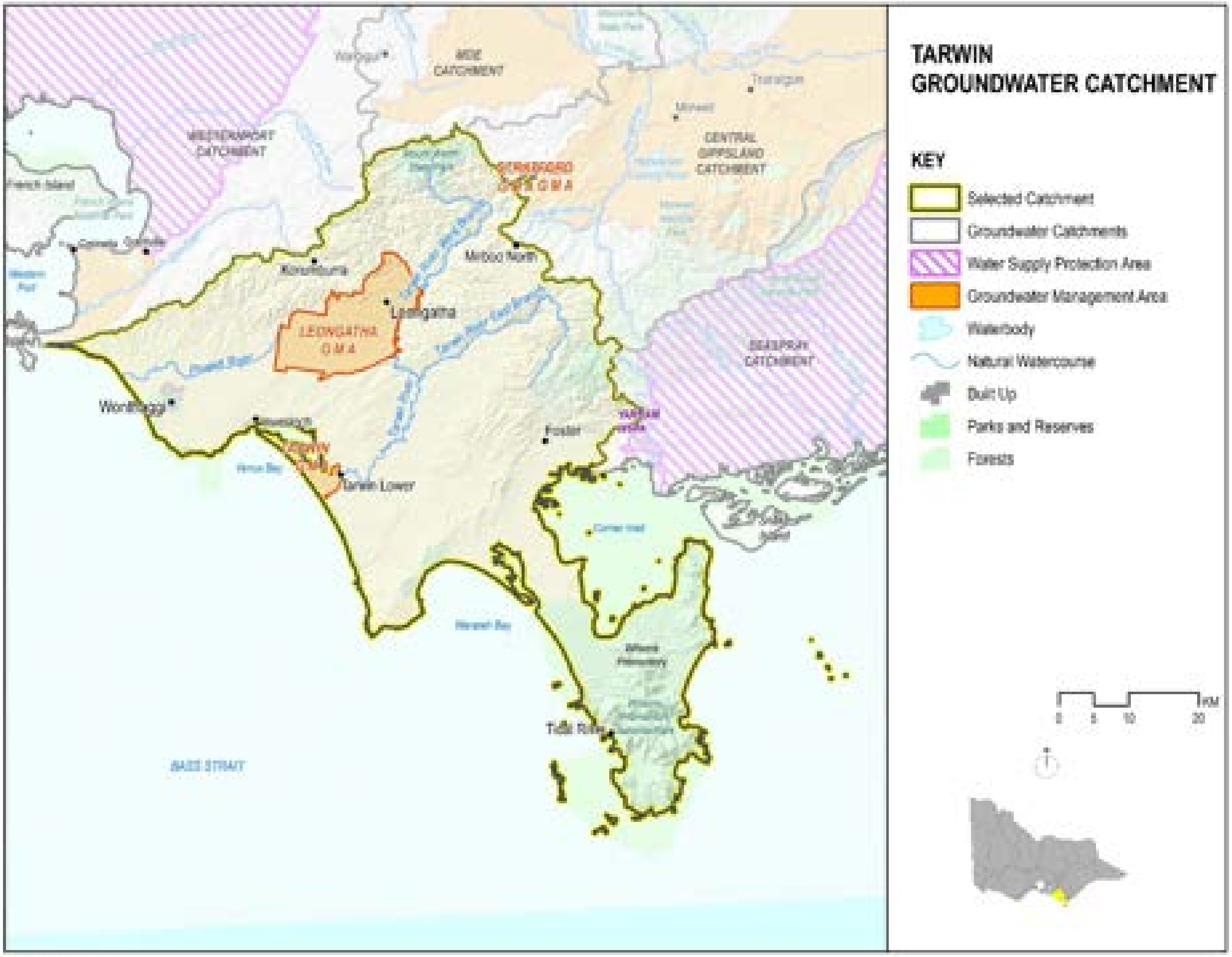
The basin's middle aquifers cover a large part of the area. They are made up of several formations, which are connected and act as one aquifer in each region. These aquifers vary in composition and include fine sands, coarse sand and gravel, clay and limestone. These aquifers are partially underlain by the middle aquitard, which mainly consists of coal and silt. The middle aquifers are mostly buried and confined by the upper aquifer, but on the eastern side of Port Phillip Bay, they are at the surface and unconfined. Recharge occurs from leakage through the overlying sediments or from direct rainfall recharge where the aquifers are near the surface.

Lower aquifers extend across the basin. They lie very deep along the coast, but in some inland areas, they are at or close to the surface. The aquifers comprise largely sand, sandstone and basalt, although some also contain clay and coal layers that act as aquitards. The bedrock is buried by the lower aquifers where they are deepest along the coast, but it reaches the surface in the highlands, where it forms the Great Dividing Range, Mornington Peninsula Highlands and Strzelecki Ranges. In the ranges, the bedrock acts as a low-yielding fractured rock aquifer and, where it is buried, it acts as an aquitard. Direct rainfall recharge occurs where the aquifers and bedrock are at the surface; elsewhere, recharge occurs as leakage.

7.5.1 Tarwin groundwater catchment

The Tarwin groundwater catchment is in south-eastern Victoria (Figure 7-11). Bass Strait forms the catchment's southern boundary.

Figure 7-11 Tarwin groundwater catchment



7.5.1.1 Management arrangements

Groundwater resources in the Tarwin groundwater catchment are managed by Southern Rural Water, which is responsible for developing and implementing groundwater management plans. Southern Rural Water also issues licences for groundwater use, bore construction and surface water diversions, and it administers domestic and stock use.

The Tarwin groundwater catchment contains the Leongatha GMA and Tarwin GMA. The area not covered by GMUs is reported as outside management units. Groundwater resources supply licensed entitlements, domestic and stock use and urban use to Leongatha.

7.5.1.2 2020–21 groundwater resources overview

The groundwater level trends for the Tarwin groundwater catchment were between stable and rising for 2020–21 (Table 7-20). The trends were stable for the whole year for the Tarwin GMA, and groundwater levels in the Leongatha GMA showed a rising trend for most of the year and were stable from October to December 2020.

Table 7-20 Groundwater level trends, Tarwin groundwater catchment

Groundwater management unit	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Groundwater management area					
Leongatha	rising	stable	rising	**rising**	**stable**
Tarwin	stable	stable	stable	**stable**	**rising**

In 2020–21, 813 ML of water was extracted for consumptive purposes, which was less than the 998 ML extracted in the previous year. Of this volume, 729 ML was estimated to be for domestic and stock use. There was no urban use in 2020–21.

7.5.1.3 Groundwater compliance and use

Compliance against water entitlements is reported for this groundwater catchment in two areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders.

Tarwin – Key compliance points	
✓	**The volume of entitlements in the catchment did not exceed relevant PCVs.**
✓	**The total volume extracted under licences (84 ML) was within the volume available for the year (2,206 ML).**

Groundwater licence and use volumes in the Tarwin groundwater catchment are shown in Table 7-21. Some groundwater licences incorporate domestic and stock use, and in these cases, the use is reported in the licensed volume in Table 7-21. Groundwater supply is available for Leongatha.

Table 7-21 Licensed groundwater volumes and use, Tarwin groundwater catchment

Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML)	Total water available (ML)	Water extracted (ML)
Leongatha GMA	Licensed use (non-urban)	1,088	0	1,088	0	**1,088**	**29**
	Leongatha urban	715	0	715	0	**715**	**0**
	Domestic & stock	-	-	-	-	-	**48**
Tarwin GMA (1)	Licensed use (non-urban)	58	0	58	0	**58**	**6**
	Domestic & stock	-	-	-	-	-	**405**
Outside management units	Licensed use (non-urban)	344	0	344	0	**344**	**49**
	Domestic & stock	-	-	-	-	-	**276**
Total 2020–21		**2,206**	**0**	**2,206**	**0**	**2,206**	**813**
Total 2019–20 (1)		2,206	0	2,206	0	2,206	998

Note
(1) The 2019–20 'Water extracted' total has been corrected from the previous accounts.

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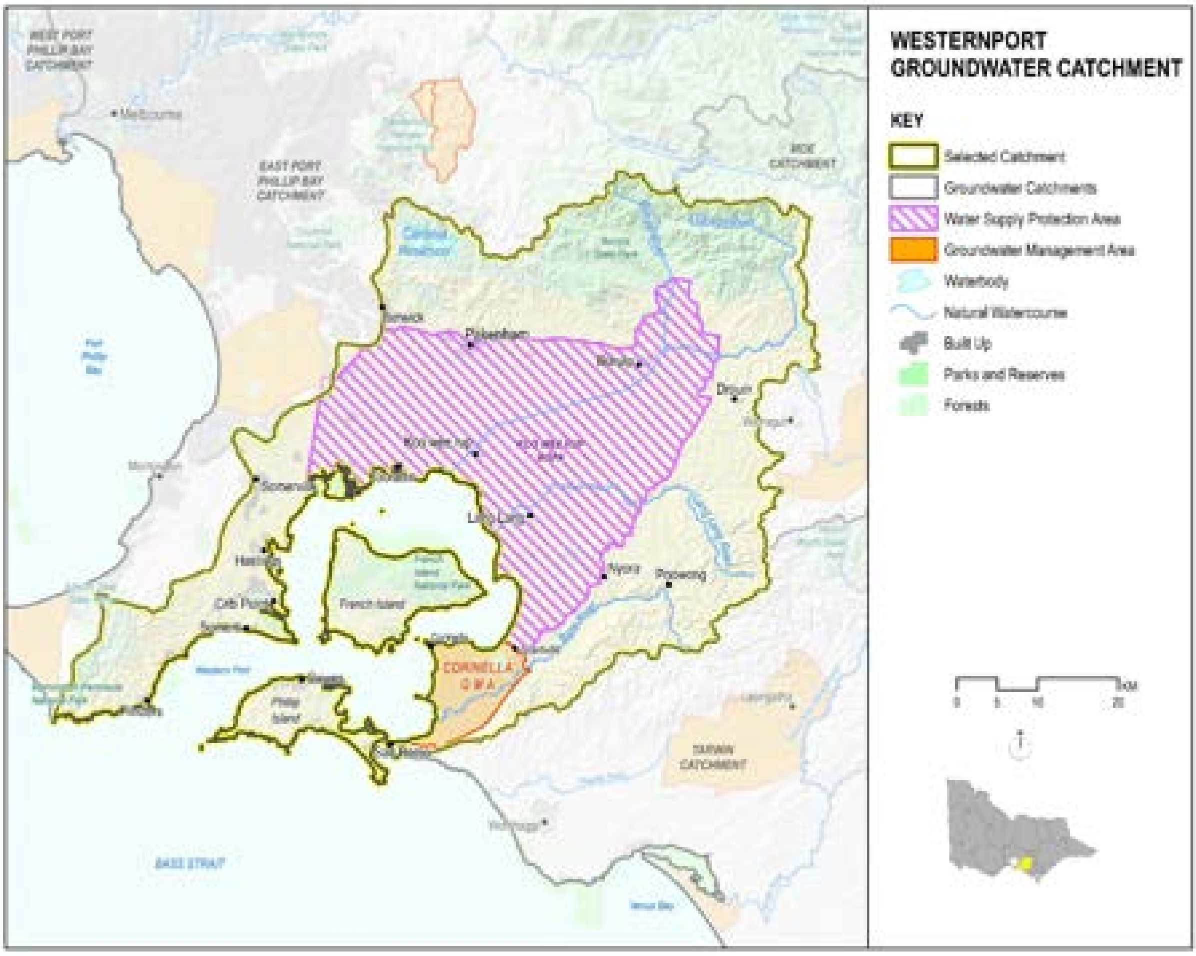
7.5.2 Westernport groundwater catchment

The Westernport groundwater catchment is in south-eastern Victoria (Figure 7-12), and it takes in the area around and to the north-east of Western Port.

Figure 7-12 Westernport groundwater catchment



7.5.2.1 Management arrangements

Groundwater resources in the Westernport groundwater catchment are managed by Southern Rural Water, which is responsible for developing and implementing groundwater management plans. Southern Rural Water also issues licences for groundwater use, bore construction and surface water diversions, and it administers domestic and stock use.

The Westernport groundwater catchment contains the Corinella GMA and Koo Wee Rup WSPA. The area not covered by GMUs is reported as outside management units. The Koo Wee Rup WSPA extends into the East Port Phillip Bay groundwater catchment. Groundwater resources supply licensed entitlements, domestic and stock use and urban use to Corinella, Grantville and Lang Lang.

7.5.2.2 2020–21 groundwater resources overview

Groundwater level trends varied across the Westernport catchment in 2020–21 (Table 7-22). The groundwater level trends in both GMUs were stable at the beginning of the year. Then, Koo Wee Rup WSPA showed a declining level trend from January to June 2021, and Corinella GMA showed a rising trend from October 2020 to June 2021.

Table 7-22 Groundwater level trends, Westernport groundwater catchment

Groundwater management unit	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Water supply protection area					
Koo Wee Rup	stable	stable	declining	**declining**	**stable**
Groundwater management area					
Corinella	stable	rising	rising	**rising**	**stable**

In 2020–21, 4,710 ML of water was extracted for consumptive purposes, which was more than the 4,615 ML extracted in the previous year. Of this volume, 1,205 ML was estimated to be for domestic and stock use. There was no urban use in 2020–21.

7.5.2.3 Groundwater compliance and use

Compliance against water entitlements is reported for this groundwater catchment in two areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders.

Westernport – Key compliance points	
✓	**The volume of entitlements in the catchment did not exceed relevant PCVs.**
✓	**The total volume extracted under licences (3,506 ML) was within the volume available for the year (17,643 ML).**

Groundwater licence and use volumes in the Westernport groundwater catchment are shown in Table 7-23. Some groundwater licences incorporate domestic and stock use, and in these cases, the use is reported in the licensed volume in Table 7-23. Groundwater is available as an urban water supply to Corinella and Grantville as well as Lang Lang.

Table 7-23 Licensed groundwater volumes and use, Westernport groundwater catchment

Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML)	Total water available (ML)	Water extracted (ML)
Corinella GMA	Licensed use (non-urban)	172	0	172	0	**172**	**14**
	Corinella / Grantville urban	490	0	490	0	**490**	**0**
	Domestic & stock	-	-	-	-	-	**48**
Koo Wee Rup WSPA (1)	Licensed use (non-urban)	12,336	0	12,515	0	**12,515**	**3,123**
	Lang Lang urban	119	0	119	0	**119**	**0**
	Domestic & stock	-	-	-	-	-	**642**
Outside management units	Licensed use (non-urban)	4,043	0	4,327	20	**4,347**	**368**
	Domestic & stock	-	-	-	-	-	**515**
Total 2020–21		**17,160**	**0**	**17,623**	**20**	**17,643**	**4,710**
Total 2019–20		17,413	0	17,444	0	17,444	4,615

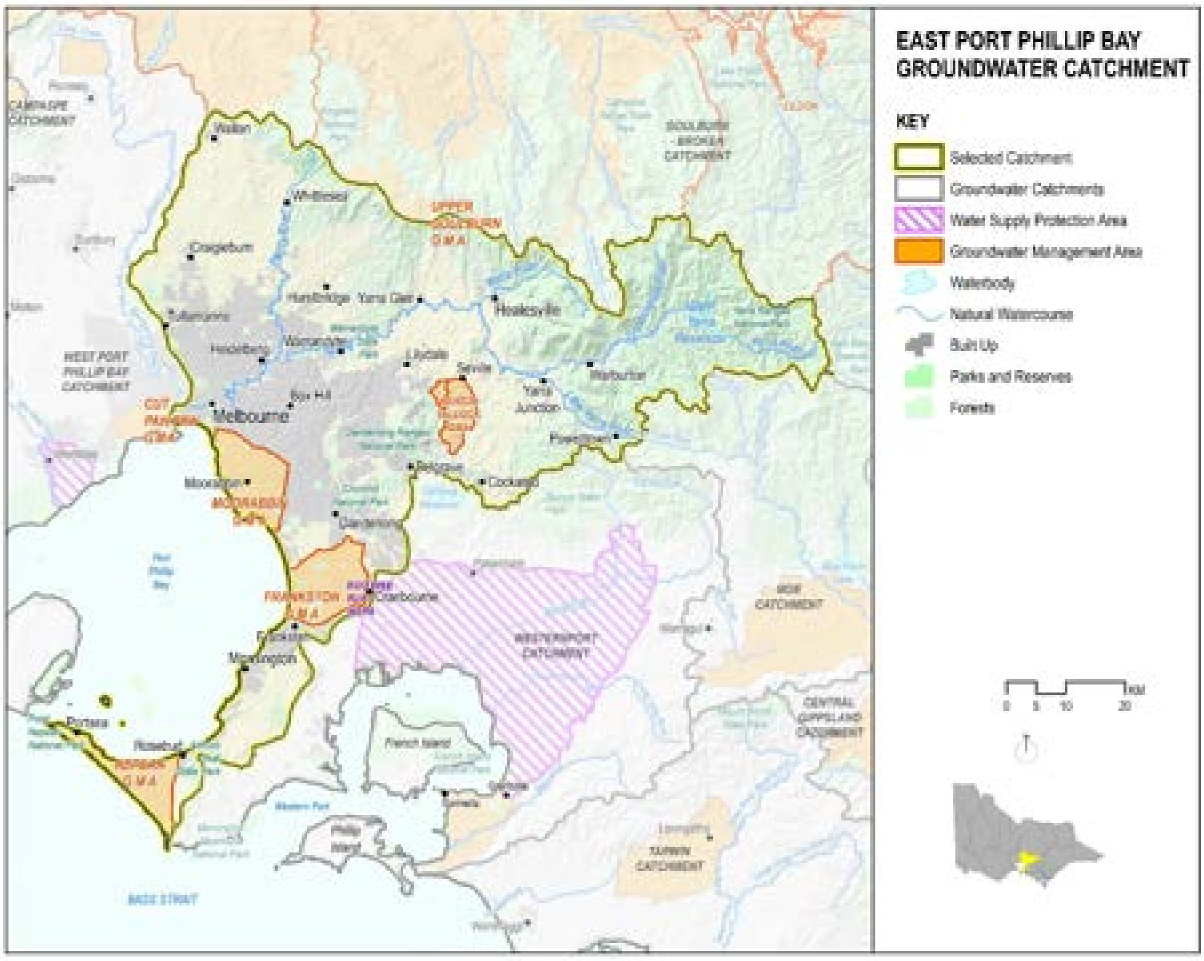
Note

(1) The Koo Wee Rup WSPA extends into the East Port Phillip Bay groundwater catchment, and an additional 111 ML of entitlement volume is reported in the East Port Phillip Bay catchment account (Table 7-25). The total entitlement volume for the Koo Wee Rup WSPA as of 30 June 2021 was 12,566 ML.

7.5.3 East Port Phillip Bay groundwater catchment

The East Port Phillip Bay groundwater catchment (Figure 7-13) stretches to the east of Melbourne, covering much of its suburban area and the Mornington Peninsula.

Figure 7-13 East Port Phillip Bay groundwater catchment



7.5.3.1 Management arrangements

Groundwater resources in the East Port Phillip Bay groundwater catchment are managed by Southern Rural Water, which is responsible for developing and implementing groundwater management plans. Southern Rural Water also issues licences for groundwater use, bore construction and surface water diversions, and it administers domestic and stock use.

