Victorian Water Accounts

2019-2020

A statement of Victorian water resources

VICTORIA State Government | Environment, Land, Water and Planning

Photo credit

Cover image: Barwon Water

Description: Participants of the Upper Barwon Landcare Network's 'Big Barwon Walk' raft down the river as part of the event. The three-day event is an initiative of Landcare members in the Barwon River catchment to explore how the river defines the landscape.

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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 has 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 2019–2020

A statement of Victorian water resources

Foreword

Victoria faced a year of climate extremes and variability in 2019–20 marked by drought, bushfires and in some parts of the state above-average rainfall.

On the back of a long and severe drought over much of Victoria, the summer of 2019–20 experienced record high temperatures and disastrous bushfires. Around 3,500 fires burnt more than 1.5 million hectares across the state between November and February 2020, the largest area since the 1939 bushfires. After years of drought, eastern Victoria was severely impacted by these fires.

On a positive note, Victoria was wetter in 2019–20 than the previous year due to above-average rainfall across most of the state from January to April 2020. However, large areas of Victoria still only received below-average rainfall for the year, and serious or severe longer-term rainfall deficiencies persisted across eastern Victoria and the northern border regions.

Dry conditions in the north of the state continued in winter and spring of 2019 and led to the lowest seasonal allocations that irrigators in the north have experienced in ten years. The south fared better with 100% high-reliability seasonal allocations early in the water year.

Due to the dry conditions, more Victorian towns were on water restrictions in 2019–20, and there were more restrictions on groundwater use than the previous year.

The Victorian Water Accounts show the total volume of surface water, groundwater, recycled water and desalinated water available in 2019–20 was 18,291 GL, which was 6,000 GL higher than what was available in 2018–19.

The increase is a result of higher catchment inflows in many of Victoria's 29 surface water basins. The Victorian Desalination Plant also contributed to this through a 125 GL water order, of which 118 GL was delivered in 2019–20, with 7 GL delivered in advance in June 2019. However, with dry conditions up to Christmas and low irrigation water availability, consumptive use decreased from 4,000 GL to 3,300 GL.

Victoria's climate has shown a warming and drying trend over recent decades, and water resources are under pressure from a decreasing supply. As the state faces these challenges, it is important that the public is made aware of Victoria's water availability and use and its water resource management framework. The *Victorian Water Accounts 2019–20* provide a comprehensive report of water availability and use, helping us to understand and manage our scarce water resources.

Improvements have been made to our online services to provide more easily accessible reporting information to the public. You can see an overview of how we manage Victoria's water resources at https://howmuch.water.vic.gov.au/ and get much of the detailed water information in these accounts for each basin at https://accounts.water.vic.gov.au/. These online services provide a new way to learn more about how water is managed and to engage with water data.

THE HON RICHARD WYNNE

Acting Minister for Water

Contents

Executive summary

Victorian Water Accounts 2019–20 at a glance

- The accounts 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 2018–19.
- Less surface water and groundwater was used than in 2018–19.
- Less recycled water was also used than in 2018–19.
- Significantly more desalinated water was produced than in 2018–19.
- Although 2019–20 was not as dry as 2018–19, rainfall was still below average across most of the state. Large parts of the east and parts of the north were especially dry, receiving very much below-average rainfall. However, above-average rainfall was received in the state's south-east, central and north-central areas and parts of the state's west.
- 2019 was Victoria's fifth-warmest year on record, with December 2019 being the fifth-driest and second-warmest December on record. Rainfall for January to April 2020 was 54% above average across Victoria, the wettest period since 2011.
- Serious or severe longer-term rainfall deficiencies persisted over large areas in East Gippsland and along the northern border.
- Between November 2019 and February 2020, 3,500 fires burnt more than 1.5 million hectares across the state, the largest area burnt since 1939.
- In declared water systems, seasonal determinations to high-reliability entitlements did not reach 100% in any major northern systems. Southern systems fared better, with 100% high-reliability determinations made in the Thomson and Werribee systems.
- There were more restrictions on urban and groundwater use than in the previous year, but fewer unregulated streams were restricted.
- Total Victorian storage levels at the end of the water year were higher than at the start. At 1 July 2019, total storage levels were at 42% of total capacity, compared to 49% at 30 June 2020. Levels only reached a peak of 53% of capacity in September, compared to 66% the previous year.
- Groundwater level trends were more stable in 2019–20 than in 2018–19.
- The VEWH reported that in 2019–20 87% of required watering actions were either fully or partially achieved. Most of these actions relied on contributions of managed water for the environment, and the rest were achieved through passing flows, natural flows, unregulated flows and/or the delivery of consumptive water; and a drying regime was intentionally implemented at some sites.

About the *Victorian Water Accounts 2019–20*

The *Victorian Water Accounts 2019–20* is the seventeenth 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 *Victorian Water Accounts 2019–20* also demonstrate that Victoria is meeting its obligations under state and federal legislation to collect and publish information about the state's water resources. The sharing of the information presented in this report is also part of the government's commitment to transparency and accountability in the management of Victoria's water resources.

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

The report consolidates 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 2019–20* 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 each system's inflows, outflows and storage volume for the year.

Variable conditions across Victoria

Winter rainfall in Victoria was below average across much of the north and east of the state, while in parts of the south it was above average. Rainfall in spring was below average in most of Victoria, and very much below average in large areas across the state's north. Statewide, rainfall was 5% below average and summer temperatures were above average. Although the summer months of January and February were wetter than average, December 2019 was Victoria's fifth-driest and second-warmest December on record. Rainfall in autumn was 27% above average, the highest since 1989.

The wetter period since January 2020 reflects what was being experienced across many parts of south-eastern Australia. Many parts of Australia experienced average or above-average rainfall from January 2020 onwards, with large parts of the country receiving more rainfall from January to April 2020 than they received in all of 2019. Overall, conditions in 2019–20 were wetter than in the previous year; the second half of 2019 was hot and dry.

Due to successive years of very low inflows and dry catchment conditions, the Minister for Water declared a water shortage and temporarily qualified rights to water in the declared Broken system during 2019–20. The temporary qualification of rights enabled all water share holders to access water for critical domestic and stock needs. The temporary qualification of rights applied from 1 January 2020 until 30 June 2020.

In 2019–20, the proportion of evapotranspiration-to-rainfall was generally higher than the long-term average. This is consistent with below-average rainfall generally being observed, because the proportion of evapotranspiration-to-rainfall generally decreases as rainfall increases. As a result, less rainfall became streamflow or groundwater recharge in 2019–20 than would be the case in an average year.

Fewer unregulated streams were subject to restrictions on licensed diversions, with a peak of 137 streams with restrictions in place in March 2020, compared to 162 for the same time in 2019. However, there were more urban and groundwater use restrictions in 2019–20 than in 2018–19. 32 towns were on urban restrictions — 26 more than 2018–19 — and restrictions on groundwater use were in place for four groundwater systems, compared to three in 2018–19. High-reliability entitlements received 100% allocation in four regulated systems, which was three less than in 2018–19.

Groundwater level trends were more stable in 2019–20 than in 2018–19.

Increased water availability and restrictions on use

A total of 18,291 GL of surface water, groundwater, desalinated water and recycled water was available in 2019–20. This is about 6,000 GL more than the 12,206 GL that was available in 2018–19.

The total annual streamflow volume in 2019–20 for Victoria was 16,662 GL, about 6,000 GL more than the previous year. However, surface water availability was still below average: streamflow was 74% of the long-term average. In 2019–20, 23 river basins had annual streamflow volumes higher than in 2018–19. Despite this, only seven basins had above-average streamflows in 2019–20.

Total Victorian storage levels at the end of the water year were higher than at the start. At 1 July 2019, total storage levels were at 42% of total capacity, compared to 49% at 30 June 2020. Levels only reached a peak of 53% of capacity in September, compared to 66% the previous year. Regional storages were 40% full at the beginning of 2019–20, reaching a peak of 51% of capacity in September, compared to 66% the previous year. Storage levels declined through the summer to a minimum of 38% of capacity by March 2020 and were 47% full on 30 June 2020. Melbourne storages ended the year (30 June 2020) at 64% of total capacity, compared to 50% at 30 June 2019. This is the first year since 2016–17 when Melbourne's storage levels were higher at the end of the water year than at the start.

Dry conditions from the previous year continued in winter and spring of 2019 and led to seasonal determinations of less than 100% high-reliability in most northern systems. Seasonal determinations in the north of the state were lower than at any time in the last ten years. Southern systems fared better, with 100% high-reliability determinations made in the Thomson and Werribee systems.

In declared water systems in 2019–20, seasonal determinations to high-reliability entitlements did not reach 100% in any major northern system, with the Murray system only reaching 66% high-reliability and the Goulburn system reaching 80% high-reliability determinations. Three systems had low-reliability entitlement allocations, one more than in the previous year. In northern Victoria, the small Bullarook system reached 100% allocation for low-reliability entitlement. In southern Victoria, the Thomson–Macalister and Werribee and Bacchus Marsh systems each received 100% allocation against low-reliability entitlement. Allocations for the Wimmera Mallee Pipeline Product began with initial allocations of 0% and ended with a final allocation of 42% of entitlement. In the Coliban Rural system, entitlement holders had access to 100% of their entitlement for the entire year.

Decreased water use

In Victoria, 3,340 GL of surface water, groundwater and recycled water was taken for consumptive use in 2019–20, about 600 GL less than the 3,958 GL taken the previous year. This volume represents about 18% of the total water available during the year. This compares with 32% of available water taken in 2018–19.