The East Port Phillip Bay groundwater catchment contains the Frankston GMA, Moorabbin GMA, Nepean GMA, Koo Wee Rup WSPA and Wandin Yallock GMA. The area not covered by GMUs is reported as outside management units. The Koo Wee Rup WSPA extends into the Westernport groundwater catchment.

Groundwater resources supply licensed entitlements and domestic and stock use. Groundwater in the East Port Phillip Bay groundwater catchment is mainly used for irrigation, with some licensed industrial and commercial use. Groundwater resources are not used for urban supply in the East Port Phillip Bay groundwater catchment.

7.5.3.2 2020–21 groundwater resources overview

Groundwater level trends varied across the East Port Phillip Bay groundwater catchment in 2020–21 (Table 7-24). They were stable for most GMUs except Koo Wee Rup WSPA, which had declining level trends from January to June 2021; Frankston GMA, which had declining level trends from July 2020 to March 2021; and Moorabbin, which had rising groundwater trends from October 2020 to June 2021.

Table 7-24 Groundwater level trends, East Port Phillip Bay groundwater catchment

Groundwater management unit	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Water supply protection area					
Koo Wee Rup	stable	stable	declining	**declining**	**stable**
Groundwater management area					
Frankston	declining	declining	declining	**stable**	**declining**
Moorabbin	stable	rising	rising	**rising**	**rising**
Nepean	stable	stable	stable	**stable**	**stable**
Wandin Yallock	rising	rising	declining	**stable**	**declining**

In 2020–21, 9,737 ML of water was extracted for consumptive purposes, which was less than the 10,122 ML extracted in the previous year. Of this volume, 3,623 ML was estimated to be for domestic and stock use. There are no urban use licences in the East Port Phillip Bay groundwater catchment.

7.5.3.3 Groundwater compliance and use

Compliance against water entitlements is reported for this groundwater catchment in two areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders.

East Port Phillip Bay – Key compliance points	
✓	**The volume of entitlements in the catchment did not exceed relevant PCVs.**
✓	**The total volume extracted under licences (6,114 ML) was within the volume available for the year (28,659 ML).**

Groundwater licence and use volumes in the East Port Phillip Bay groundwater catchment are shown in Table 7-25. Some groundwater licences incorporate domestic and stock use, and in these cases, the use is reported in the licensed volume in Table 7-25.

Table 7-25 Licensed groundwater volumes and use, East Port Phillip Bay groundwater catchment

Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML)	Total water available (ML)	Water extracted (ML)
Frankston GMA	Licensed use (non-urban)	2,542	0	2,542	0	**2,542**	**534**
	Domestic & stock	-	-	-	-	-	**51**
Koo Wee Rup WSPA (1)	Licensed use (non-urban)	111	0	111	0	**111**	**0**
	Domestic & stock	-	-	-	-	-	**0**
Moorabbin GMA	Licensed use (non-urban)	2,624	0	2,624	0	**2,624**	**667**
	Domestic & stock	-	-	-	-	-	**255**
Nepean GMA (2)	Licensed use (non-urban)	6,110	0	6,110	0	**6,110**	**2,953**
	Domestic & stock	-	-	-	-	-	**1,802**
Wandin Yallock WSPA	Licensed use (non-urban)	3,025	(1)	3,026	0	**3,025**	**425**
	Domestic & stock	-	-	-	-	-	**56**
Outside management units	Licensed use (non-urban)	14,117	(4)	14,271	(20)	**14,247**	**1,536**
	Domestic & stock	-	-	-	-	-	**1,460**
Total 2020–21		**28,529**	**(5)**	**28,684**	**(20)**	**28,659**	**9,737**
Total 2019–20		28,156	0	28,163	0	28,163	10,122

Notes

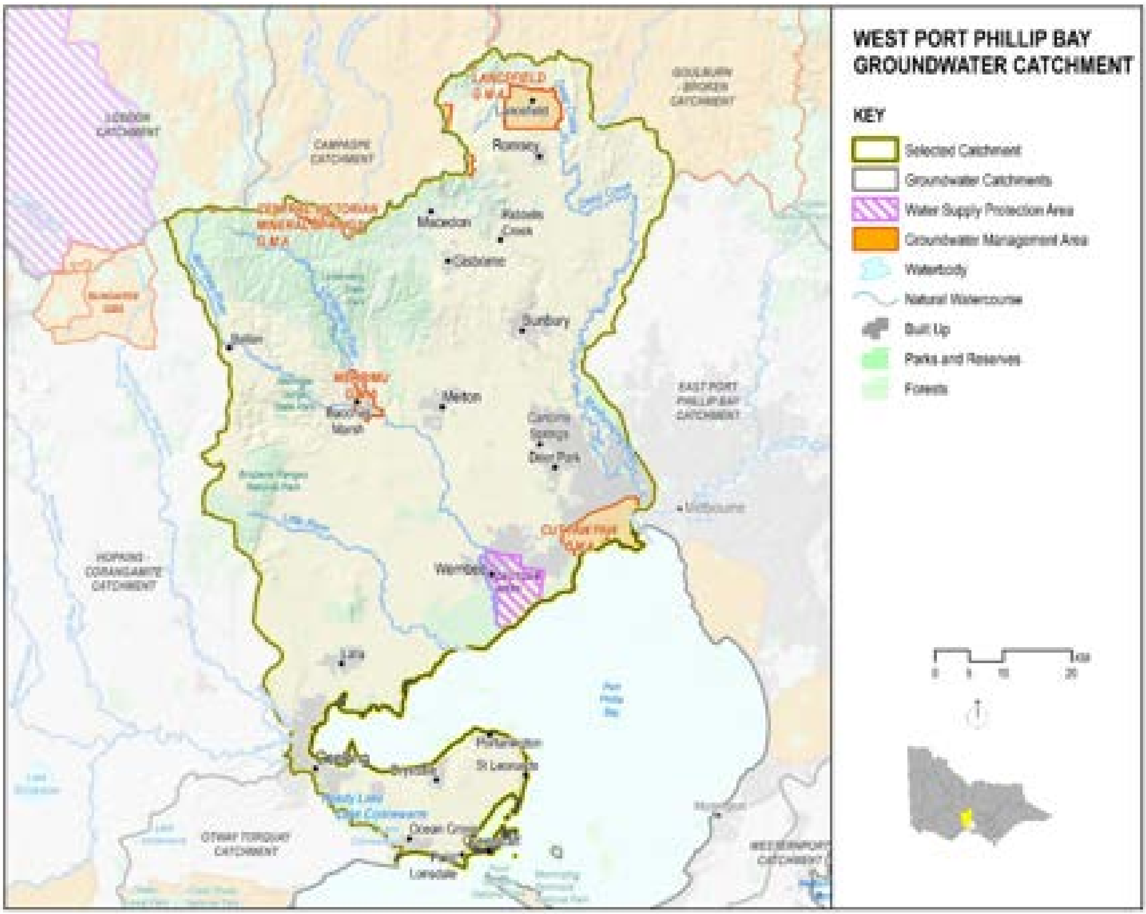
(1) The Koo Wee Rup WSPA extends into the Westernport groundwater catchment, and an additional 12,455 ML of entitlement volume is reported in the Westernport catchment account (Table 7-23). The total entitlement volume for the Koo Wee Rup WSPA as of 30 June 2021 was 12,566 ML.

(2) Estimated stock and domestic use in Nepean GMA is calculated using a factor of 1 ML per bore.

7.5.4 West Port Phillip Bay groundwater catchment

The West Port Phillip Bay groundwater catchment (Figure 7-14) extends to the north and west of Melbourne, covering its western suburbs, part of Geelong and the Bellarine Peninsula.

Figure 7-14 West Port Phillip Bay groundwater catchment



7.5.4.1 Management arrangements

Groundwater resources in the West Port Phillip Bay groundwater catchment are managed by Southern Rural Water, which is responsible for developing and implementing groundwater management plans. Southern Rural Water also issues licences for groundwater use, bore construction and surface water diversions, and it administers domestic and stock use.

The West Port Phillip Bay groundwater catchment contains the Cut Paw Paw GMA, Lancefield GMA, Merrimu GMA and Deutgam WSPA. The area not covered by GMUs is reported as outside management units. Groundwater resources supply licensed entitlements and domestic and stock use and urban use to Blackwood, Lancefield and Romsey.

7.5.4.2 2020–21 groundwater resources overview

In the Deutgam WSPA, licensed diversions were restricted to 25% of entitlement volume in July 2020 and then 50% of the entitlement for the rest of 2020–21.

Groundwater level trends were varied across the catchment in 2020–21 (Table 7-26). They were declining at the beginning of the water year for Merrimu GMA and Deutgam WSPA. All GMUs were either stable or rising by June 2021. Observation bores were not available to determine a trend in the Cut Paw Paw GMA.

Table 7-26 Groundwater level trends, West Port Phillip Bay groundwater catchment

Groundwater management unit	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Water supply protection area					
Deutgam	declining	declining	stable	**stable**	**declining**
Groundwater management area					
Lancefield	rising	rising	rising	**rising**	**rising**
Merrimu	declining	rising	rising	**rising**	**declining**

In 2020–21, 3,250 ML of water was extracted for consumptive purposes, which was less than the 3,786 ML extracted in the previous year. Of this volume, 47 ML was for urban use, and 1,619 ML was estimated to be for domestic and stock use.

7.5.4.3 Groundwater compliance and use

Compliance against water entitlements is reported for this groundwater catchment in two areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders.

West Port Phillip Bay – Key compliance points	
✓	**The volume of entitlements in the catchment did not exceed relevant PCVs.**
✓	**The total volume extracted under licences (1,631 ML) was within the volume available for the year (15,898 ML).**

Groundwater licence and use volumes in the West Port Phillip Bay groundwater catchment are shown in Table 7-27. Some groundwater licences incorporate domestic and stock use, and in these cases, the use is reported in the licensed volume in Table 7-25. Within the West Port Phillip Bay groundwater catchment, groundwater is an urban supply option for Blackwood, Lancefield and Romsey.

Table 7-27 Licensed groundwater volumes and use, West Port Phillip Bay groundwater catchment

Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML)	Total water available (ML)	Water extracted (ML)
Cut Paw Paw GMA	Licensed use (non-urban)	523	0	523	0	**523**	**0**
	Domestic & stock	-	-	-	-	-	**5**
Deutgam WSPA	Licensed use (non-urban)	5,082	(43)	2,584	0	**2,541**	**338**
	Domestic & stock	-	-	-	-	-	**59**
Lancefield GMA	Licensed use (non-urban)	1,084	0	1,084	0	**1,084**	**148**
	Lancefield urban	294	0	294	0	**294**	**0**
	Domestic & stock	-	-	-	-	-	**57**
Merrimu GMA	Licensed use (non-urban)	8	0	10	0	**10**	**0**
	Domestic & stock	-	-	-	-	-	**14**
Outside management units	Licensed use (non-urban)	10,789	0	10,797	0	**10,797**	**1,098**
	Blackwood urban	50	0	50	0	**50**	**0**
	Romsey urban	600	0	600	0	**600**	**47**
	Domestic & stock	-	-	-	-	-	**1,485**
Total 2020–21		**18,430**	**(43)**	**15,942**	**0**	**15,898**	**3,250**
Total 2019–20		18,349	0	14,662	0	14,662	3,786

7.6 Otway–Torquay groundwater management basin

The Otway–Torquay groundwater management basin is in south-western Victoria and extends offshore along the southern margin of Victoria and South Australia to the north-west of Tasmania. It borders the Goulburn–Murray groundwater management basin and the Wimmera–Mallee groundwater management basin to the north and the Central groundwater management basin to the east.

The upper aquifers of the Otway–Torquay groundwater management basin are found extensively across the south-west of the region and include volcanic aquifers, a significant sand and limestone aquifer and some older sand aquifers. The unconfined volcanic aquifers stretch from Ballarat to Portland and consist of scoria and fractured basalt. They are thickest near Ballarat, Colac, Portland and south of Hamilton. The unconfined sand and limestone aquifer occurs along the South Australian border. In the places where these aquifers are at the ground surface, they can receive recharge directly from rainfall. Discharge is mainly by leakage from the upper aquifer to the middle aquifer but also occurs through baseflows to streams. The upper aquifers interact closely with surface water (such as rivers, creeks, drainage lines, wetlands, swamps and lakes).

Middle aquifers occur across the southern part of the region, stretching from the South Australian border near the Grampians across to Port Campbell. There are two main levels of middle aquifers — known as the upper middle aquifers and lower middle aquifers — which are separated by a thick aquitard of impermeable silts and clays. The upper middle aquifer largely comprises Port Campbell limestone and is located close to the surface. It is semi-confined by the upper aquifer and receives recharge mainly from rainfall. It sometimes acts as one unit with the overlying sand and limestone aquifer.

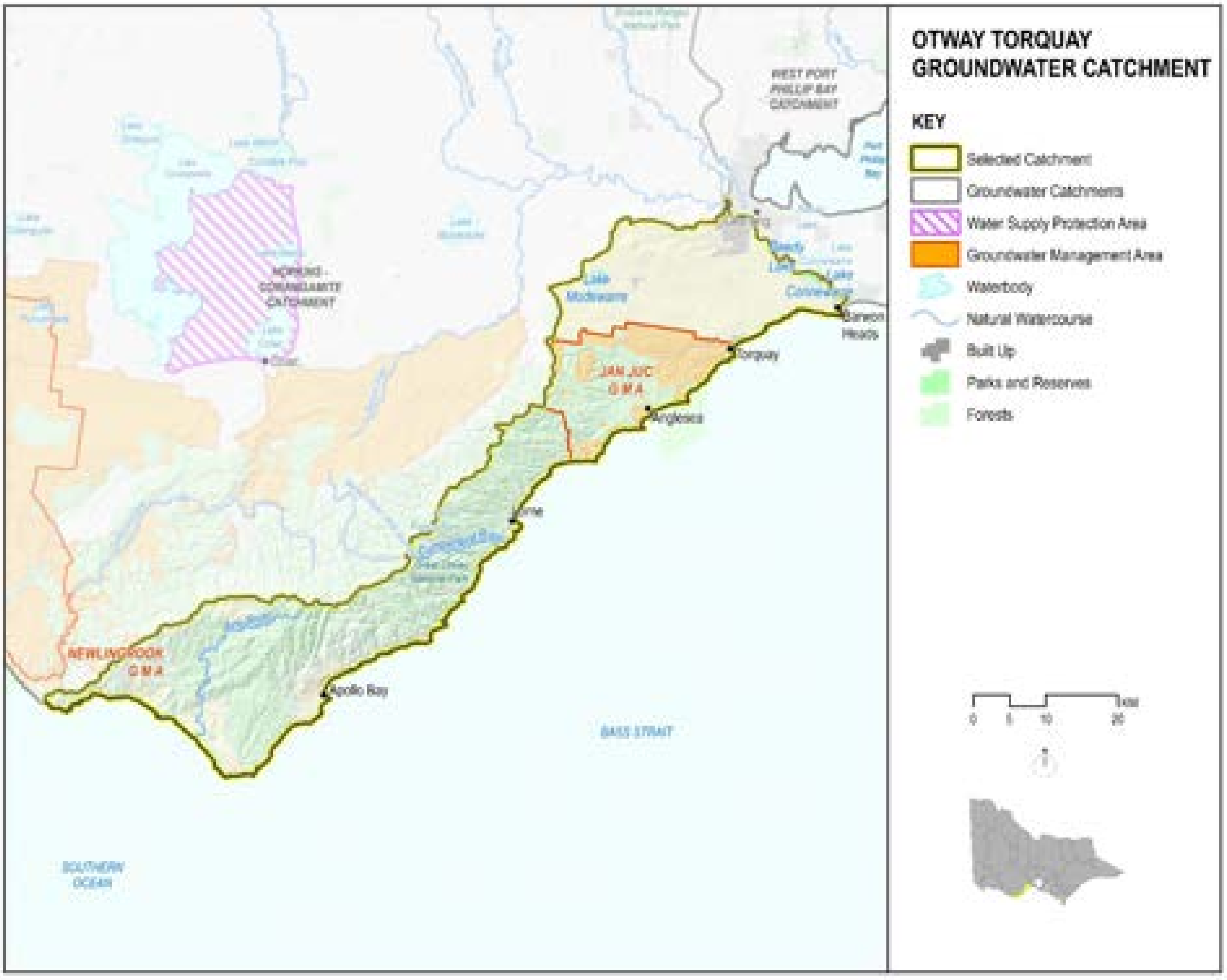
Most of the lower middle aquifer is confined by overlying layers and below by thick marl aquitards, except for the region along its northern reaches where it connects to the lower aquifers. The lower middle aquifer relies on leakage from adjacent formations for recharge. Discharge for upper middle and lower middle aquifers is most likely to occur along the coastline or into other formations. There is also some surface discharge to swamps and leakage in low-lying areas.

The lower aquifers occur across the south of the management basin, stretching from the South Australian border south of the Grampians across to Port Phillip Bay. In most of the management basin, they are overlain by hundreds of metres of sediment, but in the north and Otway Ranges region, they occur at or near the surface as unconfined aquifers. The lower aquifers mainly comprise alternating layers of sand and clay, but some are sand aquifers with minor amounts of silt and brown coal. Near the coast, the aquifers are under pressure and groundwater from these aquifers can reach temperatures of 50–60° C. The lower aquifers are underlain by bedrock comprised mainly of siltstone, which reaches the surface around the management basin margin to form the Grampians, the Otway Ranges and the Central Highlands.

7.6.1 Otway–Torquay groundwater catchment

The Otway–Torquay groundwater catchment (Figure 7-15) is in the Otway–Torquay groundwater management basin in south-western Victoria. Much of the catchment boundary is along the coastline.

Figure 7-15 Otway–Torquay groundwater catchment



7.6.1.1 *Management arrangements*

Groundwater resources in the Otway–Torquay groundwater catchment are managed by Southern Rural Water, which is responsible for developing and implementing groundwater management plans. Southern Rural Water also issues licences for groundwater use, bore construction and surface water diversions, and it administers domestic and stock use.

The Otway–Torquay groundwater catchment contains the Jan Juc GMA. The area not covered by Jan Juc GMA is reported as outside management units. Groundwater resources supply licensed entitlements, domestic and stock use and urban use to Geelong.

7.6.1.2 *2020–21 groundwater resources overview*

The groundwater level trend for the Otway–Torquay groundwater catchment for 2020–21 was generally stable (Table 7-28). The levels for Jan Juc GMA showed a stable trend for most of the water year and then a declining trend in the last quarter of 2020–21.

Table 7-28 Groundwater level trends, Otway–Torquay groundwater catchment

Groundwater management unit	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Groundwater management area					
Jan Juc	stable	stable	stable	**declining**	**rising**

In 2020–21, 292 ML of water was extracted for consumptive purposes, which was less than the 2,301 ML extracted in the previous year. Of this volume, 47 ML was estimated to be for domestic and stock use. There was minimal urban use in 2020–21, with 14 ML extracted as part of the production bore maintenance schedule. The large decrease in use in 2020–21 was due to limited groundwater extraction under the *Bulk Entitlement (Anglesea Groundwater) Order 2009*.