Surface water use was 2,704 GL in 2019–20, about 600 GL less than the 3,378 GL used the previous year. Most of the decrease was in the volume taken in the Murray and Goulburn systems. Lower water use was likely due to low water availability in the first half of the water year and lower demand in the second half, due to above-average rainfall.

Groundwater use decreased in 2019–20, with Victorian water users extracting 439 GL of groundwater, compared to 498 GL in 2018–19. Less water was used for irrigation and power generation (about 62 GL less than the 2018–19 volume) and slightly more was used for urban and domestic and stock purposes (about 2 GL more than the 2018–19 volume).

Recycled water use decreased from the previous year, with 79 GL recycled in 2019–20, compared to 100 GL in 2018–19.

In 2019–20, the Victorian Environmental Water Holder (VEWH) oversaw the delivery of 892 GL of water to 92 priority river reaches and 76 wetlands, and 87% of identified required watering actions were fully or partially achieved. The VEWH has adopted a new method for assessing achievement of potential watering actions. The new method is more quantitative than previous methods and can be more consistently applied across systems. These attributes improve the reliability of the assessment, but direct comparisons between the results from 2019–20 and previous years cannot be made at this time.

Bushfires and a strong Indian Ocean Dipole

In 2019, Victoria experienced its fifth-warmest year on record and fifth-driest and second-warmest December on record. As at the end of December 2019, a severe, multi-year drought was affecting large parts of eastern Australia and far north-west Victoria. The impacts of the low rainfall were further exacerbated by record-high temperatures in 2019, especially in the summers of 2018−19 and 2019−20. The hot conditions combined with the dry landscape and strong winds produced dangerous fire weather conditions during December 2019 into early January 2020. Between November and February 2020, 3,500 fires burnt more than 1.5 million hectares across the state, the largest area since 1939.

A major influence on the climate in the 2019 winter and spring seasons was the presence of a very strong positive phase of the Indian Ocean Dipole (IOD). This is typically associated with dry conditions in many parts of Australia and can bring an earlier start to the fire season for southern and central Australia. The 2019 event, which dissipated at the end of 2019, was amongst the strongest positive IOD events on record, suppressing rainfall and raising temperatures for much of 2019.

Want to know more?

There is much useful information online:

- ‘Managing Victoria’s water resources’ at https://howmuch.water.vic.gov.au/ creatively represents the main messages of the *Victorian Water Accounts 2019–20*
- the surface water and distribution systems chapters of the Victorian Water Accounts are online at https://accounts.water.vic.gov.au/, and 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
- http://www.vewh.vic.gov.au/ has information about environmental water
- www.bom.gov.au has information about rainfall and temperatures.

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

- Barwon Water – www.barwonwater.vic.gov.au
- Central Highlands Water – www.chw.net.au
- City West Water – 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
- Grampians Wimmera Mallee Water – www.gwmwater.org.au
- Lower Murray Water – www.lmw.vic.gov.au
- Melbourne Water – www.melbournewater.com.au

- North East Water – www.newater.com.au
- South East Water – www.southeastwater.com.au
- South Gippsland Water – www.sgwater.com.au
- Southern Rural Water – www.srw.com.au
- Wannon Water – www.wannonwater.com.au
- Western Water – www.westernwater.com.au
- Westernport Water – www.westernportwater.com.au
- Yarra Valley Water – www.yvw.com.au

Part 1: Overview of Victoria's water resources 2019–20

Part 1 of the *Victorian Water Accounts 2019–20* summarises Victoria's water entitlement and planning framework and the mechanisms it provides for sharing 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 management of Victoria's water resources. A feature of the framework is that it 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 underpins 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 key 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 which are managed under Victoria's water entitlement and water resource planning framework. These are:

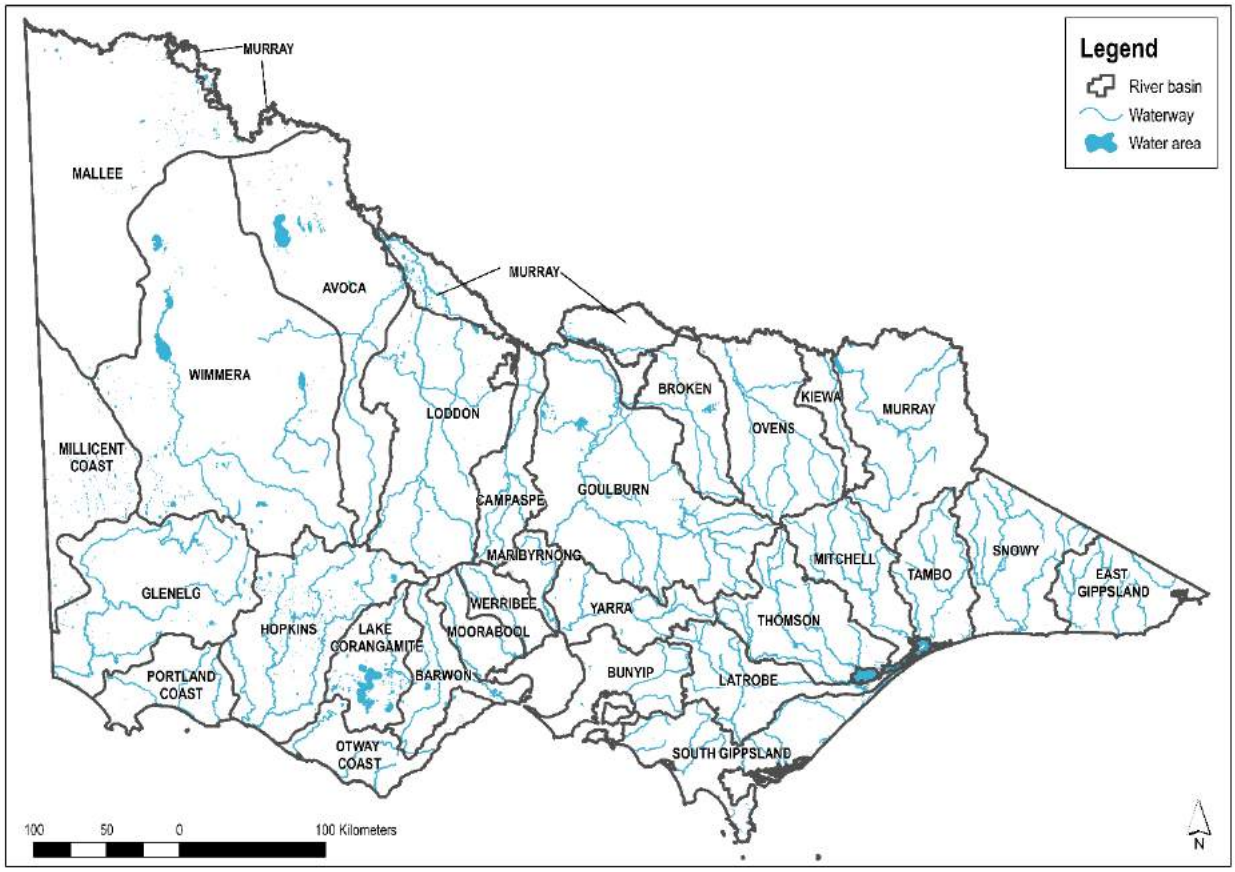
- **surface water**, which is water that occurs or flows on land. This includes water in waterways and in lakes, reservoirs, dams, wetlands and other water bodies. The term 'waterway' means a river, creek, stream, watercourse or a natural channel where water regularly flows, whether or not the flow is 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 industry 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

Victoria's surface water resources include water that occurs or flows on land. For these 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[1]. 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.

[1] 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 broadly 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. The allocation of water is managed through seasonal determinations and the Minister's carryover and trading rules. 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.

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 runoff. 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.

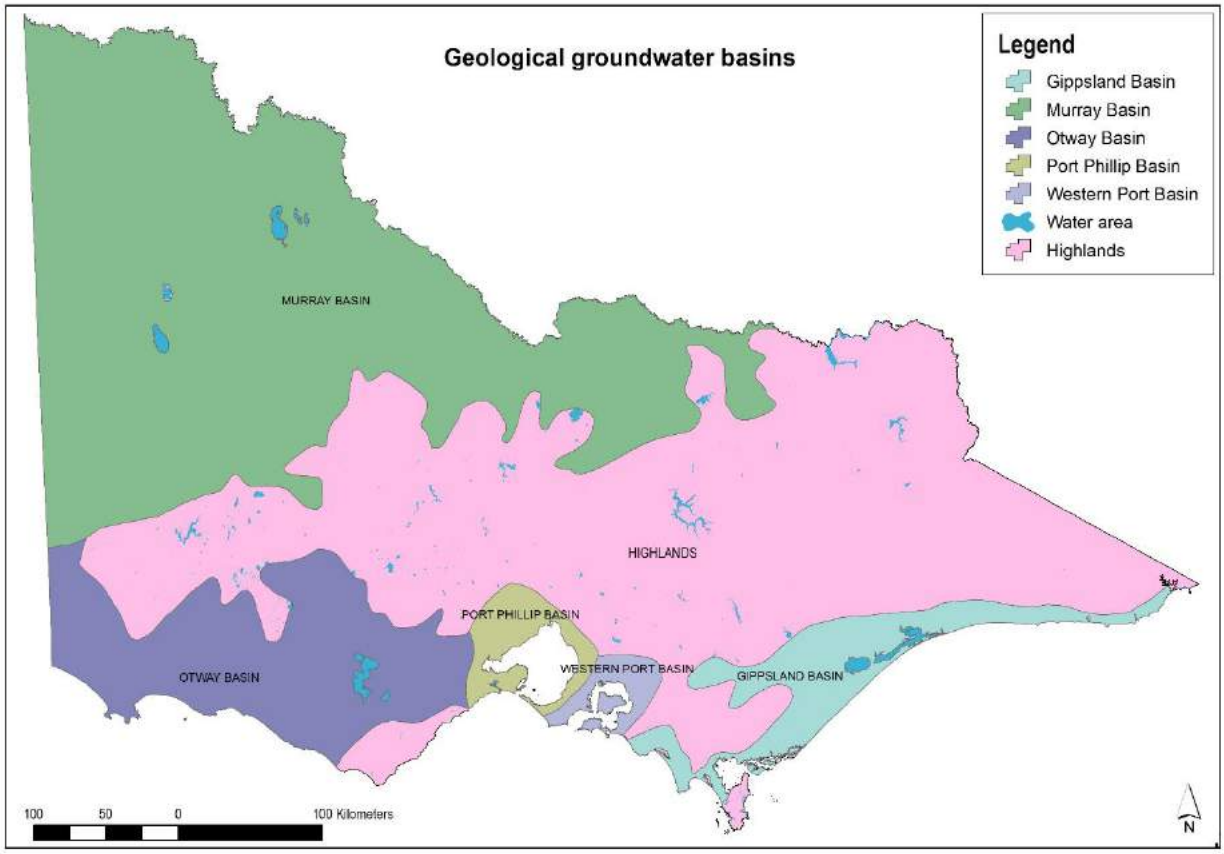
1.1.2 Groundwater

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, when rainfall, surface water or 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 and streams, lakes and wetlands, the ocean; or it may evaporate. Groundwater can be used for human consumption and agricultural, commercial and industrial purposes. Groundwater supports groundwater-dependent ecosystems and contributes to environmental flows in streams.

Where groundwater is held within a geological formation which 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 salinity of the groundwater often determines whether it is suitable for consumptive use.

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

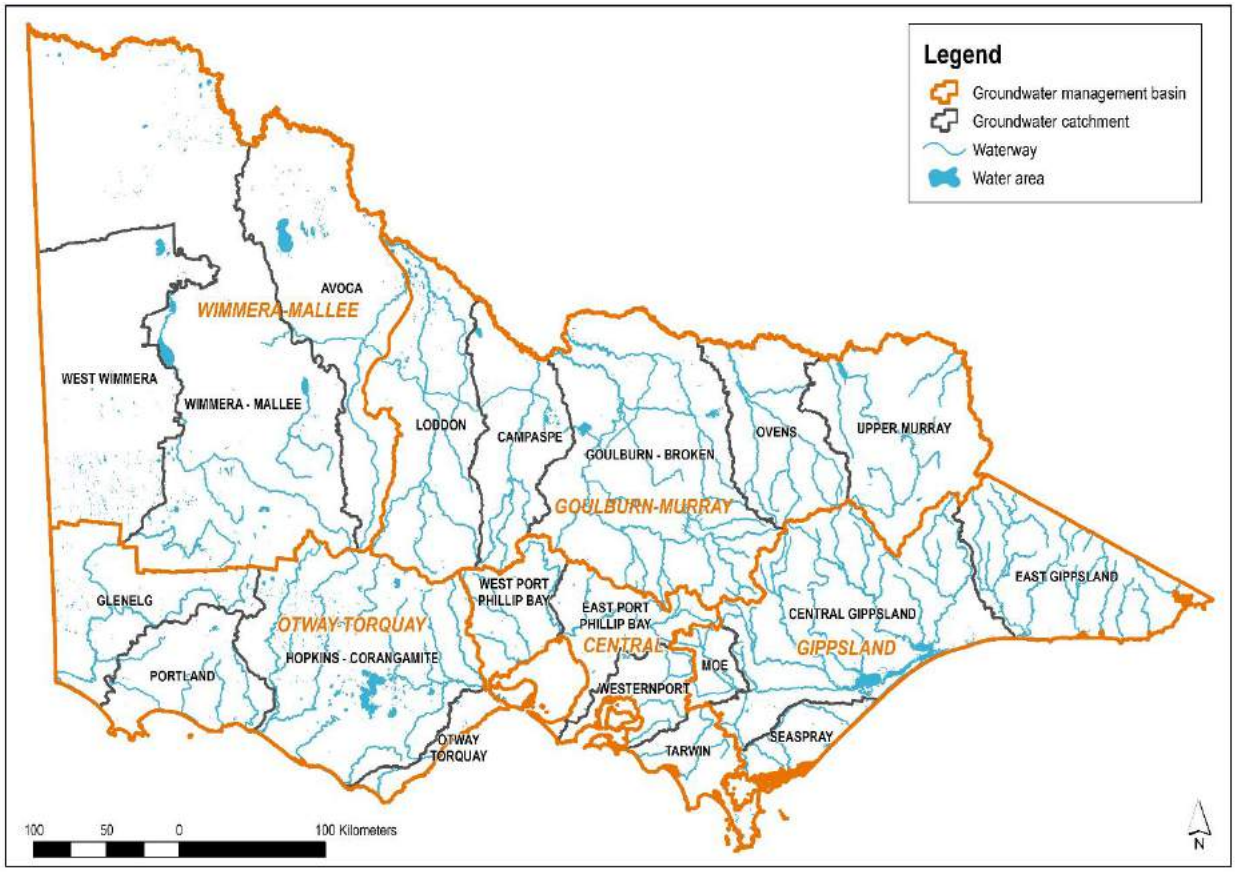


There is more information about Victoria's groundwater resources at https://www.water.vic.gov.au/groundwater/victorias-groundwater-resources.

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. It further describes Victoria's groundwater resources and accounts for 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 2019–20 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 first order from the VDP was made in March 2016 by the Minister for Water. Chapters 2.3, 3.4 and 6.17.1 (Yarra basin management arrangements) report on water produced in 2019–20.

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.

Sixteen **water corporations** provide urban water supply (including of recycled water) and sewage and trade waste disposal services to urban customers throughout Victoria. In regional Victoria, they are:

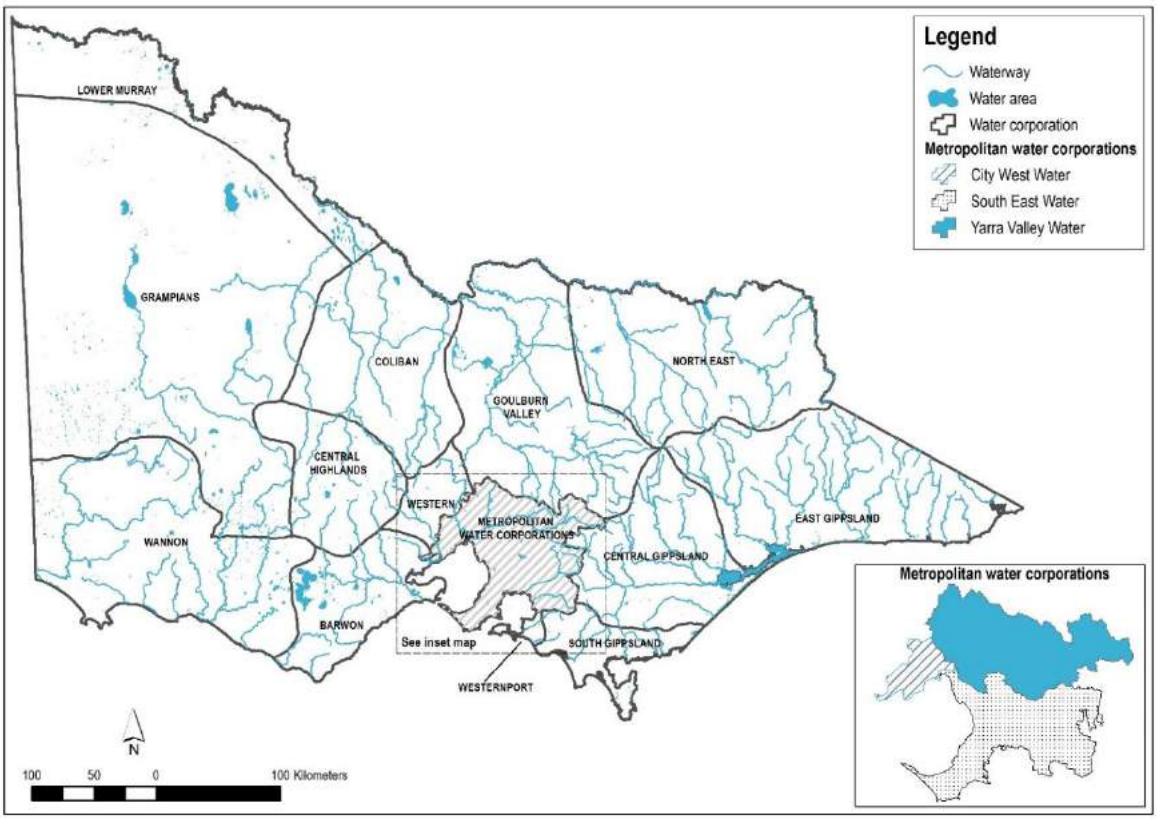
- Barwon Water
- Central Highlands Water
- Coliban Water
- East Gippsland Water
- Gippsland Water
- Goulburn Valley Water
- GWMWater
- Lower Murray Water
- North East Water
- South Gippsland Water
- Wannon Water
- Westernport Water
- Western Water.

In Melbourne, they are:

- City West Water
- South East Water
- Yarra Valley Water.

Figure 1-4 shows the urban supply areas.