7.6.1.3 Groundwater compliance and use

Compliance against water entitlements is reported for this groundwater catchment in three areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders
- **bulk entitlement provisions:** holders of entitlements do not breach any provisions that are documented in their bulk entitlement orders.

Otway–Torquay – Key compliance points	
✓	**The volume of entitlements in the catchment did not exceed relevant PCVs.**
✓	**The total volume extracted under licences (246 ML) was within the volume available for the year (14,408 ML).**
✓	**No individual bulk entitlement holder took more than the annual volume made available to them.**
✓	**Individual bulk entitlement holders complied with all provisions in their entitlements.**

Groundwater licence and use volumes in the Otway–Torquay groundwater catchment are shown in Table 7-29. Some groundwater licences incorporate domestic and stock use, and in these cases, the use is reported in the licensed volume in Table 7-29. In the Otway–Torquay groundwater catchment, groundwater is used for urban supply for Greater Geelong.

The first groundwater bulk entitlement was granted to Barwon Water on 1 July 2009. The Bulk Entitlement (Anglesea Groundwater) Order 2009 allows Barwon Water to extract a maximum of 10,000 ML of groundwater in any given year and no more than 35,000 ML in any five-year period. The bulk entitlement supplements supply to homes and businesses in the Greater Geelong supply area.

Table 7-29 Licensed groundwater volumes and use, Otway–Torquay groundwater catchment

Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML)	Total water available (ML)	Water extracted (ML)
Jan Juc GMA	Licensed use (non-urban)	4,250	0	4,250	0	**4,250**	**232**
	Greater Geelong (Anglesea Bore Field) urban (1)	10,000	0	10,000	0	**10,000**	**14**
	Domestic & stock	-	-	-	-	-	**6**
Outside management unit	Licensed use (non-urban)	98	0	158	0	**158**	**0**
	Domestic & stock	-	-	-	-	-	**41**
Total 2020–21		**14,348**	**0**	**14,408**	**0**	**14,408**	**292**
Total 2019–20		14,408	0	14,408	0	14,408	2,301

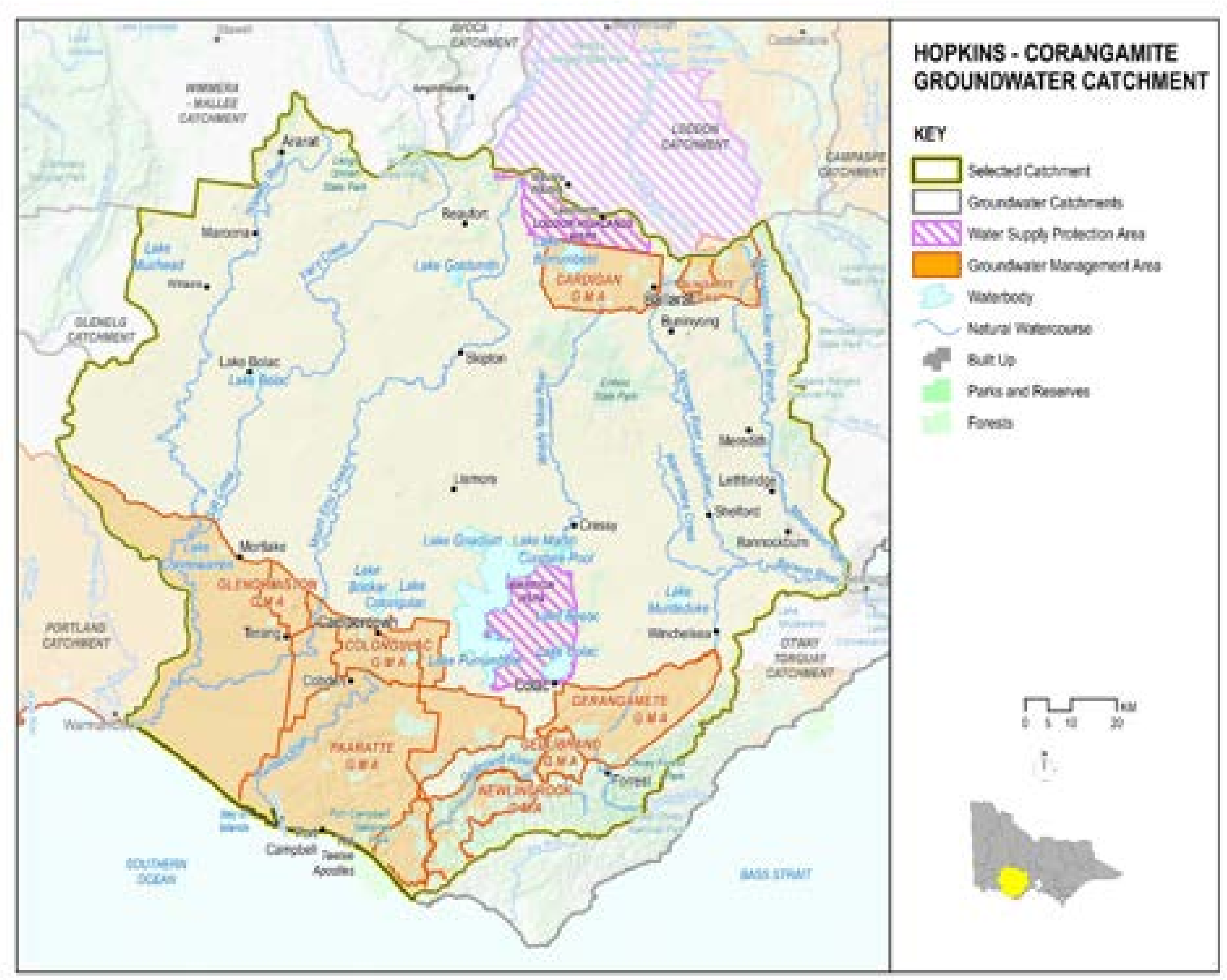
Note

(1) Greater Geelong is supplied under a bulk entitlement, which applies to Zone 2 Lower Eastern View formation. The volume is based on a five-year total of 35,000 ML with a maximum annual extraction of 10,000 ML. The last time groundwater was taken under this entitlement was in 2019–20, when 2,177 ML was taken.

7.6.2 Hopkins–Corangamite groundwater catchment

The Hopkins–Corangamite groundwater catchment (Figure 7-16) covers a large area of south-west Victoria.

Figure 7-16 Hopkins–Corangamite groundwater catchment



7.6.2.1 Management arrangements

Groundwater resources in the Hopkins–Corangamite groundwater catchment are managed by Southern Rural Water, which is responsible for developing and implementing groundwater management plans. Southern Rural Water also issues licences for groundwater use, bore construction and surface water diversions, and it administers domestic and stock use.

The Hopkins–Corangamite groundwater catchment contains the Bungaree GMA, Cardigan GMA, Colongulac GMA, Gellibrand GMA, Gerangamete GMA, Glenormiston GMA, Newlingrook GMA, Paaratte GMA, South West Limestone GMA, Loddon Highlands WSPA and Warrion WSPA. The area not covered by GMUs is reported as outside management units. The South West Limestone GMA extends into the Portland and Glenelg groundwater catchments. The Loddon Highlands WSPA straddles this catchment and the Loddon groundwater catchment.

Groundwater resources in the Hopkins–Corangamite groundwater catchment are mainly used for urban supply and irrigation. Groundwater resources from the Wimmera–Mallee groundwater catchment also supply Willaura.

7.6.2.2 2020–21 groundwater resources overview

In the Loddon Highlands WSPA, licensed diversions from all zones except the Blampied and Newlyn zones were able to take 100% of their entitlement volume in 2020–21. Licensed diversions from the Newlyn Zone were restricted to 75% of the entitlement volume for the whole year. The Blampied Zone was restricted to 75% from July 2020, and restrictions were lifted in early January 2021.

Groundwater level trends for 2020–21 in the catchment were stable or rising during the year (Table 7-30). Seven of the 10 GMUs finished the year with a rising trend, with the other three all stable. None of the GMUs had a declining groundwater level trend at all in 2020–21.

Table 7-30 Groundwater level trends, Hopkins–Corangamite groundwater catchment

Groundwater management unit (1)	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Water supply protection area					
Warrion	rising	rising	rising	**rising**	**stable**
Groundwater management area					
Bungaree	rising	rising	rising	**rising**	**rising**
Cardigan	rising	rising	rising	**rising**	**stable**
Colongulac	rising	rising	rising	**rising**	**stable**
Gellibrand	stable	stable	stable	**stable**	**stable**
Gerangamete	stable	stable	stable	**stable**	**stable**
Loddon Highlands (2)	rising	rising	rising	**rising**	**declining**
Newlingrook	stable	stable	stable	**stable**	**stable**
Paaratte	rising	rising	rising	**rising**	**stable**
South West Limestone (3)	stable	stable	stable	**rising**	**rising**

Notes

(1) There are insufficient state observation bores in the Glenormiston GMA to adequately define the groundwater resource or changes to the resource over time.
(2) The Loddon Highlands WSPA extends into the Loddon groundwater catchment.
(3) The South West Limestone GMA extends into the Portland and Glenelg groundwater catchments.

In 2020–21, 24,235 ML of water was extracted for consumptive purposes, which was less than the 26,020 ML extracted in the previous year. Of this volume, 839 ML was for urban use, and 2,226 ML was estimated to be for domestic and stock use.

7.6.2.3 Groundwater compliance and use

Compliance against water entitlements is reported for this groundwater catchment in two areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders.

Hopkins–Corangamite – Key compliance points
✓ **The volume of entitlements in the catchment did not exceed relevant PCVs:** • The South West Limestone GMA PCV has not been gazetted, so PCV compliance cannot be assessed for this GMU. Nullawarre 22,741 ML is the applicable PCV volume in the Hopkins–Corangamite groundwater catchment.
✓ **The total volume extracted under licences (22,009 ML) was within the volume available for the year (84,747 ML).**

Groundwater licence and use volumes in the Hopkins–Corangamite groundwater catchment are shown in Table 7-31. Some groundwater licences incorporate domestic and stock use, and in these cases, the use is reported in the licensed use in Table 7-31. In the Hopkins–Corangamite groundwater catchment, groundwater provides urban supply to Beaufort, Caramut, Darlington, Dean, Mortlake, Port Campbell, Timboon, Peterborough, Curdie Vale, Streatham, areas around Carlisle, Ballarat and Geelong.

GWMWater provides urban groundwater supply to Willaura. Although Willaura is in the Hopkins–Corangamite groundwater catchment, the bores that supply the town are in Mafeking in the Wimmera–Mallee groundwater catchment and are therefore reported in that chapter (chapter 7.6.2).

Table 7-31 Licensed groundwater volumes and use, Hopkins–Corangamite groundwater catchment

Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML)	Total water available (ML)	Water extracted (ML)
Bungaree GMA	Licensed use (non-urban)	5,194	0	5,257	0	**5,257**	**1,816**
	Ballarat Supply urban	69	0	69	0	**69**	**0**
	Dean urban	30	0	30	0	**30**	**13**
	Domestic & stock	-	-	-	-	-	**150**
Cardigan GMA	Licensed use (non-urban)	889	0	889	0	**889**	**305**
	Ballarat urban (1)	3,000	0	3,000	0	**3,000**	**480**
	Domestic & stock	-	-	-	-	-	**99**
Colongulac GMA	Licensed use (non-urban)	4,404	0	4,404	0	**4,404**	**853**
	Domestic & stock	-	-	-	-	-	**80**
Gerangamete GMA	Licensed use (non-urban)	238	0	238	0	**238**	**65**
	Domestic & stock	-	-	-	-	-	**5**
Glenormiston GMA	Licensed use (non-urban)	2,636	(5)	2,641	0	**2,636**	**1,180**
	Domestic & stock	-	-	-	-	-	**54**
Loddon Highlands WSPA(2)	Licensed use (non-urban)	2	0	2	0	**2**	**2**
	Domestic & stock (3)	-	-	-	-	-	**102**
Newlingrook GMA	Licensed use (non-urban)	158	0	158	0	**158**	**9**
	Otway System (Carlisle) urban	1,800	0	1,800	0	**1,800**	**12**
	Domestic & stock	-	-	-	-	-	**2**
Paaratte GMA	Licensed use (non-urban)	0	0	0	0	**0**	**0**
	Port Campbell, Timboon, Peterborough & Curdie Vale urban	3,159	0	3,159	0	**3,159**	**281**
	Domestic & stock	-	-	-	-	-	**2**
South West Limestone GMA (4) (5)	Licensed use (non-urban)	28,366	8,161	28,177	90	**36,428**	**10,518**
	Domestic & stock	-	-	-	-	-	**719**
Warrion WSPA	Licensed use (non-urban)	14,075	(43)	14,118	0	**14,075**	**2,586**
	Domestic & stock	-	-	-	-	-	**170**
Outside management units	Licensed use (non-urban)	11,941	0	11,996	0	**11,996**	**3,836**
	Beaufort urban	200	0	200	0	**200**	
	Darlington urban	10	0	10	0	**10**	**2**
	Mortlake (part) urban	335	0	335	0	**335**	**21**
	Streatham urban	60	0	60	0	**60**	**30**
	Domestic & stock	-	-	-	-	-	**846**
Total 2020–21		**76,566**	**8,113**	**76,543**	**90**	**84,747**	**24,235**
Total 2019–20 (6)		76,211	7,552	75,798	571	83,921	26,020

Notes

(1) The volume of the licence for Ballarat is 1,700 ML, but up to 3,000 ML may be taken in any one year during a water shortage.

(2) The Loddon Highlands WSPA extends into the Loddon groundwater catchment, and an additional 20,500 ML of entitlement volume is reported in the Loddon groundwater catchment account (Table 7-11). The total entitlement volume for the Loddon Highlands WSPA as of 30 June 2021 was 20,502 ML.

(3) As Loddon Highlands WSPA is a Goulburn-Murray Water GMU, estimated domestic and stock use is calculated using a factor of 2 ML per bore.

(4) The South West Limestone GMA extends into the Portland and Glenelg groundwater catchments, and an additional 35,654 ML and 17,169 ML of entitlement volume is reported in the Portland and Glenelg catchment accounts, respectively (Table 7-33 and Table 7-35). The total entitlement volume for the South West Limestone GMA as of 30 June 2021 was 81,189 ML.

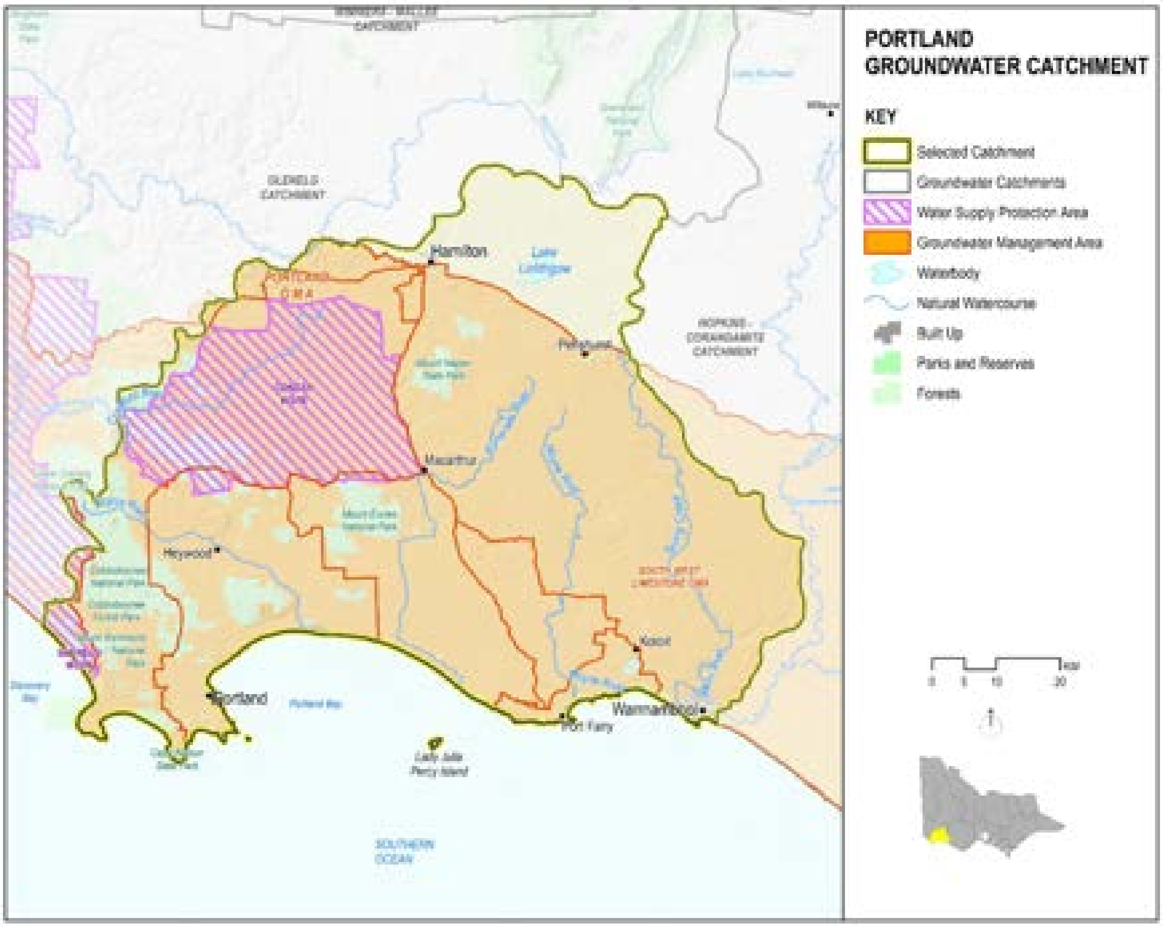
(5) The PCV for the South West Limestone GMA has not been gazetted, and so PCV compliance cannot be assessed for this GMU. The entitlements and use relate to the area defined in the South West Limestone Groundwater Management Area Plan No. LEGL./15-199. The South West Limestone GMA includes the area of the former Nullawarre WSPA, Yangery WSPA, Hawkesdale GMA and Heywood GMA, and the areas outside the former GMUs, which are now included in the South West Limestone GMA area. The PCVs for the four GMUs have not been revoked and still apply. Nullawarre 22,741 ML is the applicable PCV volume in the Hopkins–Corangamite groundwater catchment. The Portland groundwater catchment applicable PCV volumes are Yangery 14,352 ML, Hawkesdale 16,161 ML and Heywood 8,500 ML. None of these area PCVs apply to the Glenelg groundwater catchment.

(6) The 2019–20 'Water extracted' total has been corrected from the previous accounts.

7.6.3 Portland groundwater catchment

The Portland groundwater catchment (Figure 7-17) is in the far south-west of the state and extends inland from the Southern Ocean coast.

Figure 7-17 Portland groundwater catchment



7.6.3.1 Management arrangements

Groundwater resources in the Portland groundwater catchment are managed by Southern Rural Water, which is responsible for developing and implementing groundwater management plans. Southern Rural Water also issues licences for groundwater use, bore construction and surface water diversions, and administers domestic and stock use.