Figure 1-4 Water corporations' urban supply areas



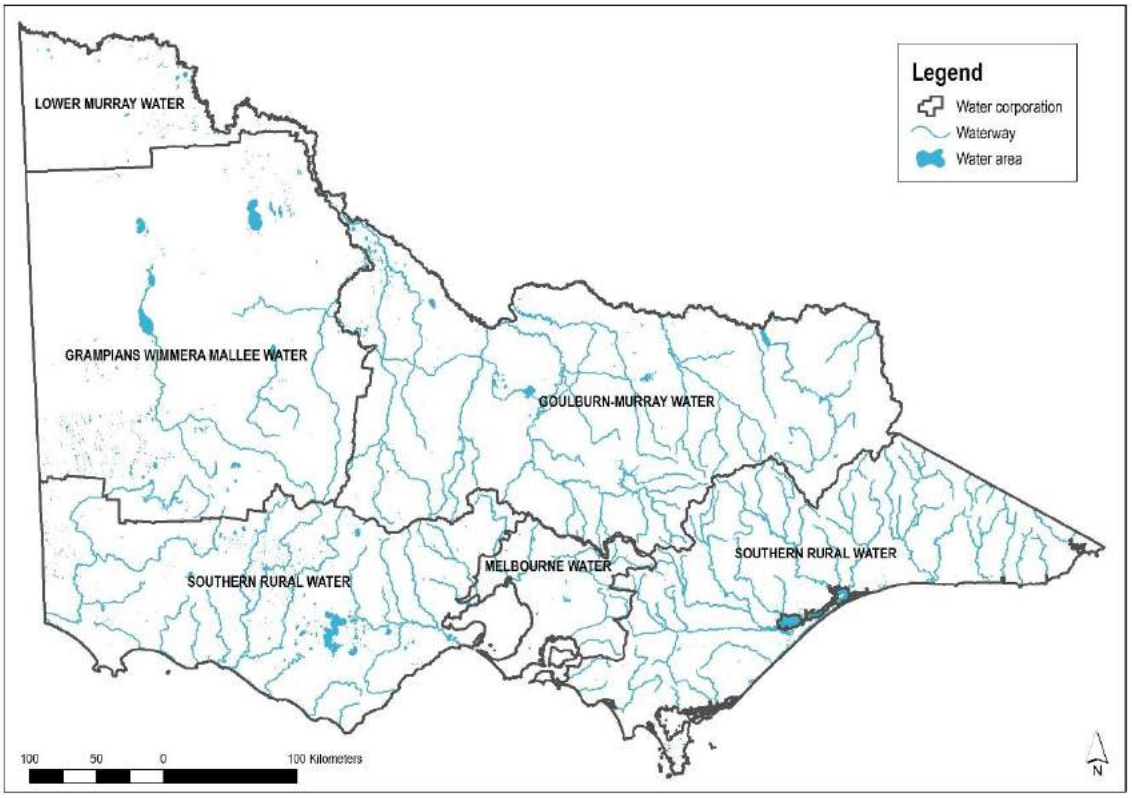
Six **rural water corporations** provide rural water services including water supply, drainage and salinity mitigation services for irrigation and domestic and stock purposes. They are:

- Southern Rural Water
- Goulburn-Murray Water

- Coliban Water
- GWMWater
- Lower Murray Water
- Melbourne Water.

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 their region via a network of open channel and pipeline systems. Water is sourced for this rural supply from their 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:

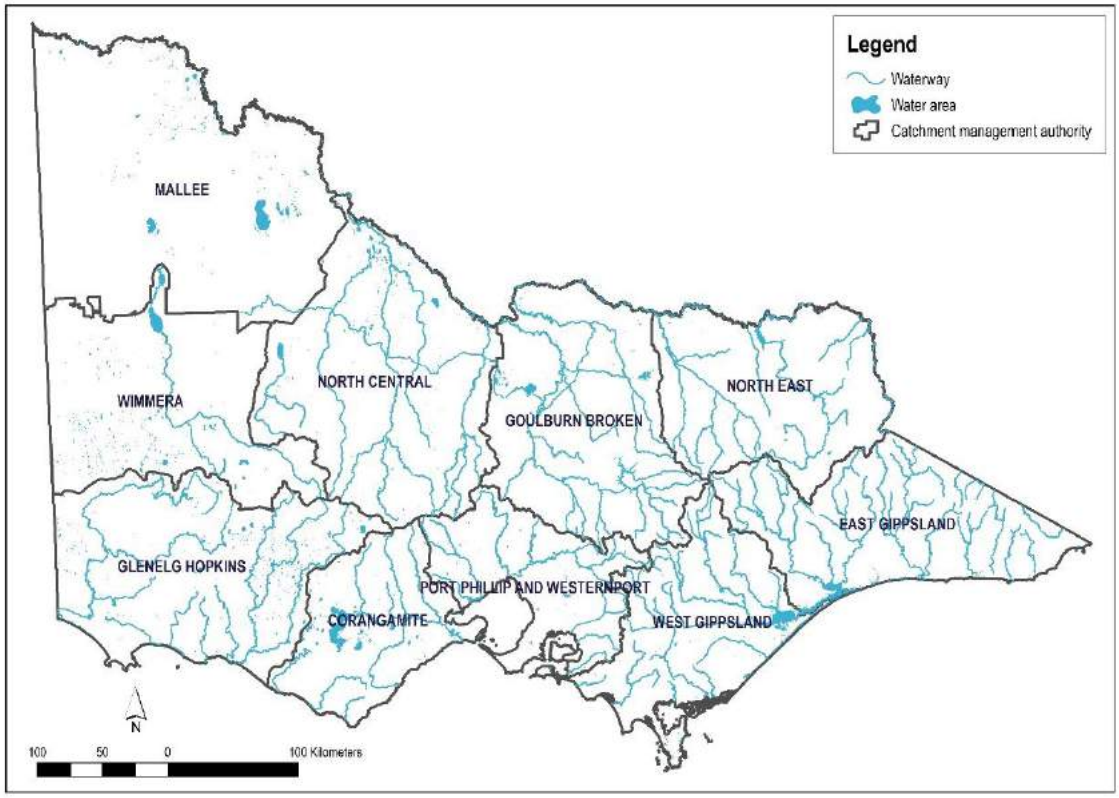
- managing rivers, creeks and major drainage systems in the Melbourne, Port Phillip and Western Port areas
- developing and implementing management plans on behalf of the Minister
- administering the diversion of water from waterways
- supplying recycled water, through a number of retail water corporations, 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 and Human Services** 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 1970*. The EPA is responsible for controlling environmental standards for wastewater discharge.

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. The CaLP Act establishes the **Victorian Catchment Management Council** as the government's key advisory body on catchment management and the condition of land and water resources at the statewide level.

Figure 1-6 Catchment management authorities



The **VEWH** is the independent authority established by the Victorian Government in 2011, and it 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 **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 ensuring compliance with the *Murray–Darling Basin Plan*, which formally commenced in November 2012. The Basin Plan sets limits on the amount of water that can be extracted from the basin, which came into effect in 2019. 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.

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 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 contractual agreements to supply
- limits on 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 is less available 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.

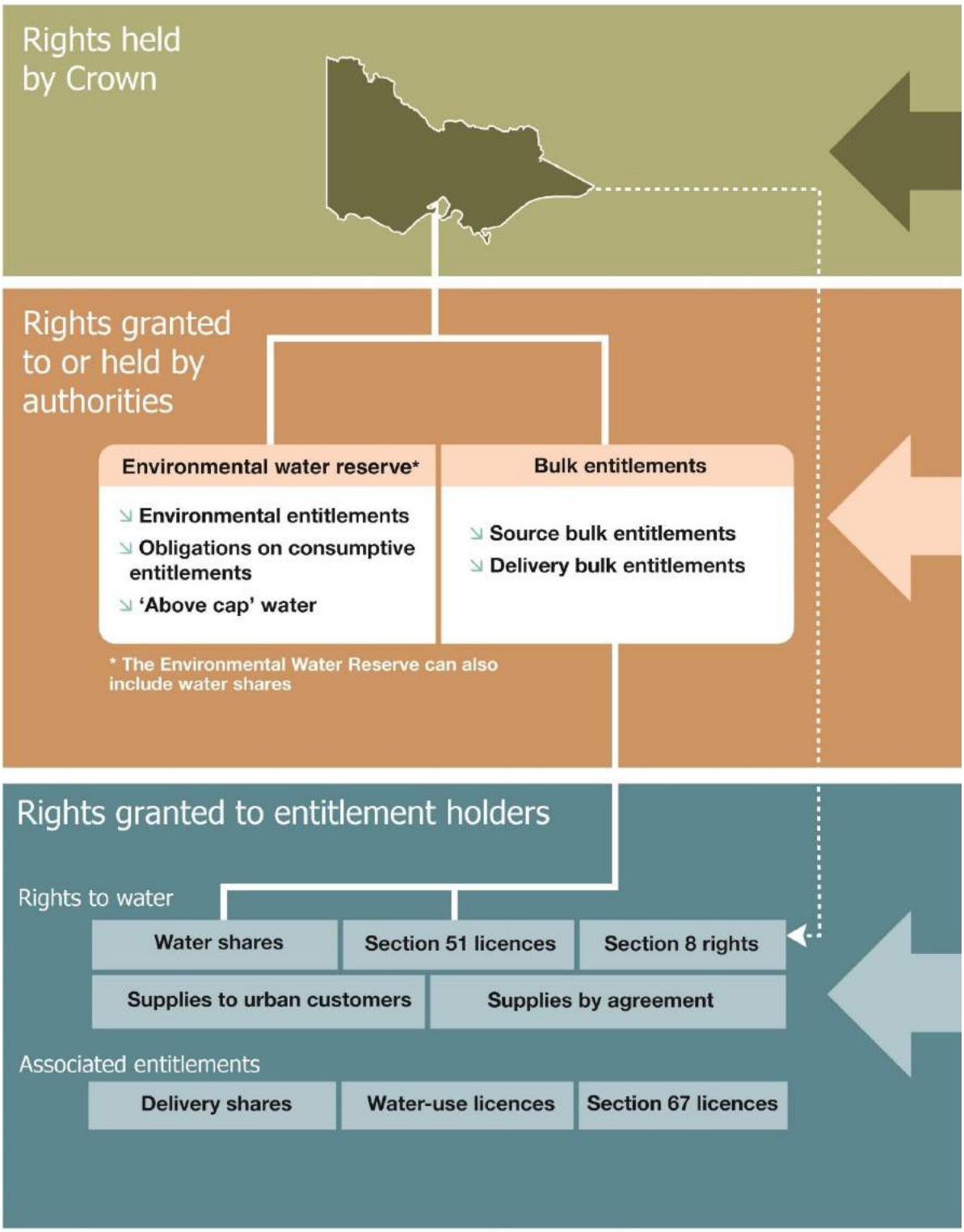
To support and guide the management of water allocated under the entitlement framework, Victoria has a water resource planning framework comprising:

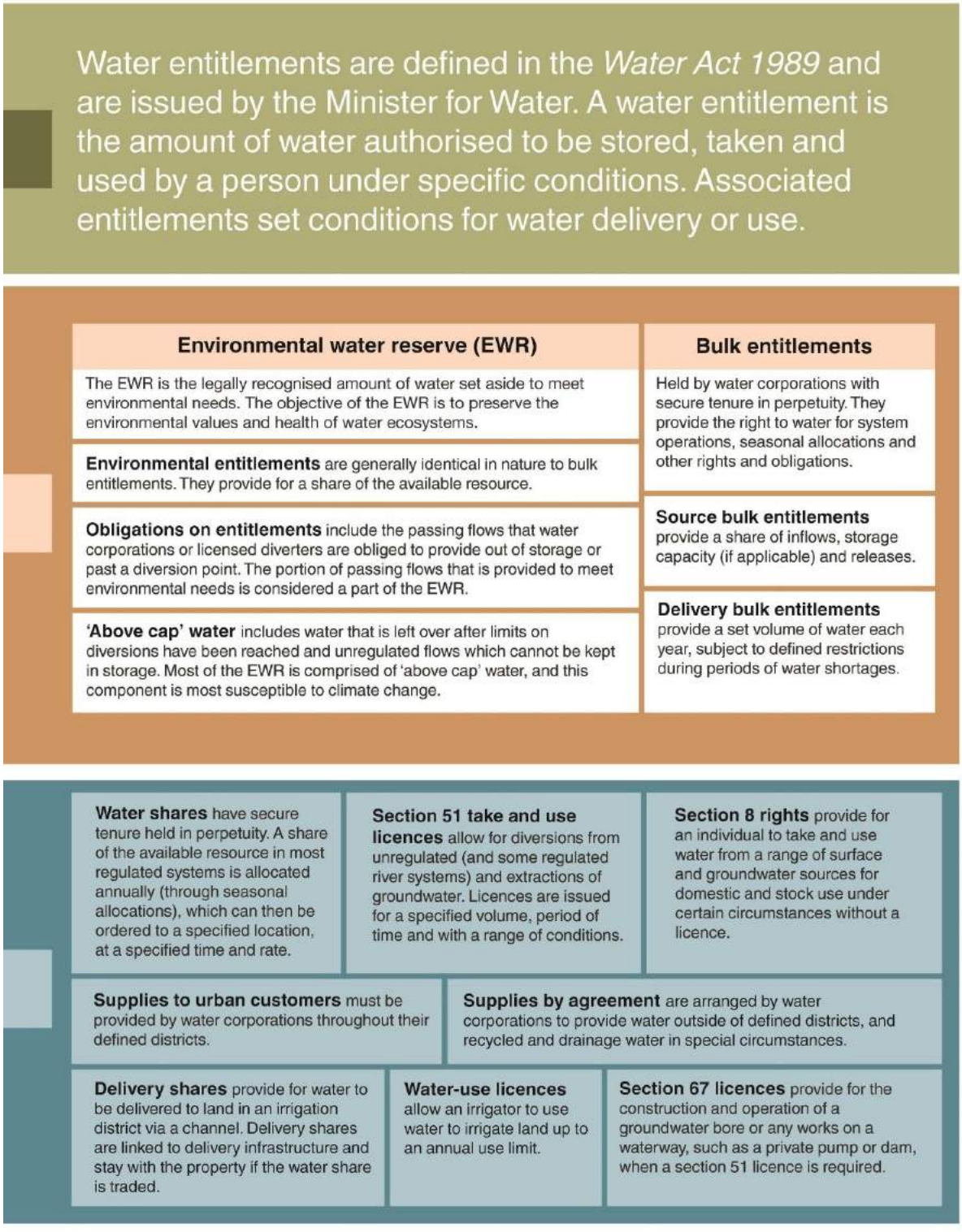
- year-to-year or short-term planning through measures such as seasonal resource determinations on rural regulated systems or drought response plans and annual water security outlooks in urban systems
- local planning to balance the demand of water and available supply in urban areas, through the development of 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 river health strategies every five years
- strategic planning through the development of regional sustainable water strategies (SWSs) every seven to ten years
- long-term water resource assessments (LTWRAs) 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 will use the assessment as one of many inputs to plan for the next 50 years as it begins work on 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





1.3.1 Water entitlements

Victoria's water entitlement framework provides for the equitable 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 (refer section 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 section 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 in storage works of a water corporation and 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 2019–20.

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.[2] 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 use 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 2019–20.

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 1.3.2.2). 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 is 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. Traditional purposes means providing for the personal, domestic or non-commercial communal needs of group members.

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.

[2] The Victorian water entitlements for The Living Murray program are held by the VEWH in trust for the MDBA. In 2019–20, the MDBA held water shares in Victoria.

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 2019–20, 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 into the 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 be based on the assumption 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. 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 2019–20.

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 2019–20.

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 2019–20.

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 2019–20.

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 2019–20.

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 2019–20.

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 2019–20.

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 researches 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 2019–20. 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 is 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 2019–20. 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 2019–20.

The following were the key water availability events in 2019–20.

- Although wetter than the previous year, rainfall in 2019–20 was still below average across most of the state. Large parts of the east and parts of the north were especially dry, receiving very much below-average rainfall. However, above-average rainfall was received in the state's south-east, central and north-central areas and in parts of the state's west.
- 2019 was Victoria's fifth-warmest calendar year on record. December 2019 was the fifth driest and second warmest on record. Rainfall for January to April 2020 was 54% above average for Victoria — the wettest period since 2011 — with the most significant rain falling in central Victoria during this time. Rainfall in autumn 2020 was 27% above average, the highest since 1989.
- Despite above-average rainfall during January to April 2020, serious or severe longer-term rainfall deficiencies persisted over large areas eastern Victoria and the northern border regions. The impacts of the low rainfall were further exacerbated by record high temperatures in 2019, especially in the summers of 2018−19 and 2019−20 (see chapter 2.1).
- The hot conditions combined with the dry landscape and strong winds produced dangerous fire weather conditions during December 2019 and into early January 2020. Between November 2019 and February 2020, 3,500 fires burnt more than 1.5 million hectares across the state, the largest area since 1939.
- One of the strongest positive Indian Ocean Dipoles on record was a substantial contributor to the dry conditions in the second half of 2019, suppressing rainfall and raising temperatures for much of 2019 (see chapter 2.1).
- Near- to above-average rainfall returned to many parts of Australia from January 2020 onwards, with large areas of the country receiving more rainfall in January to April 2020 than they did in all of 2019. Melbourne had its second wettest start to the year: the wettest was in 1924.
- 74% of long-term annual average streamflows were received in Victoria, and 23 river basins had annual streamflow volumes higher than those received in 2018–19 (see chapter 2.2).
- Total Victorian storage levels at the end of the water year were higher than at the start. At 1 July 2019, total storage levels were at 42% of total capacity, compared to 49% at 30 June 2020. Levels only reached a peak of 53% of capacity in September, compared to 66% the previous year.
- Regional storages were 40% full at the beginning of 2019–20, reaching a peak of 51% of capacity in September, compared to 66% the previous year. Storage levels declined through the summer to a minimum of 38% of capacity by March 2020, and they were 47% full on 30 June 2020 (see chapter 2.3).
- Melbourne storages were 50% full at the start of the year, reaching a peak of 64% in November 2019: the same as the previous year. Levels dropped to a minimum of 61% in April 2020, compared to 50% in May 2019, and they ended the water year at 64% of total capacity. This is the first year since 2016–17 when Melbourne's storage levels were higher at the end of the water year than at the start.
- The Victorian Desalination Project delivered a 125 GL water order, contributing 118 GL to Melbourne's storage levels in 2019–20 and 7 GL delivered in advance in June 2019. Without the desalinated water delivered since 2016–17, Melbourne's storages would have finished the year at 51.4% in 2019–20.
- Groundwater level trends were more stable in 2019–20 than in 2018–19 (see chapter 2.4).