The Portland groundwater catchment contains the Condah WSPA, Portland GMA, South West Limestone GMA and Glenelg WSPA. The area not covered by GMUs is reported as outside management units. The South West Limestone GMA extends into the Hopkins–Corangamite and Glenelg groundwater catchments. The Glenelg WSPA and Portland GMA extend into the Glenelg groundwater catchment. Groundwater resources supply licensed entitlements, domestic and stock use and urban use to 12 towns in the area. Groundwater resources from the Glenelg groundwater catchment also supply Hamilton, Tarrington and Dunkeld. Most groundwater use in the Portland groundwater catchment is for irrigation and urban use, and to a lesser extent, for dairy-wash and industrial purposes.

7.6.3.2 2020–21 groundwater resources overview

Groundwater level trends for 2020–21 were generally stable to rising for most GMUs (Table 7-32). They were stable in the Portland GMA for most of the year, with data unavailable to determine a trend from January to March 2021. The South West Limestone GMA was stable for most of the year, and rising in the last quarter (March to June 2021). Condah WSPA groundwater level trends were rising for the whole of the water year.

Table 7-32 Groundwater level trends, Portland groundwater catchment

Groundwater management unit	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Water supply protection area					
Condah	rising	rising	rising	**rising**	**declining**
Groundwater management area					
Portland	stable	stable	INS-DATA	**stable**	**stable**
South West Limestone (1)	stable	stable	stable	**rising**	**rising**

Notes
(1) The South West Limestone GMA extends into the Hopkins–Corangamite, Portland and Glenelg groundwater catchments.

In 2020–21, 17,809 ML of water was extracted for consumptive purposes, which was less than the 19,597 ML extracted in the previous year. Of this volume, 2,835 ML was for urban use, and 2,178 ML was estimated to be for domestic and stock use.

7.6.3.3 Groundwater compliance and use

Compliance against water entitlements is reported for this groundwater catchment in two areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders.

Portland – Key compliance points

✓ **The volume of entitlements in the catchment did not exceed relevant PCVs.**

- The PCV for the South West Limestone GMA has not been gazetted, and the PCV for the three previous GMUs the Portland groundwater catchment still apply: PCV volumes are Yangery 14,352 ML, Hawkesdale 16,161 ML and Heywood 8,500 ML. The total volume for the combined GMUs is 39,013 ML. The total licensed entitlement volume (35,749 ML) in the South West Limestone GMA in the Portland groundwater catchment did not exceed the combined PCV volume of 39,013 ML.

✓ **The total volume extracted under licences (15,631 ML) was within the volume available for the year (66,803 ML).**

Groundwater licence and use volumes in the Portland groundwater catchment are shown in Table 7-33. Some groundwater licences incorporate domestic and stock use, and in these cases, the use is reported in the licensed volume in Table 7-33. Groundwater provides urban supply for some towns in the Portland groundwater catchment.

Southern Rural Water provide urban groundwater supply to Hamilton, Tarrington and Dunkeld. Although these towns are in the Portland groundwater catchment, the bores that supply the town are in the Glenelg groundwater catchment and are therefore reported in that chapter (chapter 7.6.4).

Table 7-33 Licensed groundwater volumes and use, Portland groundwater catchment

Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML)	Total water available (ML)	Water extracted (ML)
Condah WSPA	Licensed use (non-urban)	7,340	0	7,340	0	**7,340**	**2,386**
	Macarthur urban	130	0	130	0	**130**	**26**
	Domestic & stock	-	-	-	-	-	**102**
Portland GMA	Licensed use (non-urban)	213	0	213	0	**213**	**0**
	Heywood urban	333	0	333	0	**333**	**153**
	Port Fairy urban	1,026	0	1,026	0	**1,026**	**602**
	Portland urban	6,222	0	6,222	0	**6,222**	**1,502**
	Domestic & stock	-	-	-	-	-	**2**
South West Limestone GMA (1) (2)	Licensed use (non-urban)	34,380	10,125	34,721	810	**45,656**	**9,587**
	Koroit urban	524	157	524	0	**681**	**0**
	Warrnambool, Allansford and Koroit (part) urban	750	225	750	0	**975**	**456**
	Domestic & stock	-	-	-	-	-	**1,911**
Outside management units	Licensed use (non-urban)	3,927	0	3,927	0	**3,927**	**822**
	Caramut urban	50	0	50	0	**50**	**26**
	Penshurst urban	250	0	250	0	**250**	**70**
	Domestic & stock	-	-	-	-	-	**164**
Total 2020–21		**55,145**	**10,507**	**55,486**	**810**	**66,803**	**17,809**
Total 2019–20 (3)		55,240	10,654	56,000	334	66,988	19,597

Notes

(1) The South West Limestone GMA extends into the Hopkins–Corangamite and Glenelg groundwater catchments, and an additional 28,366 ML and 17,169 ML of entitlement volume is reported in the Hopkins–Corangamite and Glenelg catchment accounts, respectively (Table 7-31 and Table 7-35). The total entitlement volume for the South West Limestone GMA as of 30 June 2021 was 81,189 ML.

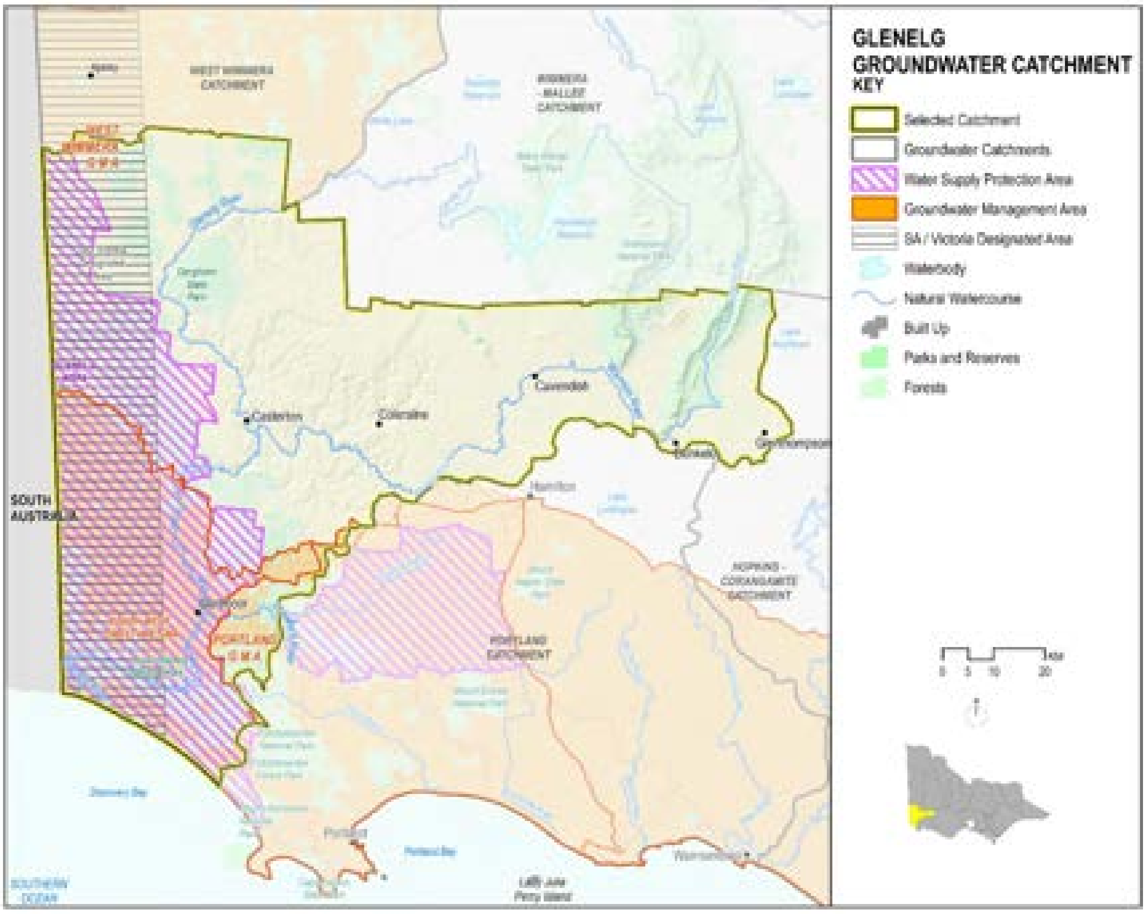
(2) The PCV for the South West Limestone GMA has not been gazetted. The entitlements and use relate to the area defined in the South West Limestone Groundwater Management Area Plan No. LEGL./15-199. The South West Limestone GMA includes the area of the former Nullawarre WSPA, Yangery WSPA, Hawkesdale GMA, Heywood GMA and the areas outside the former GMUs but included within the South West Limestone GMA area. The PCVs for the four GMUs have not been revoked and still apply. Nullawarre 22,741 ML is the applicable PCV volume in the Hopkins–Corangamite groundwater catchment. The applicable PCV volumes in the Portland groundwater catchment are Yangery 14,352 ML, Hawkesdale 16,161 ML and Heywood 8,500 ML. None of these area PCVs apply to the Glenelg groundwater catchment.

(3) The 2019–20 'Water extracted' total has been corrected from the previous accounts.

7.6.4 Glenelg groundwater catchment

The Glenelg groundwater catchment (Figure 7-18) is in the state's far south-west. The Victorian–South Australian border forms the catchment's western boundary. The area that extends 20 km east from the border forms part of the Designated Area for the purposes of the 1985 Border Groundwaters Agreement between Victoria and South Australia.

Figure 7-18 Glenelg groundwater catchment



7.6.4.1 Management arrangements

Groundwater resources in the Glenelg groundwater catchment are managed by Southern Rural Water, which is responsible for developing and implementing groundwater management plans. Southern Rural Water also issues licences for groundwater use, bore construction and surface water diversions, and it administers domestic and stock use. Management responsibilities within the Designated Area are shared between Southern Rural Water and the Government of South Australia.

The Glenelg groundwater catchment contains the Glenelg WSPA, South West Limestone GMA and Portland GMA. The area not covered by GMUs is reported as outside management units. The South West Limestone GMA extends into the Portland and Hopkins–Corangamite groundwater catchments. The Glenelg WSPA and Portland GMA extend into the Portland groundwater catchment. Groundwater resources supply licensed entitlements, domestic and stock use and urban use in Casterton, Dartmoor and Merino. Groundwater resources from the Glenelg groundwater catchment also supply Hamilton, Tarrington and Dunkeld, although these towns are outside the groundwater catchment.

7.6.4.2 2020–21 groundwater resources overview

Groundwater level trends for the Glenelg groundwater catchment for 2020–21 (Table 7-34) were mostly stable throughout the year for both GMUs and rising in the South West Limestone GMA from April to June 2021.

Table 7-34 Groundwater level trends, Glenelg groundwater catchment

Groundwater management unit	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Water supply protection area					
Glenelg	stable	stable	stable	**stable**	**stable**
Groundwater management area					
South West Limestone (1)	stable	stable	stable	**rising**	**rising**

Note

(1) The South West Limestone GMA extends into the Hopkins–Corangamite, Portland and Glenelg groundwater catchments.

In 2020–21, 10,820 ML of water was extracted for consumptive purposes, which was less than the 11,021 ML extracted in the previous year. Of this volume, 398 ML was for urban use, and 653 ML was estimated to be for domestic and stock use.

7.6.4.3 Groundwater compliance and use

Compliance against water entitlements is reported for this groundwater catchment in two areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders.

Glenelg – Key compliance points
✓ **The volume of entitlements in the catchment did not exceed relevant PCVs.** • The PCV for the South West Limestone GMA has not been gazetted, and the PCV for the three previous GMUs in the Portland groundwater catchment still apply: PCV volumes are Yangery 14,352 ML, Hawkesdale 16,161 ML and Heywood 8,500 ML. The total volume for the combined GMUs is 39,013 ML. The total licensed entitlement volume (35,749 ML) in the South West Limestone GMA in the Portland groundwater catchment did not exceed the combined PCV volume of 39,013 ML.
✓ **The total volume extracted under licences (10,168 ML) was within the volume available for the year (39,119 ML).**

Groundwater licence and use volumes in the Glenelg groundwater catchment are shown in Table 7-35. Some groundwater licences incorporate domestic and stock use, and in these cases, the use is reported in the licensed volume in Table 7-35. Groundwater is available for urban supply to Casterton, Dartmoor and Merino.

Southern Rural Water also provide urban groundwater supply to Hamilton, Tarrington and Dunkeld in the Portland groundwater catchment.

Table 7-35 Licensed groundwater volumes and use, Glenelg groundwater catchment

Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML)	Total water available (ML)	Water extracted (ML)
Glenelg WSPA	Licensed use (non-urban)	14,942	0	14,842	0	**14,842**	**5,399**
	Casterton urban	1,000	0	1,000	0	**1,000**	**378**
	Dartmoor urban	150	0	150	0	**150**	**21**
	Domestic & stock	-	-	-	-	-	**470**
South West Limestone GMA (1) (2)	Licensed use (non-urban)	17,169	4,898	17,125	(900)	**21,123**	**4,091**
	Domestic & stock	-	-	-	-	-	**27**
Outside management units	Licensed use (non-urban)	902	0	902	0	**902**	**280**
	Hamilton Tarrington Dunkeld urban (3)	1,102	0	1,102	0	**1,102**	**0**
	Merino urban	0	0	0	0	**0**	**0**
	Domestic & stock	-	-	-	-	-	**156**
Total 2020–21		**35,265**	**4,898**	**35,121**	**(900)**	**39,119**	**10,820**
Total 2019–20 (4)		35,175	4,807	35,278	(900)	39,185	11,021

Notes

(1) The South West Limestone GMA extends into the Hopkins–Corangamite and Portland groundwater catchments, and an additional 28,366 ML and 35,654 ML of entitlement volume is reported in the Hopkins–Corangamite and Portland catchment accounts, respectively (Table 7-31 and Table 7-33). The total entitlement volume for the South West Limestone GMA as of 30 June 2021 was 81,189 ML.

(2) The PCV for the South West Limestone GMA has not been gazetted. The entitlements and use relate to the area defined in the South West Limestone Groundwater Management Area Plan No. LEGL./15-199. The South West Limestone GMA includes the area of the former Nullawarre WSPA, Yangery WSPA, Hawkesdale GMA and Heywood GMA, and the areas outside the former GMUs but included within the South West Limestone GMA area. The PCVs for the four GMUs have not been revoked and still apply. Nullawarre 22,741 ML is the applicable PCV volume in the Hopkins–Corangamite groundwater catchment. The PCV volumes applicable in the Portland groundwater catchment are Yangery 14,352 ML, Hawkesdale 16,161 ML and Heywood 8,500 ML. None of these area PCVs apply to the Glenelg groundwater catchment.

(3) Hamilton, Tarrington and Dunkeld are in the Portland groundwater catchment, but the bores that supply it are in the Glenelg groundwater catchment.

(4) The 2019–20 'Water extracted' total has been corrected from the previous accounts.

7.7 Wimmera–Mallee groundwater management basin

The Wimmera–Mallee groundwater management basin is in north-western Victoria. It borders the Otway–Torquay groundwater management basin to the south and the Goulburn–Murray groundwater management basin to the east. The Wimmera–Mallee groundwater management basin also forms part of the Murray–Darling Basin in Victoria.

The Victorian–South Australian border forms the western boundary of the Wimmera–Mallee groundwater management basin, and the area that extends 20 km east from the border forms part of the Designated Area for the purposes of the 2005 Border Groundwaters Agreement between Victoria and South Australia.

The northern plains of the management basin are dominated by sedimentary aquifers, and the southern area features fractured rock highlands extending along the Great Dividing Range.

As depth increases, the major aquifers in the region are:

- the upper tertiary aquifer including the Parilla Sands Aquifer, also known as the Pliocene Sands Aquifer
- the mid-tertiary aquifer including the Murray Group Limestone Aquifer
- the lower tertiary aquifer, primarily consisting of the Tertiary Confined Sands Aquifer, also known as the Renmark Group Aquifer.

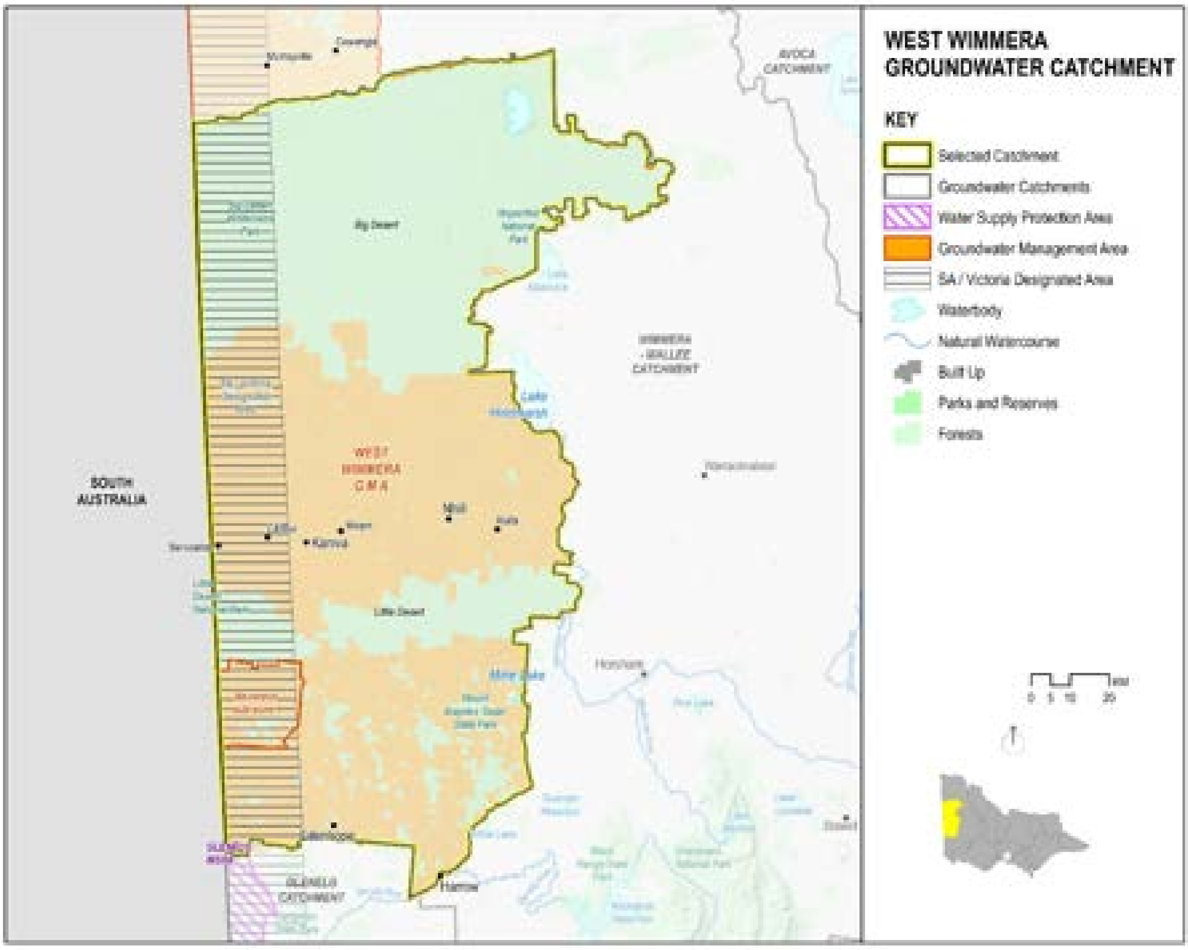
In most areas, all the aquifers are understood to be connected, with thin aquitards between the aquifers in part or all of the catchment. The Renmark Group Aquifer in the West Wimmera GMA is the exception: it is considered to be disconnected from the water above it.