Although fewer unregulated streams were restricted, there were more restrictions on urban and groundwater use than in the previous year, and high-reliability entitlements only reached 100% in four regulated systems, compared to seven in 2018–19. In 2019–20:

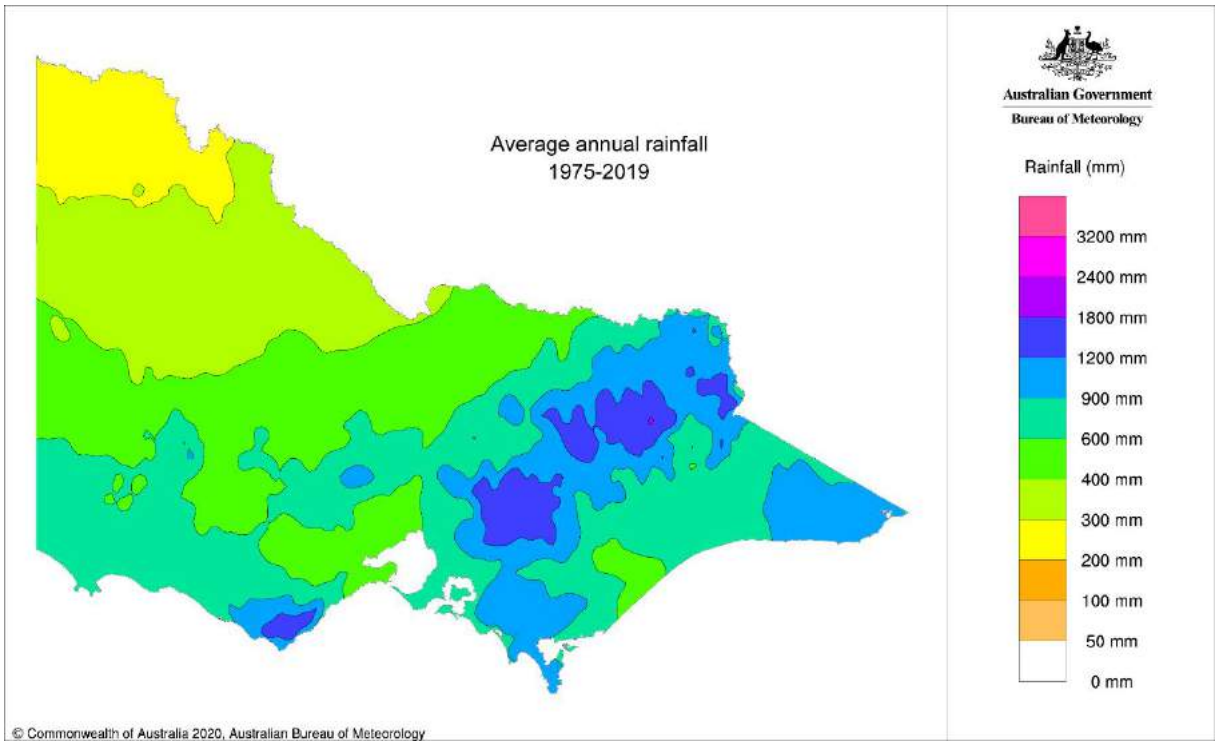
- 32 towns were on urban water restrictions, 26 more than in 2018–19 (see chapter 2.5.1)
- in declared water systems, seasonal determinations to high-reliability entitlements did not reach 100% in any major northern systems. Southern systems fared better, with 100% high-reliability determinations made in the Thomson and Werribee systems (see chapter 2.5.2)
- 137 streams were subject to restrictions on diversions in March 2020, compared to 162 at the same time in the previous year (see chapter 2.5.3)

- entitlement holders in four GMUs were subject to restrictions on groundwater use: one more GMU than on the previous year.

2.1 Rainfall

Long-term average rainfall in Victoria varies from less than 300 mm a year in the north-west of the state to over 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, 1975–2019



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 has shown a warming and drying trend over recent decades, and this trend is expected to continue. Compared to historical conditions, we are already experiencing:

- higher temperatures, particularly during the warmer months of the year
- reductions in rainfall in late autumn and early winter, and in some locations some increases in rainfall during the warmer months
- in some catchments, a shift in the streamflow response to rainfall, with less streamflow generated for the same amount of rain.

As part of implementing *Water for Victoria*, the Victorian Government is investing in further research to better understand how Victoria's climate is changing and the water-resource implications. For these 2019–20 accounts, the BoM has provided a map showing Victoria's long-term (1975–2019) average annual rainfall (Figure 2-1), a map showing the state's 2019–20 rainfall (Figure 2-2) and a map comparing the two (Figure 2-3).

In 2019–20, rainfall was just below average across most of the state, with above-average rainfall received in south-eastern, central and north-central areas and parts of the west. The lowest rainfall received was in the north-west and east Gippsland. Throughout the year, temperatures were above average for most of the state, especially east Gippsland, except in winter when night-time temperatures were cooler than average in the Victorian Alps and in autumn when days were cooler than average for most of the state away from east Gippsland.

As at the end of December 2019, a severe multi-year drought was affecting large parts of eastern Australia and far north-west Victoria. The impacts of the low rainfall had been further exacerbated by record high temperatures in 2019, especially in the summers of 2018−19 and 2019−20. The hot conditions combined with the dry landscape and strong winds produced dangerous fire weather conditions during December 2019 into early January 2020. Between November and February 2020, 3,500 fires burnt more than 1.5 million hectares across the state, the largest area since 1939.

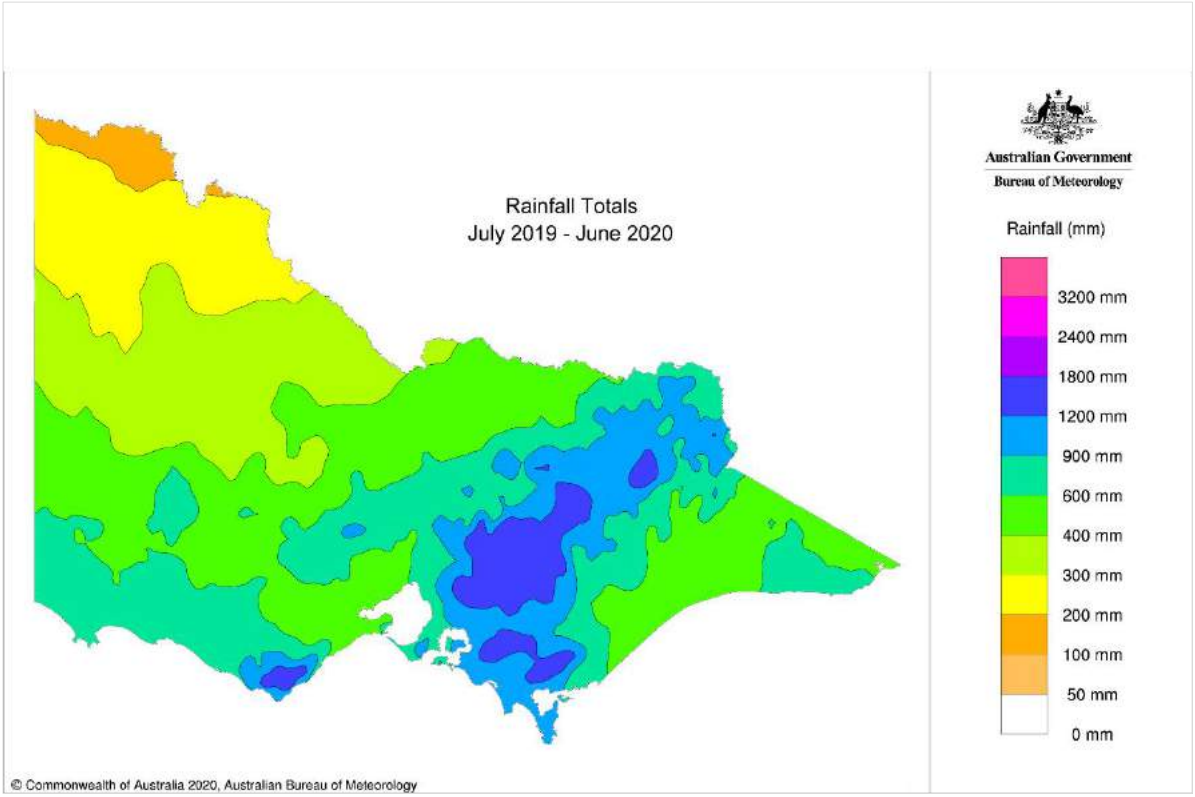
Near- to above-average rainfall returned to many parts of Australia from January 2020 onwards, with large parts of the country receiving more rainfall in January to April 2020 than they did in all of 2019.

A major influence on the climate in winter and spring 2019 was the presence of a very strong positive phase of the Indian Ocean Dipole (IOD). This is typically associated with dry conditions in many parts of Australia. The 2019 event, which eventually broke down at the end of the year, was amongst the strongest positive IOD events on record, suppressing rainfall and raising temperatures for much of 2019. Typically, a positive IOD brings below-average winter-spring rainfall and snow depths, above-average temperatures and an earlier start to the fire season for southern and central Australia.

The IOD returned to neutral in January 2020 and both the IOD and El Niño–Southern Oscillation (ENSO) remained neutral through to the end of 2019–20. The BoM's ENSO Outlook shifted to La Niña WATCH in late June 2020 when the Tropical Pacific Ocean continued to cool. At this time, most of the bureau's climate models anticipated this cooling would be close to the threshold for La Niña by early spring; three of the six models continued to suggest the possibility of a negative IOD developing during winter or early spring. La Niña events typically bring above-average spring rainfall in northern, central and eastern Australia, and a negative IOD typically brings above-average winter–spring rainfall to southern Australia.