Most groundwater is extracted from the Murray Group Aquifer along the border with South Australia. The water in the Murray group is thought to originate from recharge received during a much wetter period about 20,000 years ago. The contribution of modern recharge is considered to be modest across much of the area and less than the rate of use.

7.7.1 West Wimmera groundwater catchment

The West Wimmera groundwater catchment (Figure 7-19) is in the far west of Victoria. Its western boundary is the Victorian–South Australian border, and the area that extends 20 km east from the border forms part of the Designated Area for the purposes of the 1985 Border Groundwaters Agreement between Victoria and South Australia.

Figure 7-19 West Wimmera groundwater catchment



7.7.1.1 Management arrangements

Groundwater resources in the West Wimmera groundwater catchment are managed by GWMWater, which is responsible for developing and implementing groundwater management plans. GWMWater also issues licences for groundwater use, bore construction and surface water diversions, and it administers domestic and stock use. Management responsibilities within the Designated Area are shared between GWMWater and the Government of South Australia.

The West Wimmera groundwater catchment is fully covered by the West Wimmera GMA. Groundwater resources supply licensed entitlement (irrigation), domestic and stock use and urban use to Apsley, Harrow, Miram, Serviceton, Edenhope, Kiata, Goroke, Lillimur, Kaniva and Nhill.

7.7.1.2 2020–21 groundwater resources overview

In the West Wimmera groundwater catchment, licence holders in the Neuarpur subzone 1 — a trading zone in the West Wimmera GMA — were restricted to 80% of their licence volume in 2020–21.

Groundwater level trends for 2020–21 are shown in Table 7-36. Although groundwater level trends in the West Wimmera GMA were stable for the year, levels in the Neuarpur subzone 1 (in the western part of the catchment) have historically been declining.

Table 7-36 Groundwater level trends, West Wimmera groundwater catchment

Groundwater management unit	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Groundwater management area					
West Wimmera	stable	stable	stable	**stable**	**stable**
West Wimmera – Neuarpur subzone1 (1)	declining	declining	declining	**declining**	**declining**

Note
(1) Restrictions on seasonal allocations are in place to address the trend deviation in the Neuarpur subzone in the West Wimmera GMA.

In 2020–21, 24,597 ML of water was extracted for consumptive purposes, which was less than the 25,330 ML extracted in the previous year. Of this volume, 555 ML was for urban use, and 754 ML was estimated to be for domestic and stock use.

7.7.1.3 Groundwater compliance and use

Compliance against water entitlements is reported for this groundwater catchment in two areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders.

West Wimmera – Key compliance points

- ✓ **The volume of entitlements in the catchment did not exceed relevant PCVs.**
- ✓ **The total volume extracted under licences (23,843 ML) was within the volume available for the year (61,777 ML).**

Groundwater licence and use volumes in the West Wimmera groundwater catchment are shown in Table 7-37. Some groundwater licences incorporate domestic and stock use, and in these cases, the use is reported in the licensed volume in Table 7-37. Groundwater is available for urban supply to Apsley, Edenhope, Goroke, Harrow, Kaniva, Kiata, Lillimur, Miram, Nhill and Serviceton.

Table 7-37 Licensed groundwater volumes and use, West Wimmera groundwater catchment

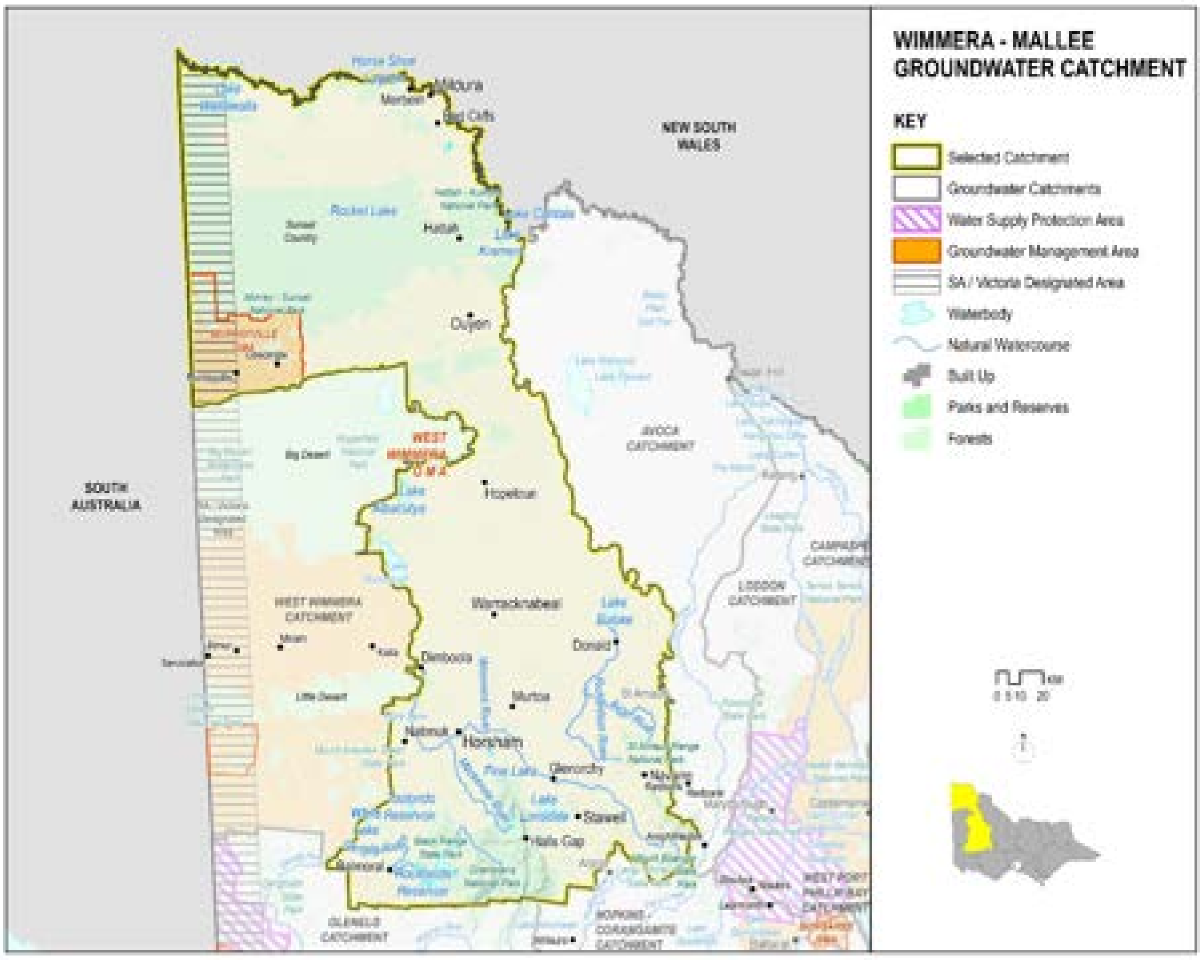
Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML)	Total water available (ML)	Water extracted (ML)
West Wimmera GMA	Licensed use (non-urban)	51,218	11,895	47,100	0	**58,995**	**23,288**
	Apsley urban	40	12	40	0	**52**	**26**
	Edenhope urban	250	75	250	0	**325**	**110**
	Goroke urban	86	26	86	0	**112**	**38**
	Harrow urban	60	18	60	0	**78**	**39**
	Kaniva urban	600	180	600	0	**780**	**152**
	Kiata urban	40	12	40	0	**52**	**5**
	Lillimur urban	32	10	32	0	**42**	**7**
	Miram urban	7	2	7	0	**9**	**0**
	Nhill urban	1,000	300	1,000	0	**1,300**	**170**
	Serviceton urban	25	8	25	0	**33**	**7**
	Domestic & stock	-	-	-	-	-	**754**
Total 2020–21		**53,358**	**12,537**	**49,240**	**0**	**61,777**	**24,597**
Total 2019–20 (1)		53,688	11,363	49,580	0	60,942	25,330

Note
(1) The 2019–20 'Water extracted' total has been corrected from the previous accounts.

7.7.2 Wimmera–Mallee groundwater catchment

The Wimmera–Mallee groundwater catchment (Figure 7-20) is in north-western Victoria.

Figure 7-20 Wimmera–Mallee groundwater catchment



7.7.2.1 *Management arrangements*

Groundwater resources in most of the Wimmera–Mallee groundwater catchment are managed by GWMWater; in the northern area, they are managed by Lower Murray Water. Each is responsible for developing and implementing groundwater management plans for their area of the catchment. For their sections, Lower Murray Water issues and administers groundwater licences in its northern area. GWMWater issues licences for groundwater use, bore construction and surface water diversions, and it administers domestic and stock use. The Wimmera–Mallee groundwater catchment forms part of the Murray–Darling Basin, and groundwater management arrangements are subject to the requirements of the Murray–Darling Basin Plan. Management responsibilities within the Designated Area are shared between GWMWater and the Government of South Australia.

The Wimmera–Mallee groundwater catchment contains the Murrayville GMA. The area not covered by Murrayville GMA is reported as outside management units. Groundwater resources supply licensed entitlements, domestic and stock use and urban use to Cowangie, Landsborough, Murrayville and Willaura, and they provide a backup urban supply for Horsham. Groundwater resources from the Wimmera–Mallee groundwater catchment also supply Willaura, although it is outside the groundwater catchment.

7.7.2.2 *2020–21 groundwater resources overview*

The groundwater level trend in the Murrayville GMA for 2020–21 was stable (Table 7-38).

Table 7-38 Groundwater level trends, Wimmera–Mallee groundwater catchment

Groundwater management unit	Groundwater level trend 2020–21				Groundwater level trend June 2020
	Sep-20	Dec-20	Mar-21	Jun-21	
Groundwater management area					
Murrayville	stable	stable	stable	**stable**	**stable**

In 2020–21, 6,823 ML of water was extracted for consumptive purposes, which was more than the 6,151 ML extracted in the previous year. Of this volume, 359 ML was for urban use, and 342 ML was estimated to be for domestic and stock use.

7.7.2.3 Groundwater compliance and use

Compliance against water entitlements is reported for this groundwater catchment in two areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders.

Wimmera–Mallee – Key compliance points	
✓	**The volume of entitlements in the catchment did not exceed relevant PCVs.**
✓	**The total volume extracted under licences (6,471 ML) was within the volume available for the year (19,075 ML).**

Groundwater licence and use volumes in the Wimmera–Mallee groundwater catchment are shown in Table 7-39. Some groundwater licences incorporate domestic and stock use, and in these cases, the use is reported in the licensed volume in Table 7-39. Groundwater provides urban supply to Cowangie, Landsborough, Murrayville and Willaura and a backup urban supply for Horsham.

Table 7-39 Licensed groundwater volumes and use, Wimmera–Mallee groundwater catchment

Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML)	Total water available (ML)	Water extracted (ML)
Murrayville GMA	Licensed use (non-urban)	9,240	2,487	9,240	0	**11,726**	**6,014**
	Cowangie urban	40	12	40	0	**52**	**4**
	Murrayville urban	475	143	475	0	**618**	**132**
	Domestic & stock	-	-	-	-	-	**76**
Outside management unit	Licensed use (non-urban)	5,109	0	5,109	0	**5,109**	**107**
	Horsham Mt Zero urban	1,200	0	1,200	0	**1,200**	**11**
	Landsborough urban	150	0	150	0	**150**	**36**
	Willaura urban (1)	220	0	220	0	**220**	**166**
	Domestic & stock	-	-	-	-	-	**266**
Total 2020–21		**16,434**	**2,641**	**16,434**	**0**	**19,075**	**6,813**
Total 2019–20 (2)		16,445	1,865	16,445	0	18,309	6,151

Notes

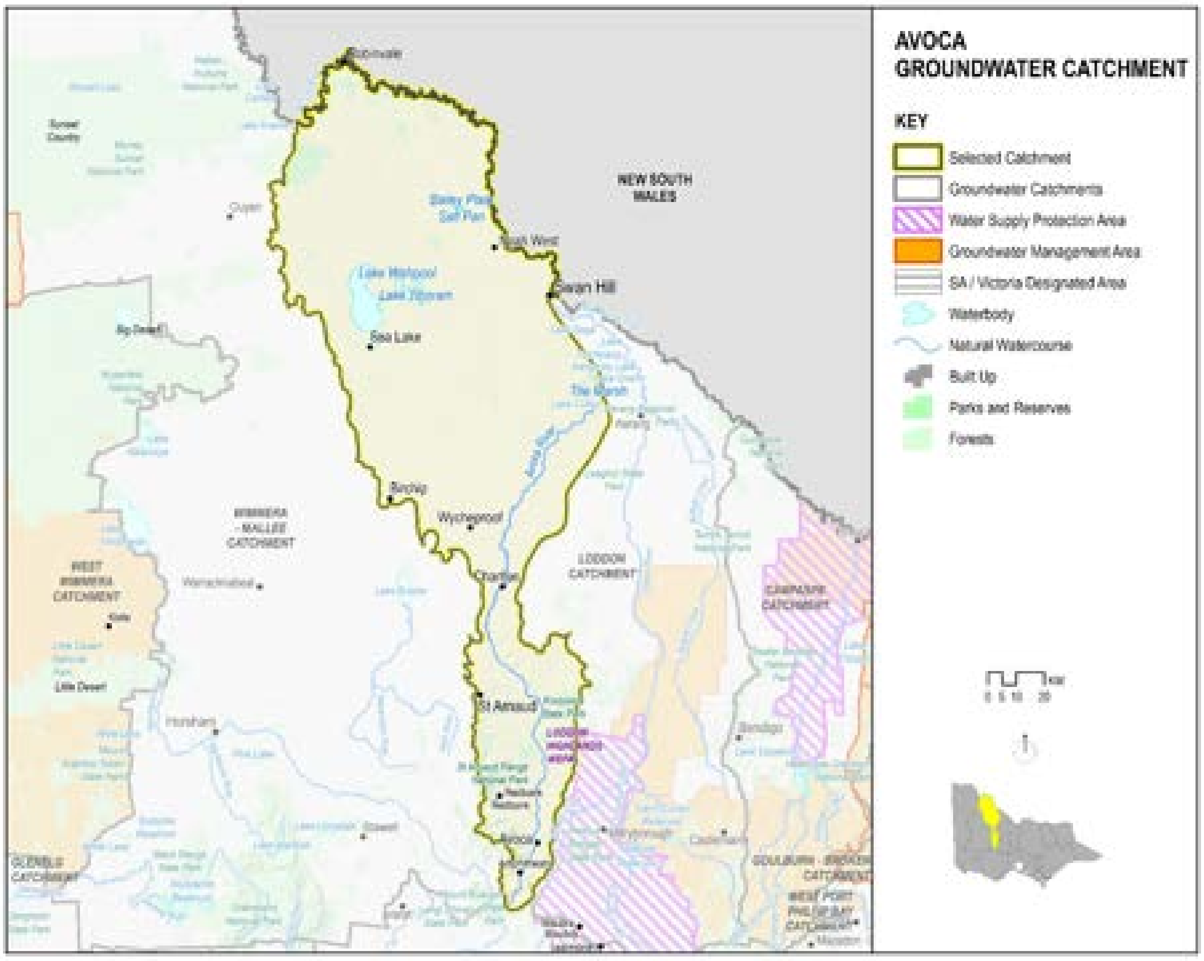
(1) Willaura is in the Hopkins–Corangamite groundwater catchment, but the bores that supply it are in the Wimmera–Mallee groundwater catchment at Mafeking.

(2) The 2019–20 'Water extracted' total has been corrected from the previous accounts.

7.7.3 Avoca groundwater catchment

The Avoca groundwater catchment is in north-western Victoria (Figure 7-21), and its northern boundary is the Murray River.

Figure 7-21 Avoca groundwater catchment



7.7.3.1 Management arrangements

Groundwater resources in most of the Avoca groundwater catchment are managed by GWMWater; in the northern area, they are managed by Lower Murray Water. Each is responsible for developing and implementing groundwater management plans for their area of the catchment. Lower Murray Water issues and administers groundwater licences in its northern area. GWMWater issues licences for groundwater use, bore construction and surface water diversions, and it administers domestic and stock use. Groundwater resources supply licensed entitlements, domestic and stock use and urban use to Amphitheatre, Avoca and Redbank. Groundwater resources from the Loddon groundwater catchment also supply Avoca. The Avoca groundwater catchment forms part of the Murray–Darling Basin, and groundwater management arrangements are subject to the requirements of the Murray–Darling Basin Plan.

The Avoca groundwater catchment does not contain any GMAs or WSPAs: all licence volume is reported as outside management units.

7.7.3.2 2020–21 groundwater resources overview

In 2020–21, 858 ML of water was extracted for consumptive purposes, which was less than the 1,678 ML extracted in the previous year. Of this volume, 5 ML was for urban use, and 62 ML was estimated to be for domestic and stock use.

7.7.3.3 Groundwater compliance and use

Compliance against water entitlements is reported for this groundwater catchment in two areas:

- **entitlement issued:** the volume of entitlements issued in the catchment does not exceed relevant PCVs or has not increased without appropriate approvals
- **water extracted:** the volume of water taken under entitlements during the year does not exceed the total water available to licence holders.

Avoca – Key compliance points	
✓	**The volume of entitlements in the catchment did not exceed relevant PCVs.**
✓	**The total volume extracted under licences (797 ML) was within the volume available for the year (2,985 ML).**

Groundwater licence and use volumes in the Avoca groundwater catchment are shown in Table 7-40. Some groundwater licences incorporate domestic and stock use, and in these cases, the use is reported in the licensed volume in Table 7-40. Groundwater provides urban supply to two towns in the Avoca groundwater catchment.

Goulburn-Murray Water provides urban groundwater supply to Avoca. Although Avoca is in the Avoca groundwater catchment, the bores that supply the town are in the Loddon groundwater catchment and are therefore reported in that chapter (chapter 7.3.5).

Table 7-40 Licensed groundwater volumes and use, Avoca groundwater catchment

Groundwater management unit	Use type	Licensed entitlement (ML/year)	Carryover (ML)	Licensed volume allocated (ML)	Net trade (ML)	Total water available (ML)	Water extracted (ML)
Outside management unit	Licensed use (non-urban)	2,915	0	2,915	0	**2,915**	**791**
	Amphitheatre urban	20	0	20	0	**20**	**2**
	Redbank urban	50	0	50	0	**50**	**4**
	Domestic and stock use	-	-	-	-	-	**62**
Total 2020–21		**2,985**	**0**	**2,985**	**0**	**2,985**	**859**
Total 2019–20 (1)		2,985	0	2,985	0	2,985	1,678

Note
(1) The 2019–20 ‘Water extracted’ total has been corrected from the previous accounts.

Appendix A: Estimated evapotranspiration

Introduction

Evapotranspiration is the sum of transpiration by plants plus evaporation from soil, open water surfaces and the wet surfaces of plants soon after rainfall. This appendix presents modelled basin estimates of evapotranspiration for 2020–21.

The evapotranspiration and rainfall estimates reported in this appendix have been calculated by the Bureau of Meteorology using the Australian Landscape Water Balance model (AWRA-L) [7].