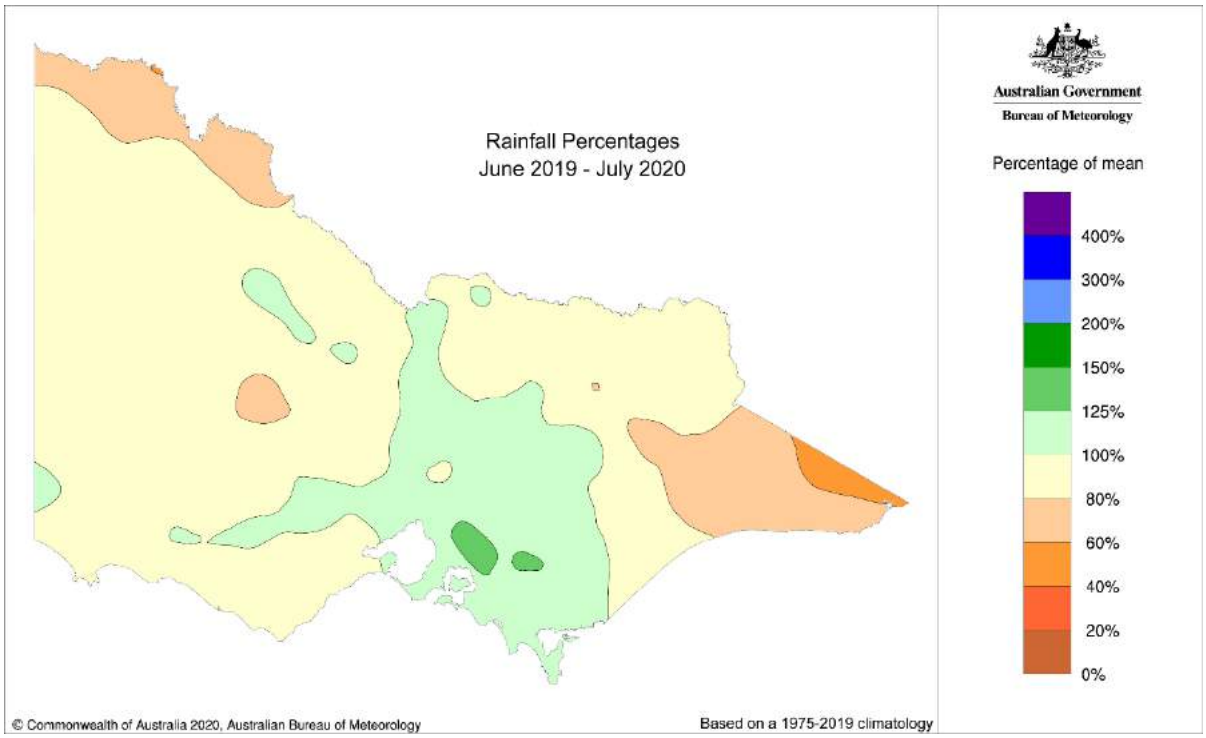
The range for total annual rainfall varied across the state from 100 mm to 1,800 mm. The lowest rainfall — of between 100 to 300 mm — was received in the north-west; it was drier along the border with NSW and in the Mallee. 300 to 600 mm was received in the north-central and west of the state; and the south-west coast, Ballarat and east Gippsland received up to 900 mm of rainfall. From 900 to 1,200 mm was received in the north-east, west Gippsland and around Daylesford. The highest rainfall (of up to 1,800 mm) was received in the Yarra Ranges, the Otways and around Bright in the north-east (Figure 2-2).

Figure 2-2 Rainfall, Victoria, 2019–20



Rainfall across Victoria was typically between 80% and 100% of the average (Figure 2-3). Above-average rainfall (100-125%) was received in parts of the west, the south-east, south Gippsland, central and north-central Victoria, with up to 150% of average rainfall received around Koo Wee Rup and Warragul. Close-to-average rainfall (between 80% and 100%) was received in much of the state's west and north-east and in the Latrobe area. Below-average rainfall was again received in the north-west and in east Gippsland and also in the west near Stawell. The greatest rainfall deficiencies were recorded in east Gippsland.

Figure 2-3 Rainfall, Victoria, 2019–20, as a percentage of 1975–2019 average



Averaged across Victoria as a whole, evapotranspiration in 2019–20 was estimated to be 520 mm. This is about 5% below long-term (1975–2020) average evapotranspiration. When estimated at a basin scale, evapotranspiration was typically lower than and within +/- 10% of the long-term average for most Victorian basins. The exceptions were the Mallee, Snowy, Tambo and East Gippsland basins, where there was reduction of more than 10% in estimated annual evapotranspiration, relative to the long-term average. This was because of below-average rainfall over the modelled period. However, the model's calculations do not reflect the impacts of the 2019–20 fires in east Gippsland, which could have reduced interception and transpiration by plants, reducing evapotranspiration further in affected catchments. The highest rates of evapotranspiration, when compared to the long-term average, were estimated for the Moorabool, Werribee, Yarra and Bunyip basins.

In 2019–20, the proportion of evapotranspiration-to-rainfall was generally higher than the long-term average. This is consistent with below-average rainfall generally being observed, because the proportion of evapotranspiration-to-rainfall generally decreases as rainfall increases. As a result, less rainfall became streamflow or groundwater recharge in 2019–20 than would be the case in an average year (Appendix A).

Winter 2019

Winter rainfall in Victoria was below average across much of the north and east of the state, while in parts of the south it was above average (Figure 2-4A). Statewide, rainfall was about 11% below the winter average of 203 mm. Daytime and night-time temperatures were above average. Daytime temperatures were very much above average in most of east Gippsland, and only the Victorian Alps had cooler-than-average nights in winter.

Spring 2019

Statewide, average rainfall was 39% below the long-term spring average. Rainfall in spring was below average in most of Victoria, and very much below average in large areas across the state's north (Figure 2-4B). Daytime temperatures in spring were warmer than average across most of the state, and very much warmer than average in east Gippsland. October was Victoria's eighth driest and eighth warmest on record.

A Code Red (indicating catastrophic fire danger) was declared for the Mallee and Northern Country fire districts on 21 November 2019 due to the extreme heat; the last time a Code Red was declared in Victoria was in January 2010. In east Gippsland, fires near Bruthen, Ensay and Gelantipy burnt thousands of hectares of bush in November.

Summer 2019–20

In summer 2019–20, statewide, rainfall was 5% below average (Figure 2-4C) and temperatures were above average. January and February were wetter than average, but December 2019 was Victoria's fifth driest and second warmest on record. December 20 and 30 were exceptionally hot throughout Victoria, and many sites had their highest December temperature on record. All of Victoria recorded accumulated Forest Fire Danger Index values for December in the highest 10% of historical records, and the highest on record for December over the north and north-west of the state and in east Gippsland.

Fires, smoke and flash flooding in summer 2019–20

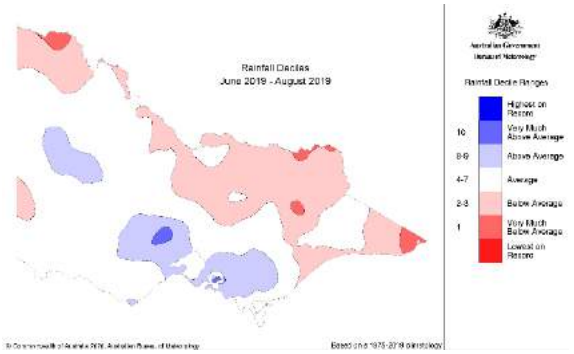
- Significant new fires commenced in east Gippsland during December, burning more than 230,000 hectares in east Gippsland and more than 1.5 million hectares statewide.
- Some fires were so big that they created their own storms: a pyro cumulonimbus cloud formed over firegrounds in the east Gippsland area on 30 December, generating lightning.
- Thousands of properties in east Gippsland and north-east Victoria lost electricity due to fires.
- Widespread areas of smoke from fires burning in southern New South Wales and East Gippsland extended across eastern and southern Victoria on 23 December and again on 13 January, persisting over several days.
- Severe thunderstorms developed in the afternoons on 15 and 19 January bringing heavy rainfall, flash flooding and damaging winds to central Victoria and parts of Melbourne.
- Widespread rainfall on 20 and 22 January helped reduce the number of uncontained bushfires in the state's east.
- On 23 January, strong northerly winds brought dust from north-west Victoria to the southern parts of the state. It came down with rain, coating surfaces with a layer of dust and colouring the Yarra River brown.
- Powerful storms swept through eastern Melbourne and parts of Gippsland on 14 February and again on 18 February, leading to flash flooding and fallen trees.

Autumn 2020

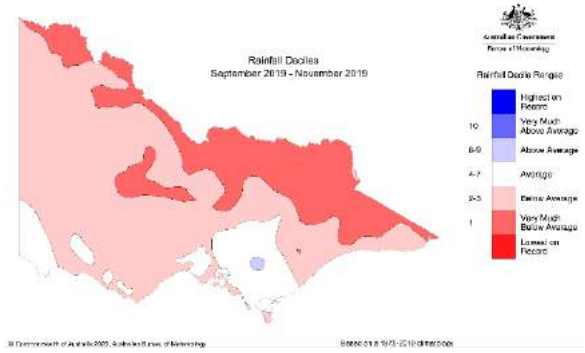
Averaged across the state, rainfall in autumn 2020 was 27% above average, the highest since 1989 (Figure 2-4D). Autumn was wetter than average for most of Victoria, with some parts of the north, north-east, north-central and central districts much wetter than average. It was drier than average only in parts of east Gippsland. Days were cooler than average for most of the state away from east Gippsland and parts of the coast, while night-time temperatures were generally close to average.