The AWRA-L evapotranspiration output used is "E_{tot}" — the modelled landscape actual evapotranspiration, or the total evapotranspiration from vegetation, soil and groundwater.

The adoption of AWRA-L outputs to report on evapotranspiration and rainfall for 2020–21 follows the method used in the *Victorian Water Accounts 2019–20*. However, before 2019–20, the Victorian Water Accounts used evapotranspiration estimates based on results from the SoilFlux model, a one-dimensional water balance model. The *Victorian Water Accounts 2019–20* documented a comparison of the new and old methods and reported that there was no obvious negative or positive bias when comparing the data.

The AWRA-L approach has thus been adopted due to the availability and ease of use of AWRA-L model outputs, as well as the quality of the documentation that the Bureau of Meteorology provides to support the Australian Landscape Water Balance model.

More information is available at www.bom.gov.au/water/landscape.

Evapotranspiration in 2020–21

Evapotranspiration amounts vary considerably across Victoria depending on a range of factors including water availability. Averaged across Victoria as a whole, evapotranspiration in 2020–21 was estimated to be 561 mm, which is about 2% above the long-term average calculated based on a post-1975 historic climate reference period.

Modelled estimates of basin evapotranspiration are presented in Figure A-1. Evapotranspiration is presented in terms of millimetres per unit area, to allow for direct comparison between basins of different sizes.

Figure A-1 shows that estimated annual evapotranspiration in 2020–21 was within +/- 10% of the long-term average for most Victorian basins, with two exceptions. The Mallee and Avoca basins experienced a greater-than-10% reduction in estimated annual evapotranspiration relative to the long-term average, due to dry conditions. At the other end of the scale, the Corangamite, Hopkins and Moorabool basins showed a greater-than-10% increase in estimated annual evapotranspiration relative to the long-term average. However, in general, the estimated annual evapotranspiration for most basins was greater than the long-term average. This is because of above-average rainfall over the reporting period.

Figure A-2 shows evapotranspiration as a proportion of rainfall in Victoria's basins. Averaged across the state in 2020–21, the evapotranspiration-to-rainfall ratio was less than the long-term average, which was consistent with above-average rainfall generally being observed. Within this state average, the basins in northern Victoria tended to have a higher evapotranspiration-to-rainfall ratio than the long-term average and the basins in the state's far east to have a lower ratio.

[7] http://www.bom.gov.au/water/landscape/assets/static/publications/AWRALv6_Model_Description_Report.pdf

Figure A-1 Modelled evapotranspiration per unit area

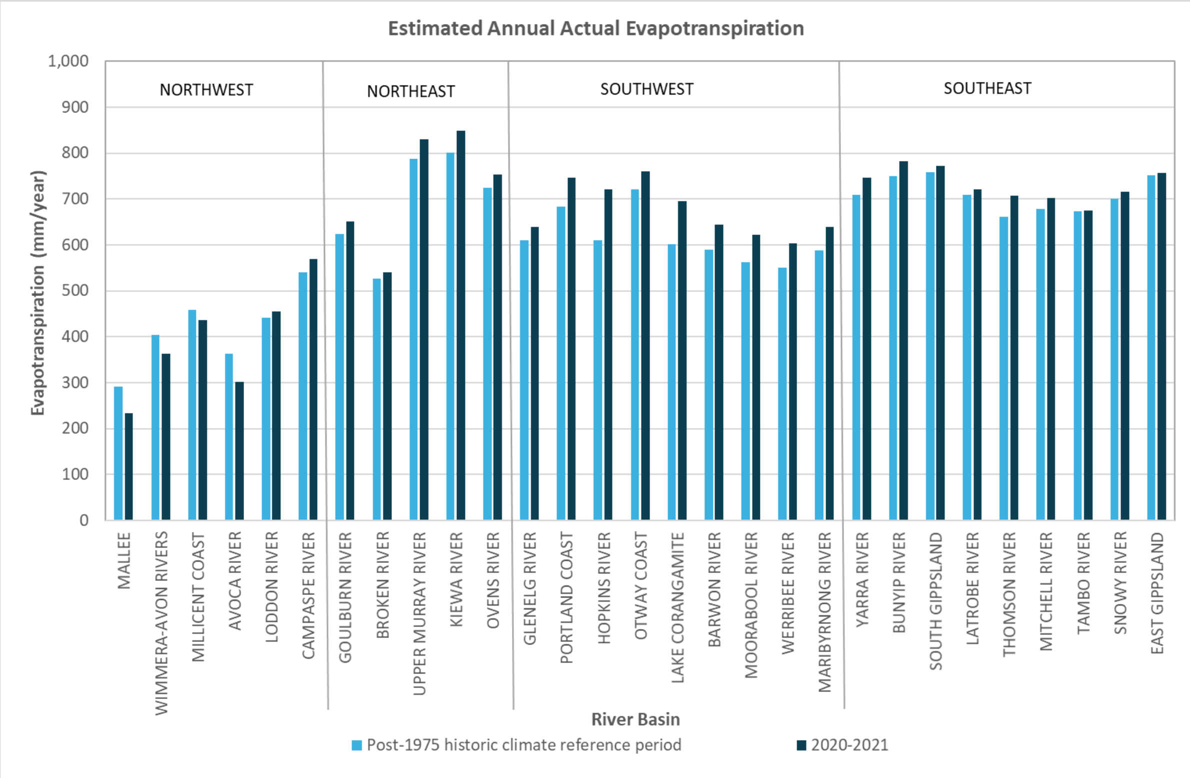
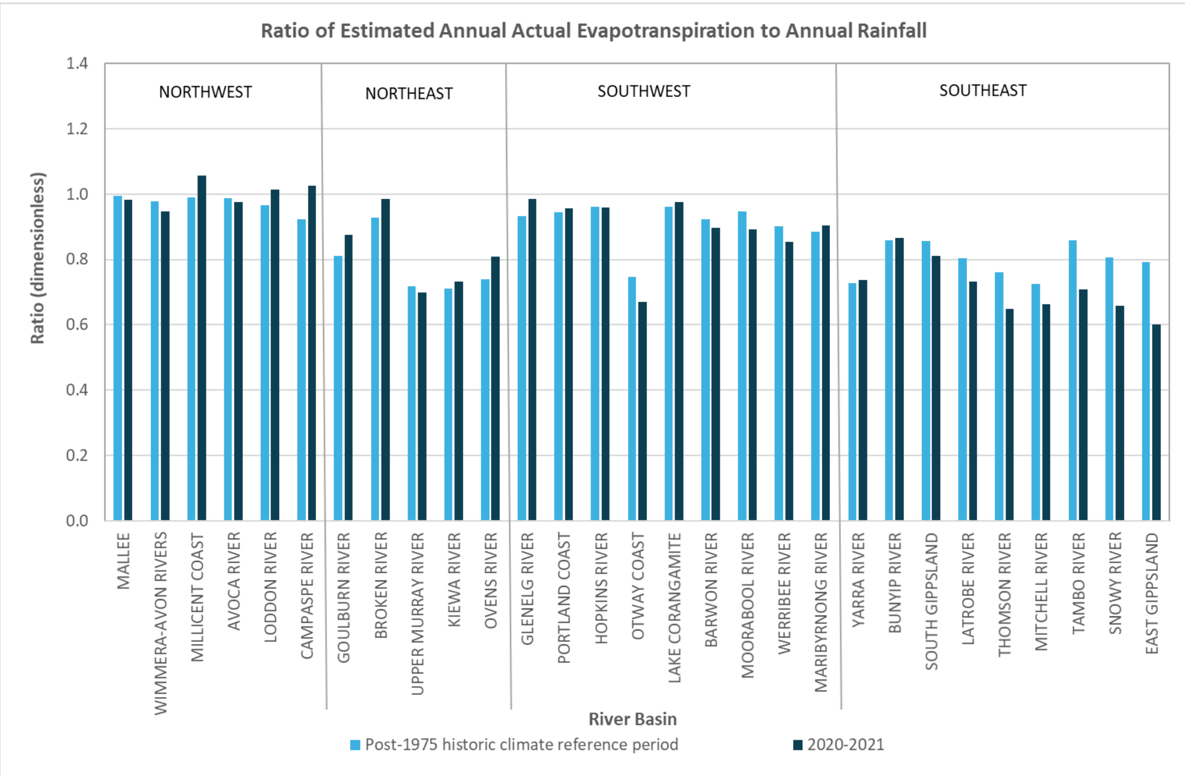


Figure A-2 Modelled evapotranspiration as a percentage of rainfall



North-western Victoria (Mallee to Campaspe basins)

Dry conditions over north-western Victoria in 2019–20 resulted in estimates of evapotranspiration that were generally below average for the north-western basins, except for the Loddon and Campaspe basins. The estimated evapotranspiration ranged from 230 mm in the Mallee basin to 570 mm in the Campaspe basin. Comparisons with the long-term average ranged from 20% below average in the Mallee basin to 5% above average in the Campaspe basin (Figure A-1).

In 2020–21, evapotranspiration as a proportion of rainfall in the north-western basins was generally about the same or greater than the long-term average. The Millicent Coast basin was estimated to have the north-west's highest evapotranspiration as a proportion of rainfall: 106% compared to the long-term average of 99%. The lowest was in the Wimmera basin: 95% compared to the long-term average of 98% (Figure A-2).

North-east Victoria (Goulburn to Upper Murray basins)

Rainfall over north-eastern Victoria in 2020–21 varied, with some basins receiving more rain and others less rain than the long-term average, although all were within +/- 8%. The estimates of evapotranspiration were above average for the north-eastern basins. The estimated evapotranspiration ranged from 540 mm in the Broken basin to 850 mm in the Kiewa basin. Comparisons with the long-term average showed higher rates of evapotranspiration in 2020–21 across all basins, ranging from between 2–6% above average (Figure A-1).

In 2020–21, evapotranspiration as a proportion of rainfall in the north-eastern basins was generally about the same or greater than the long-term average. The Broken basin was estimated to have had the north-east's highest evapotranspiration as a proportion of rainfall: 98% compared to the long-term average of 93%. The lowest was in the Upper Murray basin: 70% compared to the long-term average of 72% (Figure A-2).

South-western Victoria (Maribyrnong to Glenelg basins)

Rainfall over south-western Victoria in 2020–21 was generally more than the long-term average. The exception was the Glenelg basin, which received a marginal 1% less than the long-term average. Rainfall in the other south-western basins was between 6–19% more than average. The estimated evapotranspiration was also greater than the average. Comparisons with the long-term average ranged from 5–18% above average (Figure A-1). The 2020–21 estimated evapotranspiration values ranged from 600 mm in the Werribee basin to 760 mm in the Otway Coast basin.

In 2020–21, evapotranspiration as a proportion of rainfall in the south-western basins compared to the long-term average was mixed. All evapotranspiration-to-rainfall ratios were within +/- 8% of the average. The Glenelg basin was estimated to have the south-west's highest evapotranspiration as a proportion of rainfall: 99% compared to the long-term average of 93%. The lowest was in the Otway Coast basin: 67% compared to the long-term average of 75% (Figure A-2).

South-eastern Victoria (East Gippsland to Yarra basins)

It was a wet year in south-eastern Victoria; rainfall in 2020–21 was above average by 3–33%. The basins in the far east received the most rainfall, with the East Gippsland basin receiving 33% more than the long-term average. Similarly, the estimated evapotranspiration rates were higher than average, ranging from between 0–7% above the long-term average (Figure A-1). Estimated evapotranspiration ranged from 675 mm in the Tambo basin to 780 mm in the Bunyip basin.

In 2020–21, evapotranspiration as a proportion of rainfall was low across all south-eastern basins. The Bunyip basin was estimated to have the south-east's highest evapotranspiration as a proportion of rainfall: 87% compared to the long-term average of 86%. The lowest was in the East Gippsland basin: 60% compared to the long-term average of 79% (Figure A-2).

Key assumptions and data limitations

The estimates of evapotranspiration presented in this appendix are based on results from the Bureau of Meteorology's Australian Landscape Water Balance model (AWRA-L)[8].

Modelling evapotranspiration requires many approximations and assumptions that qualify the accuracy of the estimates. Major assumptions and limitations of the method used to derive the above estimates of evapotranspiration include:

- representing the landscape as only two land use types: shallow and deep-rooted vegetation
- not explicitly accounting for actual evapotranspiration in urban, rocky or irrigated areas or over reservoirs and lakes.

The basin areas used to report evapotranspiration estimates are slightly different to those used for reporting in the basin water accounts in chapter 6. In the basin water accounts, the Murray basin captures information about Murray River irrigation districts in the Mallee, Avoca, Loddon, Campaspe, Goulburn and Broken basins. For evapotranspiration reporting, these irrigation districts are included within their host river basin (for example, the Mildura Irrigation District is in the Mallee basin). However, as noted above, the evapotranspiration estimates do not account for water applied by irrigation.

[8] Information about the assumptions of the AWRA-L model can be found in Frost et al. (2016): http://www.bom.gov.au/water/landscape/assets/static/publications/AWRALv6_Model_Description_Report.pdf

Appendix B: Storage levels

Basin	Reservoir	On-stream / Off-stream	Storage capacity (ML)	% full at 1 July 2020	% full at 30 June 2021
Murray	Lake Dartmouth (Victoria's share)	On-stream	1,928,116	49%	69%
	Lake Hume (Victoria's share)	On-stream	1,502,579	37%	54%
	Lake Victoria (Victoria's share)	On-stream	338,500	88%	56%
	Menindee Lakes (Victoria's accessible share)	On-stream	865,500	0%	55%
	Kangaroo Lake	Off-stream	39,200	80%	81%
	Kow Swamp	Off-stream	51,710	80%	73%
	Lake Boga	Off-stream	37,000	82%	70%
	Lake Charm	Off-stream	22,000	92%	86%
	Lake Cullulleraine	Off-stream	5,270	84%	84%
Kiewa	Lake Guy	On-stream	1,416	47%	35%
	Rocky Valley	On-stream	28,294	62%	59%
	Clover Pondage	Off-stream	255	37%	104%
	Pretty Valley basin	Off-stream	355	100%	100%
Ovens	Lake Buffalo	On-stream	23,340	61%	62%
	Lake William Hovell	On-stream	13,690	102%	101%
Broken	Lake Nillahcootie	On-stream	40,400	67%	75%
	Loombah McCall-Say	On-stream	1,747	100%	84%
Goulburn	Goulburn Weir	On-stream	25,500	80%	86%
	Lake Eildon	On-stream	3,334,158	49%	58%
	Sunday Creek Reservoir	On-stream	1,650	68%	99%
	Greens Lake	Off-stream	32,500	32%	20%
	Waranga basin	Off-stream	432,360	86%	59%
Campaspe	Campaspe Weir	On-stream	2,624	103%	103%
	Lake Eppalock	On-stream	304,651	38%	36%
	Lauriston Reservoir	On-stream	19,790	83%	92%
	Malmsbury Reservoir	On-stream	12,034	20%	26%
	Upper Coliban Reservoir	On-stream	37,770	84%	94%
Loddon	Cairn Curran Reservoir	On-stream	147,130	39%	39%
	Hepburn Lagoon	On-stream	2,424	65%	77%
	Laanecoorie Reservoir	On-stream	8,000	37%	42%
	Newlyn Reservoir	On-stream	3,012	57%	85%
	Tullaroop Reservoir	On-stream	72,950	60%	40%
	Evansford Reservoir	Off-stream	1,346	61%	79%
	Sandhurst Reservoir	Off-stream	2,595	84%	76%
	Spring Gully Reservoir	Off-stream	1,680	61%	62%
East Gippsland	None	-	-	-	-
Snowy	None	-	-	-	-
Tambo	None	-	-	-	-
Mitchell	None	-	-	-	-
Thomson	Lake Glenmaggie	On-stream	177,640	79%	79%

	Thomson Reservoir	On-stream	1,068,000	60%	74%
Latrobe	Blue Rock Lake	On-stream	198,280	100%	100%
	Lake Narracan	On-stream	7,230	66%	70%
	Moondarra Reservoir	On-stream	30,458	100%	100%
South Gippsland	Candowie Reservoir	On-stream	4,463	100%	100%
	Hyland Reservoir	On-stream	671	100%	86%
	Lance Creek Reservoir	On-stream	4,200	100%	98%
	Western Reservoir	On-stream	1,137	100%	85%
Bunyip	Tarago Reservoir	On-stream	37,580	84%	101%
Yarra	Maroondah Reservoir	On-stream	22,179	100%	96%
	O'Shannassy Reservoir	On-stream	3,123	83%	100%
	Upper Yarra Reservoir	On-stream	200,579	39%	63%
	Yan Yean Reservoir	On-stream	30,266	86%	89%
	Cardinia Reservoir	Off-stream	286,911	73%	72%
	Greenvale Reservoir	Off-stream	26,839	81%	84%
	Silvan Reservoir	Off-stream	40,445	88%	90%
	Sugarloaf Reservoir	Off-stream	96,253	94%	87%
Maribyrnong	Rosslynne Reservoir	On-stream	25,368	22%	40%
Werribee	Djerriwarrh Reservoir	On-stream	1,014	72%	100%
	Melton Reservoir	On-stream	14,364	71%	101%
	Merrimu Reservoir (total)	On-stream	32,516	33%	47%
	Pykes Creek Reservoir	On-stream	22,119	82%	100%
Moorabool	Bostock Reservoir	On-stream	7,360	55%	87%
	Korweinguboora Reservoir	On-stream	2,327	52%	44%
	Lal Lal Reservoir	On-stream	59,549	84%	87%
	Moorabool Reservoir	On-stream	6,192	55%	57%
	Wilsons Reservoir	On-stream	1,010	14%	18%
	Upper Stony Creek Reservoir	Off-stream	9,494	75%	65%
Barwon	Gong Gong Reservoir	On-stream	1,902	39%	49%
	West Barwon Reservoir	On-stream	22,064	22%	90%
	White Swan Reservoir	On-stream	14,107	75%	87%
	Wurdee Boluc Reservoir	Off-stream	40,032	54%	62%
Corangamite	None	-	-	-	-
Otway Coast	West Gellibrand Reservoir	On-stream	1,860	93%	100%
Hopkins	None	-	-	-	-
Portland Coast	None	-	-	-	-
Glenelg	Konongwootong Reservoir	On-stream	1,920	94%	93%
	Moora Moora Reservoir	On-stream	6,300	43%	56%
	Rocklands Reservoir	On-stream	296,000	24%	23%
Millicent Coast	None	-	-	-	-
Wimmera	Fyans Lake	On-stream	18,460	74%	73%
	Green Lake	On-stream	5,350	44%	20%
	Lake Bellfield	On-stream	78,560	62%	56%
	Lake Lonsdale	On-stream	53,300	13%	5%
	Taylors Lake	On-stream	27,060	40%	50%

	Toolondo Reservoir	On-stream	50,530	16%	8%
	Wartook Reservoir	On-stream	29,300	37%	34%
Mallee	None	-	-	-	-
Avoca	None	-	-	-	-
Total			**12,405,858**		

Appendix C: Groundwater entitlement and use

Groundwater management unit	PCV (ML)	Licences			Domestic and stock		Total use (licensed + domestic and stock)
		Licensed entitlement (ML)	No. of licences	Metered use (ML)	No. of domestic and stock bores [1]	Estimated use (ML) [2]	
Goulburn-Murray Water							
Water supply protection areas							
Katunga [3]	60,577	60,203	265	**26,133**	746	**1,492**	**27,625**
Loddon Highlands [4]	20,697	20,502	184	**4,534**	405	**810**	**5,344**
Lower Campaspe Valley [5]	55,875	55,860	133	**33,050**	372	**744**	**33,794**
Upper Ovens River [6]	n/a	3,605	98	**919**	135	**270**	**1,189**
Groundwater management areas							
Barnawartha	2,100	375	4	**3**	32	**64**	**67**
Broken	3,732	2,986	68	**507**	343	**686**	**1,193**
Central Victorian Mineral Springs	6,024	5,076	140	**872**	1,056	**2,112**	**2,984**
Eildon	1,496	645	26	**180**	303	**606**	**786**
Kiewa	3,852	3,109	100	**397**	225	**450**	**847**
Lower Ovens [7]	25,200	19,877	269	**5,712**	991	**1,982**	**7,694**
Mid Goulburn	12,470	12,375	66	**2,531**	127	**254**	**2,785**
Mid Loddon	34,037	33,927	104	**17,515**	152	**304**	**17,819**
Shepparton Irrigation Region [8] [9]	n/a	185,737	1,060	**91,567**	997	**1,994**	**93,561**
Strathbogie	1,660	1,373	57	**469**	223	**446**	**915**
Upper Goulburn	8,568	6,119	116	**868**	508	**1,016**	**1,884**
Upper Murray	7,674	3,532	74	**466**	200	**400**	**866**
West Goulburn [10]	n/a	3,037	44	**920**	67	**134**	**1,054**
Outside management units							
Goulburn-Murray Water	n/a	14,680	98	**2,839**	721	**1,442**	**4,281**
GWMWater							
Groundwater management areas							
Murrayville	11,005	9,755	38	**6,151**	38	**76**	**6,227**
West Wimmera [11] [12]	57,409	53,358	164	**23,843**	377	**754**	**24,597**
Outside management units							
GWMWater	n/a	9,601	50	**1,117**	164	**328**	**1,445**
Southern Rural Water							
Water supply protection areas							
Condah	7,475	7,470	33	**2,413**	68	**102**	**2,515**
Deutgam [13]	5,100	5,082	148	**338**	39	**59**	**397**
Glenelg [20]	33,262	16,092	33	**5,797**	313	**470**	**6,267**
Koo Wee Rup	12,915	12,566	339	**3,123**	428	**642**	**3,765**
Sale	21,238	21,203	114	**10,697**	230	**345**	**11,042**
Warrion	14,086	14,075	130	**2,586**	113	**170**	**2,756**
Yarram	25,690	25,688	86	**9,677**	224	**336**	**10,013**
Groundwater management areas							
Bungaree	5,334	5,293	99	**1,826**	100	**150**	**1,976**
Cardigan	3,967	3,889	21	**785**	66	**99**	**884**
Colongulac	4,695	4,404	65	**853**	53	**80**	**932**
Corinella	2,550	662	13	**14**	32	**48**	**62**
Cut Paw Paw	3,650	523	4	**0**	3	**5**	**5**

Denison (14)	18,502	18,499	121	**4,175**	71	**107**	**4,282**
Frankston	3,200	2,542	27	**534**	34	**51**	**585**
Gellibrand (15)	0	0	0	**0**	0	**0**	**0**
Gerangamete (16)	239	238	3	**65**	3	**5**	**70**
Giffard	5,689	5,689	19	**2,366**	78	**117**	**2,483**
Glenormiston	2,698	2,636	45	**1,180**	36	**54**	**1,234**
Jan Juc (17)	14,250	14,250	3	**245**	4	**6**	**251**
Lancefield	1,485	1,378	15	**148**	38	**57**	**205**
Leongatha	6,500	1,803	33	**29**	32	**48**	**77**
Merrimu	451	8	1	**0**	9	**14**	**14**
Moe	8,200	3,762	96	**416**	82	**123**	**539**
Moorabbin	2,700	2,624	53	**667**	170	**255**	**922**
Nepean (12)	6,110	6,110	77	**2,953**	1,802	**1,802**	**4,755**
Newlingrook	1,977	1,958	6	**21**	1	**2**	**22**
Orbost	1,217	1,217	4	**59**	3	**5**	**63**
Paaratte	4,606	3,159	1	**281**	1	**2**	**283**
Portland	7,795	7,794	8	**2,257**	1	**2**	**2,259**
Rosedale (11) (18)	22,372	22,272	72	**6,319**	111	**167**	**6,486**
South West Limestone (19) (20)	n/a	81,189	829	**24,651**	1,771	**2,657**	**27,308**
Stratford (11) (18)	27,686	37,434	15	**24,019**	12	**24**	**24,043**
Tarwin	1,300	58	4	**6**	270	**405**	**411**
Wa De Lock (11) (14)	30,795	29,124	251	**4,110**	253	**380**	**4,490**
Wandin Yallock	3,027	3,025	192	**425**	37	**56**	**481**
Wy Yung (11)	7,463	7,462	53	**367**	7	**11**	**378**
Outside management units (14)							
Southern Rural Water	n/a	71,372	1,342	**11,882**	3,960	**5,940**	**17,822**
Total 2020–21	**n/a**	**948,278**	**7,513**	**345,878**	**18,637**	**31,152**	**377,030**
Total 2019–20	n/a	948,037	7,520	406,438	19,287	32,212	438,649

Notes

(1) The 2019–20 Domestic & stock and Total use volumes have been corrected from the previous accounts.

(2) The number of domestic and stock bores includes all bores registered in the Water Measurement Information System that are less than 30 years old. Bore depths (where recorded) have been considered to ensure that domestic and stock bores are assigned to the appropriate GMU where management units overlap. The number of bores that are active or used is not known. Domestic and stock use is estimated as 2 ML per bore except for the Southern Rural Water GMUs, where 1.5 ML per bore has been assigned (unless otherwise noted) and the Nepean GMA, where 1 ML per bore is assigned.

(3) Licences in Katunga WSPA were restricted to 70% of entitlement as per the rules in the management plan.

(4) Licences in the Loddon Highlands WSPA Newlyn zone were restricted to 75% of entitlement, and those in the Blampied Zone would start the year with a 75% allocation, which later increased to 100% after the resource had recovered sufficiently, as per the rules in the management plan.

(5) Licences in the Lower Campaspe Valley WSPA (Barnadown, Elmore-Rochester, Bamawn and Echuca zones) were restricted to 75% of entitlement, as per the rules of the management plan.

(6) There is no PCV set for the Upper Ovens River WSPA. However, the management plan for the Upper Ovens River WSPA prevents additional entitlements or an increase in entitlement volume from being issued, but it allows trade.

(7) A moratorium on granting new licences applies in the Lower Ovens GMA while the management plan is being reviewed.

(8) There is no PCV set for the Shepparton Irrigation Region GMA.

(9) Groundwater use in the Shepparton Irrigation Region GMA is estimated using a method that considers annual use by a subset of Shepparton Irrigation Region GMA licensed groundwater users that are metered, the volume of metered groundwater use in the Katunga WSPA, and spring rainfall.

(10) There is no PCV set for the West Goulburn GMA. However, individual management zone limits have been set in the *West Goulburn GMA Local Management Plan*. The limits are 1,000 ML for the Kyabram Zone, 2,500 ML for the Puckapunyal Zone, 500 ML for the Cornella Zone and 500 ML for the Corop Lakes Zone.

(11) The PCV figure reported is the sum of the PCVs for each of the zones within the respective GMAs for West Wimmera GMA, Wy Yung GMA, Nepean GMA, Rosedale GMA, Stratford GMA and Wa De Lock GMA. No PCV has been set for the whole of each area.

(12) Licences in West Wimmera GMA (Neuarpur subzone 1) were restricted to 80% of entitlement, as per the rules of the management plan.

(13) Licences in the Deutgam WSPA were restricted to 50% of entitlement.

(14) The reported values of metered use include the salinity control in the following GMAs: Denison GMA 446 ML, Wa De Lock GMA 195 ML and Central Gippsland outside management units 871 ML.

(15) The PCV for the Gellibrand GMA was set at 0 ML on 26 June 2019.

(16) The PCV for the Gerangamete GMA was amended from 20,000 ML to 239 ML on 26 June 2019. The decrease was due to the non-renewal of Barwon Water's 20,000 ML licence.

(17) PCVs are set for zones and aquifers in the Jan Juc GMA but not for the whole GMA. The PCV for Zone 1 all formations is 250 ML, Zone 2 Upper Eastern View formation is 4,000 ML and Zone 2 Lower Eastern View formation is 35,000 ML in any five-year period and zone 2 all formations below the Lower Eastern formation is 0 ML. The Jan Juc bulk entitlement, which applies to Zone 2 Lower Eastern View formation, provides for a five-year total extraction of 35,000 ML with a maximum annual extraction of 10,000 ML. The PCV reported is a notional volume (14,250 ML) for the sum of the annual limits.

(18) The reported values of licensed entitlement and metered use for the Rosedale and Stratford GMAs include metered extractions for the Latrobe Valley coal mines (Rosedale GMA 9,304 ML entitlement and 1,265 ML use, and Stratford GMA 36,207 ML entitlement and 23,964 ML use).

(19) There is no PCV set for the South West Limestone GMA. The entitlements and use relate to the area defined in the *South West Limestone Local Management Plan*, which covers and includes the following GMUs and their PCVs: Nullawarre (22,741 ML), Yangery (14,352 ML), Hawkesdale (16,161 ML) and Heywood (8,500 ML).

(20) Some licences (approximately 14,000 ML) that are registered as in the South West Limestone GMA are located in the Glenelg WSPA. This is where these two areas overlap. It is noted therefore that the licence volume for Glenelg WSPA should be approximately 30,000 ML, rather than 16,092 ML.

Appendix D: Bulk entitlement holders

Basin	Entitlements	Holder
Murray	Bulk Entitlement (Corryong) Conversion Order 2000	North East Water
	Bulk Entitlement (Cudgewa) Conversion Order 2000	North East Water
	Bulk Entitlement (Dartmouth) Conversion Order 2000	North East Water
	Bulk Entitlement (Omeo) Conversion Order 2008	East Gippsland Water
	Bulk Entitlement (River Murray – City West Water) Order 2012	City West Water
	Bulk Entitlement (River Murray – Coliban Water) Conversion Order 1999	Coliban Water
	Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999	Victorian Environmental Water Holder
	Bulk Entitlement (River Murray – Goulburn Valley Water) Conversion Order 1999	Goulburn Valley Water
	Bulk Entitlement (River Murray – Goulburn-Murray Water) Conversion Order 1999	Goulburn-Murray Water
	Bulk Entitlement (River Murray – Grampians Wimmera Mallee Water) Conversion Order 1999	GWMWater
	Bulk Entitlement (River Murray – Lower Murray Urban and Rural Water – Irrigation) Conversion Order 1999	Lower Murray Water
	Bulk Entitlement (River Murray – Lower Murray Urban and Rural Water – Urban) Conversion Order 1999	Lower Murray Water
	Bulk Entitlement (River Murray – North East Water) Conversion Order 1999	North East Water
	Environmental Entitlement (River Murray – NVIRP Stage 1) 2012	Victorian Environmental Water Holder
	Bulk Entitlement (River Murray – Snowy Environmental Reserve) Conversion Order 2004	Victorian Environmental Water Holder
	Bulk Entitlement (River Murray – South East Water) Order 2012	South East Water
	Bulk Entitlement (River Murray – Yarra Valley Water) Order 2012	Yarra Valley Water
	Bulk Entitlement (Walwa) Conversion Order 2000	North East Water
Kiewa	Bulk Entitlement (Kiewa – Hydro) Conversion Order 1997	AGL Hydro Partnership
	Bulk Entitlement (Kiewa – Tangambalanga) Conversion Order 2000	North East Water
	Bulk Entitlement (Mount Beauty – Tawonga) Conversion Order 1997	North East Water
	Bulk Entitlement (Yackandandah) Conversion Order 2001	North East Water
Ovens	Bulk Entitlement (Beechworth) Conversion Order 2001	North East Water
	Bulk Entitlement (Bright) Conversion Order 2000	North East Water
	Bulk Entitlement (Chiltern) Conversion Order 2000	North East Water
	Bulk Entitlement (Glenrowan) Conversion Order 1999	North East Water
	Bulk Entitlement (Harrietville) Conversion Order 1999	North East Water
	Bulk Entitlement (Myrtleford) Conversion Order 2001	North East Water
	Bulk Entitlement (Ovens System – Goulburn-Murray Water) Conversion Order 2004	Goulburn-Murray Water
	Bulk Entitlement (Ovens System – Moyhu, Oxley and Wangaratta – North East Water) Conversion Order 2004	North East Water
	Bulk Entitlement (Springhurst) Conversion Order 1999	North East Water
	Bulk Entitlement (Whitfield) Conversion Order 1999	North East Water
Broken	Bulk Entitlement (Broken System – Goulburn-Murray Water) Conversion Order 2004	Goulburn-Murray Water
	Bulk Entitlement (Broken System – Tungamah, Devenish & St James – North East Water) Conversion Order 2004	North East Water
	Bulk Entitlement (Loombah McCall-Say) Conversion Order 2001	North East Water
Goulburn	Bulk Entitlement (Broadford, Kilmore & Wallan) Conversion and Augmentation Order 2003	Goulburn Valley Water
	Bulk Entitlement (Buxton) Conversion Order 1995	Goulburn Valley Water
	Bulk Entitlement (Eildon – Goulburn Weir) Conversion Order 1995	Goulburn-Murray Water
	Environmental Entitlement (Goulburn System – Living Murray) 2007	Victorian Environmental Water Holder
	Bulk Entitlement (Euroa System) Conversion Order 2001	Goulburn Valley Water
	Bulk Entitlement (Goulburn Channel System – Coliban Water) Order 2012	Coliban Water

Basin	Entitlements	Holder
	Bulk Entitlement (Goulburn Channel System – Goulburn Valley Water) Order 2012	Goulburn Valley Water
	Bulk Entitlement (Goulburn River & Eildon – Goulburn Valley Water) Order 2012	Goulburn Valley Water
	Goulburn River Environmental Entitlement 2010	Victorian Environmental Water Holder
	Bulk Entitlement (Goulburn System – City West Water) Order 2012	City West Water
	Environmental Entitlement (Goulburn System – NVIRP Stage 1) 2012	Victorian Environmental Water Holder
	Bulk Entitlement (Goulburn System – Snowy Environmental Reserve) Order 2004	Victorian Environmental Water Holder
	Bulk Entitlement (Goulburn System – South East Water) Order 2012	South East Water
	Bulk Entitlement (Goulburn System – Yarra Valley Water) Order 2012	Yarra Valley Water
	Bulk Entitlement (Longwood) Conversion Order 1995	Goulburn Valley Water
	Bulk Entitlement (Mansfield) Conversion Order 1995	Goulburn Valley Water
	Bulk Entitlement (Marysville) Conversion Order 1995	Goulburn Valley Water
	Bulk Entitlement (Pyalong) Conversion Order 1997	Goulburn Valley Water
	Bulk Entitlement (Quambatook – Grampians Wimmera Mallee Water) Order 2006	GWMWater
	Bulk Entitlement (Rubicon – Hydro) Conversion Order 1997	AGL Hydro Partnership
	Silver & Wallaby Creeks Environmental Entitlement 2006	Victorian Environmental Water Holder
	Bulk Entitlement (Silver & Wallaby Creeks – Melbourne Water) Order 2014	Melbourne Water
	Bulk Entitlement (Strathbogie) Conversion Order 2012	Goulburn Valley Water
	Bulk Entitlement (Thornton) Conversion Order 1995	Goulburn Valley Water
	Bulk Entitlement (Upper Delatite) Conversion Order 1995	Goulburn Valley Water
	Bulk Entitlement (Violet Town) Conversion Order 1997	Goulburn Valley Water
	Bulk Entitlement (Woods Point) Conversion Order 1995	Goulburn Valley Water
	Bulk Entitlement (Yea) Conversion Order 1997	Goulburn Valley Water
Campaspe	Bulk Entitlement (Axedale, Goornong and Part Rochester) Conversion Order 1999	Coliban Water
	Campaspe River Environmental Entitlement 2013	Victorian Environmental Water Holder
	Bulk Entitlement (Campaspe System – Coliban Water) Conversion Order 1999	Coliban Water
	Bulk Entitlement (Campaspe System – Goulburn-Murray Water) Conversion Order 2000	Goulburn-Murray Water
	Environmental Entitlement (Campaspe River – Living Murray Initiative) 2007	Victorian Environmental Water Holder
	Bulk Entitlement (Trentham) Conversion Order 2012	Coliban Water
	Bulk Entitlement (Woodend) Conversion Order 2004	Western Water
Loddon	Environmental Entitlement (Birch Creek – Bullarook System) 2009	Victorian Environmental Water Holder
	Bulk Entitlement (Bullarook System – Central Highlands Water) Conversion Order 2009	Central Highlands Water
	Bulk Entitlement (Bullarook System – Goulburn-Murray Water) Conversion Order 2009	Goulburn-Murray Water
	Bulk Entitlement (Creswick) Conversion Order 2004	Central Highlands Water
	Bulk Entitlement (Daylesford-Hepburn Springs) Conversion Order 2004	Central Highlands Water
	Bulk Entitlement (Evansford-Talbot System – Part Maryborough – Central Highlands Water) Conversion Order 2006	Central Highlands Water
	Bulk Entitlement (Lexton) Conversion Order 2004	Central Highlands Water
	Bulk Entitlement (Loddon River – Environmental Reserve) Order 2005	Victorian Environmental Water Holder
	Bulk Entitlement (Loddon System – Coliban Water) Conversion Order 2005	Coliban Water
	Bulk Entitlement (Loddon System – Goulburn-Murray Water) Conversion Order 2005	Goulburn-Murray Water
	Bulk Entitlement (Loddon System – Part Maryborough – Central Highlands Water) Conversion Order 2005	Central Highlands Water
East Gippsland	Bulk Entitlement (Bemm River) Conversion Order 1997	East Gippsland Water
	Bulk Entitlement (Cann River) Conversion Order 1997	East Gippsland Water
	Bulk Entitlement (Mallacoota) Conversion Order 1997	East Gippsland Water
Snowy	Bulk Entitlement (Buchan) Conversion Order 1997	East Gippsland Water
	Bulk Entitlement (Orbost System) Conversion Order 1997	East Gippsland Water
Tambo	*Bulk Entitlement (Nowa Nowa) Conversion Order 1997*	East Gippsland Water
	Bulk Entitlement (Swifts Creek) Conversion Order 1997	East Gippsland Water
Mitchell	*Bulk Entitlement (Bairnsdale) Conversion Order 2000*	East Gippsland Water
Thomson	*Macalister River Environmental Entitlement 2010*	Victorian Environmental Water Holder

Basin	Entitlements	Holder
	Bulk Entitlement (Thomson Macalister – Southern Rural Water) Conversion Order 2001	Southern Rural Water
	Bulk Entitlement (Thomson Macalister Towns – Gippsland Water) Conversion Order 2005	Gippsland Water
	Bulk Entitlement (Thomson River – Melbourne Water) Order 2014	Melbourne Water
	Bulk Entitlement (Thomson River – Environment) Order 2005	Victorian Environmental Water Holder
Latrobe	*Blue Rock Environmental Entitlement 2013*	Victorian Environmental Water Holder
	Bulk Entitlement (Boolarra) Conversion Order 1997	Gippsland Water
	Bulk Entitlement (Gippsland Water – Blue Rock) Conversion Order 1997	Gippsland Water
	Bulk Entitlement (Erica) Conversion Order 1997	Gippsland Water
	Bulk Entitlement (Latrobe – Southern Rural) Conversion Order 1996	Southern Rural Water
	Lower Latrobe Wetlands Environmental Entitlement 2010	Victorian Environmental Water Holder
	Bulk Entitlement (Mirboo North) Conversion Order 1997	Gippsland Water
	Bulk Entitlement (Moe – Narracan Creek) Conversion Order 1998	Gippsland Water
	Bulk Entitlement (Moondarra Reservoir) Conversion Order 1997	Gippsland Water
	Bulk Entitlement (Noojee) Conversion Order 1997	Gippsland Water
	Bulk Entitlement (Thorpdale) Conversion Order 1997	Gippsland Water
	Bulk Entitlement (Latrobe – Loy Yang B) Conversion Order 1996	Southern Rural Water
	Bulk Entitlement (Latrobe – Loy Yang A) Conversion Order 1996	AGL Loy Yang Partnership
	Bulk Entitlement (Latrobe – Loy Yang 3/4 Bench) Conversion Order 1996	Minister for Energy, Environment and Climate Change (on behalf of the Victorian Government)
	Bulk Entitlement (Latrobe – Yallourn) Conversion Order 1996	Energy Australia
	Bulk Entitlement (Latrobe Reserve) Order 2013	Southern Rural Water
South Gippsland	*Bulk Entitlement (Devon North, Alberton, Yarram & Port Albert) Conversion Order 1997*	South Gippsland Water
	Bulk Entitlement (Dumbalk) Conversion Order 1997	South Gippsland Water
	Bulk Entitlement (Fish Creek) Conversion Order 1997	South Gippsland Water
	Bulk Entitlement (Foster) Conversion Order 1997	South Gippsland Water
	Bulk Entitlement (Korumburra) Conversion Order 1997	South Gippsland Water
	Bulk Entitlement (Leongatha) Conversion Order 1997	South Gippsland Water
	Bulk Entitlement (Loch, Poowong & Nyora) Conversion Order 1997	South Gippsland Water
	Bulk Entitlement (Meeniyan) Conversion Order 1997	South Gippsland Water
	Bulk Entitlement (Desalinated Water – City West Water) Order 2014	City West Water
	Bulk Entitlement (Desalinated Water – South East Water) Order 2014	South East Water
	Bulk Entitlement (Desalinated Water – Yarra Valley Water) Order 2014	Yarra Valley Water
	Bulk Entitlement (Seaspray) Conversion Order 1997	Gippsland Water
	Bulk Entitlement (Toora, Port Franklin, Welshpool & Port Welshpool) Conversion Order 1997	South Gippsland Water
	Bulk Entitlement (Westernport) Conversion Order 1997	Westernport Water
	Bulk Entitlement (Westernport – Bass River) Order 2009	Westernport Water
	Bulk Entitlement (Wonthaggi – Inverloch) Conversion Order 1997	South Gippsland Water
Bunyip	*Tarago and Bunyip Rivers Environmental Entitlement 2009*	Victorian Environmental Water Holder
	Bulk Entitlement (Tarago River – Gippsland Water) Conversion Order 2009	Gippsland Water
	Bulk Entitlement (Tarago River – Southern Rural Water) Conversion Order 2009	Southern Rural Water
	Bulk Entitlement (Tarago and Bunyip Rivers – Melbourne Water) Order 2014	Melbourne Water
Yarra	*Bulk Entitlement (Yarra River – Melbourne Water) Order 2014*	Melbourne Water
	Yarra River Environmental Entitlement 2006	Victorian Environmental Water Holder
Maribyrnong	*Bulk Entitlement (Gisborne – Barringo Creek) Conversion Order 2004*	Western Water
	Bulk Entitlement (Lancefield) Conversion Order 2001	Western Water
	Bulk Entitlement (Macedon and Mount Macedon) Conversion Order 2004	Western Water
	Bulk Entitlement (Maribyrnong – Melbourne Water) Conversion Order 2000	Melbourne Water
	Bulk Entitlement (Maribyrnong – Southern Rural Water) Conversion Order 2000	Southern Rural Water
	Bulk Entitlement (Maribyrnong – Western Water) Conversion Order 2000	Western Water
	Bulk Entitlement (Riddells Creek) Conversion Order 2001	Western Water
	Bulk Entitlement (Romsey) Conversion Order 2001	Western Water
Werribee	*Bulk Entitlement (Ballan) Conversion Order 1998*	Central Highlands Water

Basin	Entitlements	Holder
	Bulk Entitlement (Blackwood & Barry's Reef) Conversion Order 1998	Central Highlands Water
	Bulk Entitlement (Myrniong) Conversion Order 2004	Western Water
	Werribee River Environmental Entitlement 2011	Victorian Environmental Water Holder
	Bulk Entitlement (Werribee System – Irrigation) Conversion Order 1997	Southern Rural Water
	Bulk Entitlement (Werribee System – Western Water) Conversion Order 2004	Western Water
Moorabool	*Bulk Entitlement (Lal Lal – Barwon) Conversion Order 1995*	Barwon Water
	Bulk Entitlement (Lal Lal – Central Highlands) Conversion Order 1995	Central Highlands Water
	Bulk Entitlement (Meredith) Conversion Order 1995	Barwon Water
	Moorabool River Environmental Entitlement 2010	Victorian Environmental Water Holder
	Bulk Entitlement (She Oaks) Conversion Order 1995	Barwon Water
	Bulk Entitlement (Upper East Moorabool System) Conversion Order 1995	Barwon Water
	Bulk Entitlement (Upper West Moorabool System) Conversion Order 1995	Central Highlands Water
Barwon	*Barwon River Environmental Entitlement 2011*	Victorian Environmental Water Holder
	Upper Barwon River Environmental Entitlement 2018	Victorian Environmental Water Holder
	Bulk Entitlement (Upper Barwon System) Conversion Order 2002	Barwon Water
	Bulk Entitlement (Yarrowee – White Swan System) Conversion Order 2002	Central Highlands Water
Otway Coast	*Bulk Entitlement (Aireys Inlet) Conversion Order 1997*	Barwon Water
	Bulk Entitlement (Apollo Bay) Order 2010	Barwon Water
	Bulk Entitlement (Colac) Amendment Order 2003	Barwon Water
	Bulk Entitlement (Gellibrand) Conversion Order 1997	Barwon Water
	Bulk Entitlement (Lorne) Conversion Order 1997	Barwon Water
	Bulk Entitlement (Otway System) Conversion Order 1998	Wannon Water
Hopkins	*Bulk Entitlement (Beaufort) Conversion Order 2005*	Central Highlands Water
	Bulk Entitlement (Skipton) Conversion Order 2005	Central Highlands Water
Glenelg	*Bulk Entitlement (Coleraine, Casterton & Sandford) Conversion Order 1997*	Wannon Water
	Bulk Entitlement (Dunkeld System) Conversion Order 1997	Wannon Water
	Bulk Entitlement (Glenthompson) Conversion Order 1997	Wannon Water
	Bulk Entitlement (Hamilton) Conversion Order 1997	Wannon Water
Wimmera	*Bulk Entitlement (Landsborough-Navarre) Conversion Order 2003*	Central Highlands Water
	Bulk Entitlement (Willaura, Elmhurst and Buangor Systems – GWMWater) Conversion Order 2012	GWMWater
	Bulk Entitlement (Willaura System – Wannon Water) Conversion Order 2012	Wannon Water
	Bulk Entitlement (Wimmera and Glenelg Rivers – Coliban Water) Order 2010	Coliban Water
	Bulk Entitlement (Wimmera and Glenelg Rivers – GWMWater) Order 2010	GWMWater
	Bulk Entitlement (Wimmera and Glenelg Rivers – Wannon Water) Order 2010	Wannon Water
	Wimmera and Glenelg Rivers Environmental Entitlement 2010	Victorian Environmental Water Holder
Avoca	*Bulk Entitlement (Amphitheatre) Conversion Order 2003*	Central Highlands Water
	Bulk Entitlement (Avoca) Conversion Order 2003	Central Highlands Water
	Bulk Entitlement (Redbank) Conversion Order 2003	Central Highlands Water
Jan Juc GMA	*Bulk Entitlement (Anglesea Groundwater) Order 2009*	Barwon Water

Abbreviations

AWRC	Australian Water Resources Council
CEWH	Commonwealth Environmental Water Holder
CMA	Catchment management authority
DELWP	Department of Environment, Land, Water and Planning (Victorian Government)
ESC	Essential Services Commission
GL	Gigalitre
GMA	Groundwater management area
GMU	Groundwater management unit
IGWC	Inspector-General of Water Compliance
MDBA	Murray–Darling Basin Authority
ML	Megalitre
PCV	Permissible consumptive volume
RWC	Rural Water Corporation
PWSR	Permanent water-saving rules
REALM	Resource allocation model
VEWH	Victorian Environmental Water Holder
WSPA	Water supply protection area

Glossary

Allocation: The assignment of water within a given water year against a water entitlement held by a person or authority. See also 'Seasonal allocation'.

Aquifer: A layer of underground sediments that holds groundwater and allows water to flow through it.

Aquitard: An underground layer of clay, silt or rock with low permeability which restricts the movement of groundwater between aquifers.

Basin (river basin): The area of land into which a river and its tributaries drain. In the Victorian Water Accounts, river basins are consistent with those defined by the Australian Water Resources Council (AWRC). The exception is the Murray basin which, for the purposes of this report, includes the Upper Murray basin as defined by AWRC and areas in Victoria supplied from the Murray River downstream of Lake Hume. See also 'river basin'.

Bulk entitlement: The right to water held by water and other authorities defined in the *Water Act 1989*. A bulk entitlement defines the amount of water from a river or storage to which an authority is entitled and may include the rate at which it may be taken and the reliability of the entitlement.

Bulk entitlement conversion order: The statutory instrument used to issue a bulk entitlement under the provisions in the *Water Act 1989*.

Consumptive entitlement: A water entitlement that permits the holder to use the water taken under the entitlement for the purposes of consumption.

Cap: A limit placed on the amount of water that can be taken from a system within a given timeframe.

Carryover: Provides the right to take unused allocations at the end of one season into the subsequent season. Carryover is available under rules to the holders of permanent entitlements, including water shares, supplies by agreement and specified bulk and environmental entitlements, in the regulated water systems of northern Victoria.

Catchment: An area of land where run-off from rainfall goes into one river system.

Catchment management authorities (CMAs): Statutory bodies established under the *Catchment and Land Protection Act 1994*. CMAs have responsibilities under both the Catchment and Land Protection Act and the *Water Act 1989* for river health; regional and catchment planning and coordination; and waterway, floodplain, salinity and water quality management.

Declared systems: A water system that has been declared in accordance with section 6A of the *Water Act 1989*. Water rights and take and use licences in declared water systems have been converted into unbundled entitlements.

Distribution system: The infrastructure constructed, maintained and owned by a water corporation that is used to distribute water from its source to a user.

Entitlement: See 'Water entitlement'.

Environment: Surroundings in which an organisation operates including air, water, land, natural resources, flora, fauna, humans and their interdependence.

Environmental (bulk) entitlement: A water entitlement held by the Minister for Water that permits the use of water in a river or storage for a purpose that benefits the environment.

Environmental flow: The streamflow required to maintain appropriate environmental conditions in a waterway.

Evaporation: The process by which water changes from a liquid to a gas or vapour.

Evapotranspiration: The sum of transpiration by plants, evaporation from soil and open water surfaces, and evaporation from the wet surfaces of plants soon after rainfall.

Floodplain: Land adjacent to rivers that is subject to overflow during flood events. Floodplains are often valuable for their ecological assets.

Gigalitre (GL): 1,000 megalitres, which also is 1,000,000,000 litres.

Groundwater: The reserve of water that is located beneath the earth's surface in pores and crevices of rocks and soil. These areas vary in size and volume throughout Victoria and are known as aquifers.

Groundwater management unit (GMU): Groundwater in Victoria is managed through groundwater management units (GMUs). A GMU may be classified as either a groundwater management area (GMA) or a water supply protection area (WSPA).

Groundwater management area (GMA): A discrete area where groundwater resources of suitable quality for irrigation, commercial or domestic and stock use are available or expected to be available. The area may have a management plan approved by the relevant rural water corporation.

Heritage river: A river protected in Victoria for its special features under the *Heritage Rivers Act 1992*.

Irrigation district: An area declared under the *Water Act 1989* that is supplied with water by channels and pipelines used mainly for irrigation purposes.

Long-term average annual rainfall (expressed as a percentage): The amount of rainfall across the geographical spread of an area, which is averaged over a grid of about 25 by 25 km.

Living Murray: A program to improve the health of the Murray River, established by the Murray–Darling Basin Ministerial Council in 2002 and funded by the New South Wales, Victorian, South Australian, Australian Capital Territory and Australian governments.

Megalitre: One million litres.

Millennium Drought: The most severe drought in Victoria's recorded history, spanning from 1997 to 2009.

Murray–Darling Basin cap: The climatically adjusted limit on surface water diversions in the Murray–Darling Basin, agreed by a ministerial council under the Murray–Darling Basin Agreement.

Non-potable: Water not suitable for drinking

Order (ordering of water): The advance notification given by an entitlement holder to a storage operator to enable the storage operator to regulate water flows so that all entitlement holders' needs can be met at a particular time.

Passing flow requirements: The flows that a water authority must pass at its weirs or reservoirs before it can take water for other uses. Passing flow requirements are specified as obligations in bulk entitlements, and entitlement holders must report on their compliance with these requirements.

Percent full: The volume of water in storage as a percentage of the accessible storage capacity. Note that the percentage full may exceed 100% (for example, due to floods).

Permissible consumptive volume (PCV): The total amount of water that may be licensed and taken in a GMU under a ministerial declaration.

Qualification of rights: The Minister for Water has the power (under section 33AAA of the *Water Act 1989*) to qualify rights to water to maintain essential supplies to towns and rural communities. The Minister may declare a temporary qualification of rights where a water shortage exists in an area or water system. Where the water shortage is due to a long-term change to water availability, a permanent qualification of rights may be declared but only following a long-term water resources assessment which finds the long-term water availability will have a disproportionate effect on water allocated for consumptive purposes or the environment.

Ramsar Convention: An international treaty that aims to conserve wetlands that have been listed for their international significance to ensure they are managed wisely. It was agreed in Ramsar, Iran, in 1971.

REALM model: A computer-based water supply system model used by the Victorian Department of Environment, Land, Water and Planning to aid the allocation of Victoria's water resources. It is an abbreviation of REsource ALlocation Model.

Recycled water: Water (derived from sewerage systems or industry processes) that is treated to a standard appropriate for its intended end use.

Representative river: Rivers that can be used to represent the major river classes that once occurred naturally across Victoria. They also need to be in good condition to be representative. A list of the suggested representative rivers can be found in the *Victorian River Health Strategy (2002)*.

Regulated river: A river containing structures (such as dams or major diversion weirs) that control the flow of water in the river for licensed diverters or users in an irrigation district.

Reticulation system: The network of pipelines used to deliver water to end users.

Riparian: Situated alongside a river or stream.

River: Large stream of water flowing to the sea, a lake, a marsh or another river.

River basin: The land into which a river and its tributaries drain. See also 'Basin'.

Seasonal allocation: An entitlement holder's share of the water available for a season, determined by a water corporation and expressed as a percentage of the entitlement holder's water share. It is sometimes shortened to 'Allocation'.

Sewage: The waterborne wastes of a community.

Small catchment dam: A dam that is filled from its own catchment and is not located on a waterway. This includes small catchment dams used for domestic and stock purposes, which are not required to be licensed. It also includes dams used for commercial purposes and irrigation, which are now required to be registered (under the *Water Act 1989*). Not all small catchment dams are registered as yet.

Snowy Water Inquiry: The Snowy Water Inquiry was established under *Snowy Hydro Corporatisation Act 1997* (NSW). This inquiry identified and analysed options to mitigate the impact of the Snowy Scheme on environmental flows.

South Australia–Victoria Designated Area: The area extending 20 km on either side of the border between South Australia and Victoria, as set out under the *Groundwater (Border Agreement) Act 1985*, established for the cooperative management and equitable sharing of groundwater resources between the states.

Spill: An uncontrolled flow of water past a reservoir or a weir.

Stream: A body of water flowing in a bed, river or brook.

Streamflow management plan: A statutory management plan prepared for a WSPA to manage the surface water resources of the area.

Take and use licence: A fixed-term entitlement to take and use water from a waterway, catchment dam, spring, soak or aquifer. Each licence is subject to conditions set by the Minister for Water and specified on the licence.

Terminal lakes: Lakes that form the endpoint of all surface water flow within a basin.

Transpiration: The process by which water that is absorbed by plants, usually through the roots, is evaporated from the plant surface into the atmosphere.

Unincorporated area: An area of Victoria which contains substantial and often unquantified groundwater of varying yield and quality that has not been designated as either a GMA or a WSPA.

Unregulated river: A river without dams or major diversion weirs that control the flow of water in the river.

Use (water use): The water use data presented in this edition of the Victorian Water Accounts is reported as the volume of water diverted from a stream or groundwater bore. It is not the same as 'use' by the end consumer of the water.

Victorian Water Register: Provides water users with essential information about water entitlements, seasonal allocations, trade and transfers. The water register is the authoritative record of water entitlements, and it facilitates the transactions that underpin Victoria's water markets.

Wastewater: The volume of sewage that enters a dedicated treatment plant.

Water corporations: Government organisations charged with supplying water to urban and rural water users. They administer the diversion of water from waterways and the extraction of groundwater. They were formerly known as water authorities.

Water balance: A statement of the water flows in a given area and time period, in which the sum of the outflows from the area equals the sum of the inflows less the water accumulated in the area.

Water entitlement: The volume of water authorised to be taken and used by the holder. Water entitlements include bulk entitlements, environmental entitlements, water rights, surface water and groundwater licences.

Water leaving the basin: The volume of water that is calculated to flow out of the basin. This amount is typically derived from both gauged streamflow information and calculated information.

Water right: A water entitlement held by an irrigator in an irrigation district.

Water share: A legally recognised, secure share of the water available to be taken from a declared water system. Water shares were created as part of the unbundling reforms. They may be high-reliability or low-reliability, and they are specified as a maximum volume of seasonal allocation that may be made against that share.

Water supply protection area (WSPA): An area declared under section 27 of the *Water Act 1989* to protect the area's groundwater or surface water resources for equitable management and long-term sustainability. A WSPA is subject to a statutory management plan approved by the Minister for Water.

Waterway: The *Water Act 1989* defines a waterway as a river, creek, stream, watercourse and a natural channel where water regularly flows, whether or not the flow is continuous.

Wetlands: Inland, standing, shallow bodies of water that may be permanent or temporary, and fresh or saline.

Yield: The quantity of water that a storage or aquifer produces.