Figure 2-4 Rainfall deciles, Victoria, by quarter

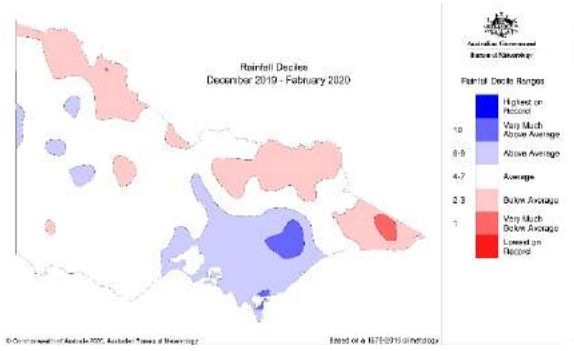
A. Rainfall deciles for winter 2019 (June–Aug)



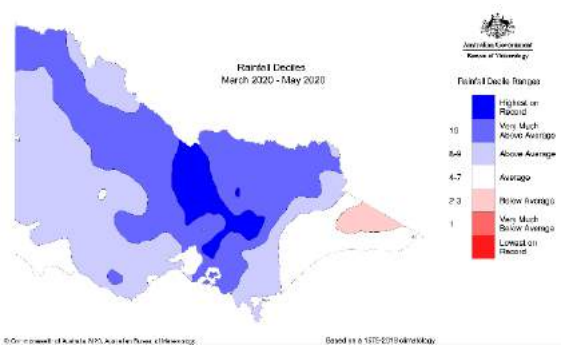
B. Rainfall deciles for spring 2019 (Sept–Nov)



C. Rainfall deciles for summer 2019–20 (Dec–Feb)

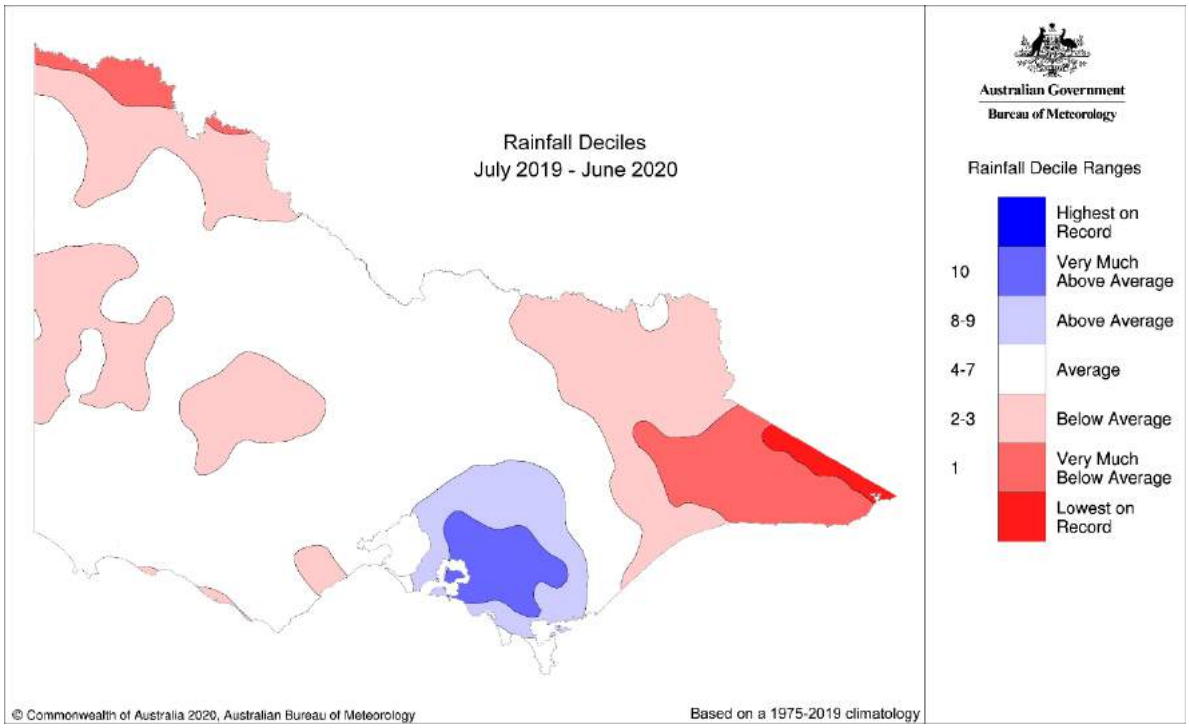


D. Rainfall deciles for autumn 2020 (Mar–May)



Overall, rainfall for 2019–20 was below average across most of the state. Above-average rainfall was received in the south-eastern, central and north-central areas. Rainfall was very much below average in parts of the west, and parts of the north and large parts of the east (Figure 2-5). Despite above-average rainfall during January to April 2020, serious or severe longer-term rainfall deficiencies persisted across eastern Victoria and the northern border regions.

Figure 2-5 Rainfall deciles, Victoria, 2019–20



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.

As with the 2018–19 accounts, the long-term average inflows are based on data from 1975 to 2019.

In 2019–20, 23 river basins had annual streamflow volumes higher than in 2018–19 (Table 2-1). When compared to the long-term annual average streamflows, seven basins had above-average streamflows for 2019–20, compared to the previous year when two basins had above-average streamflows. The total annual streamflow volume for Victoria was 16,662,382 ML, 74% of the long-term average (Table 2-1). This is more than the volume in 2018–19, which was 10,704,896 ML, 47% of the long-term average.

Compared to last year, there was more rainfall in 2019–20 across most of the state, which meant most streams received more rainfall. Rainfall was above average for most of the state from January to June 2020, with many areas receiving more rainfall in January to April 2020 than in all of 2019. Rainfall for 2019–20 was very much below average in parts of the west, and parts of the north and large parts of the east. South-eastern, central and north-central areas received above-average rainfall for the year.

The Avoca basin was the driest basin in 2019–20, receiving 7% of long-term average inflows: slightly higher than in the previous year. The Corangamite basin received the highest percentage of long-term average inflows: 194,972 ML, 225% of the long-term average.

Four basins received less streamflows than in the previous year. These included two in the far east (East Gippsland and Snowy) and two in the south-west (Glenelg and Portland Coast). Of the 23 basins that received more streamflows than in the previous year, the Broken and Thomson basins received the largest increases: more than triple the volume received in 2018–19.

In the east and south-east:

- the East Gippsland, Tambo, Snowy and Mitchell basins received below-average streamflows for the third year in a row (15%, 24%, 43% and 69% respectively)
- the Latrobe, South Gippsland and Thomson basins all received above-average streamflows of between 103% and 155% of the long-term annual average, much higher than in 2018–19 when they received between 46% and 57%
- the Bunyip basin received more than double the streamflows received in 2018–19 and the highest percentage of the long-term annual average in the east (192%).

Although all basins in the north received more streamflows than in the previous year, all basins received below-average streamflows in 2019–20:

- the Broken, Ovens and Kiewa basins in the north-east received between 45% and 80% of the long-term average

- the Loddon, Campaspe, Murray and Goulburn basins in north-central Victoria received between 44% and 53% of the long-term average
- the Avoca and Wimmera basins in the north-west received 7% and 25% of the long-term average respectively.

In the south-west:

- the Glenelg and Portland basins received less streamflows in 2019–20 than in the previous year (39% and 41% of the long-term average respectively)
- the Hopkins, Otway Coast and Corangamite basins all received more streamflows in 2019–20 than in the previous year, 83%, 121% and 225% respectively of the long-term annual average.

In the central basins:

- the Maribyrnong (55%), Barwon (59%) and Moorabool (67%), Werribee (82%) basins received below-average streamflows, but all basins received increases from the previous year
- the Yarra basin received above average streamflows (108%), around double the streamflows of the previous year.

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

Basin	Long-term average annual inflows (ML)	2019–20 streamflows (1)		2018–19 streamflows (1)	
		(ML)	(% of LTA)	(ML)	(% of LTA)
Avoca	87,100	6,431	7%	3,397	4%
Barwon	248,000	147,415	59%	97,286	39%
Broken	260,800	117,935	45%	32,924	13%
Bunyip	564,400	1,083,251	192%	487,957	87%
Campaspe	258,600	117,033	45%	51,918	20%
Corangamite	86,800	194,972	225%	111,426	128%
East Gippsland	857,700	125,854	15%	182,905	21%
Glenelg	527,300	217,010	41%	347,250	66%
Goulburn (2)	2,859,000	2,155,436	75%	1,444,085	51%
Hopkins	325,100	269,866	83%	135,766	42%
Kiewa	676,700	543,893	80%	457,330	68%
Latrobe	843,300	866,562	103%	379,938	46%
Loddon	243,400	107,751	44%	58,090	24%
Mallee (3)	-	-	-	-	-
Maribyrnong	92,800	50,964	55%	25,740	28%
Millicent Coast (3)	-	-	-	-	-
Mitchell	804,100	554,446	69%	385,870	48%
Moorabool	103,400	69,075	67%	33,905	36%
Murray	6,649,300	3,501,757	53%	2,737,418	41%
Otway Coast	733,300	884,419	121%	816,710	111%
Ovens	1,729,300	1,007,608	58%	702,562	41%
Portland Coast	462,200	179,570	39%	202,080	44%
Snowy (4)	795,600	343,275	43%	388,996	49%
South Gippsland	932,900	1,439,013	154%	528,478	57%
Tambo	297,200	72,072	24%	43,687	15%
Thomson	936,400	1,450,093	155%	461,302	48%
Werribee	88,600	73,090	82%	51,068	52%
Wimmera	223,100	54,700	25%	24,306	11%
Yarra	954,200	1,028,892	108%	512,504	51%
Total	**22,640,600**	**16,662,382**	**74%**	**10,704,896**	**47%**

Notes

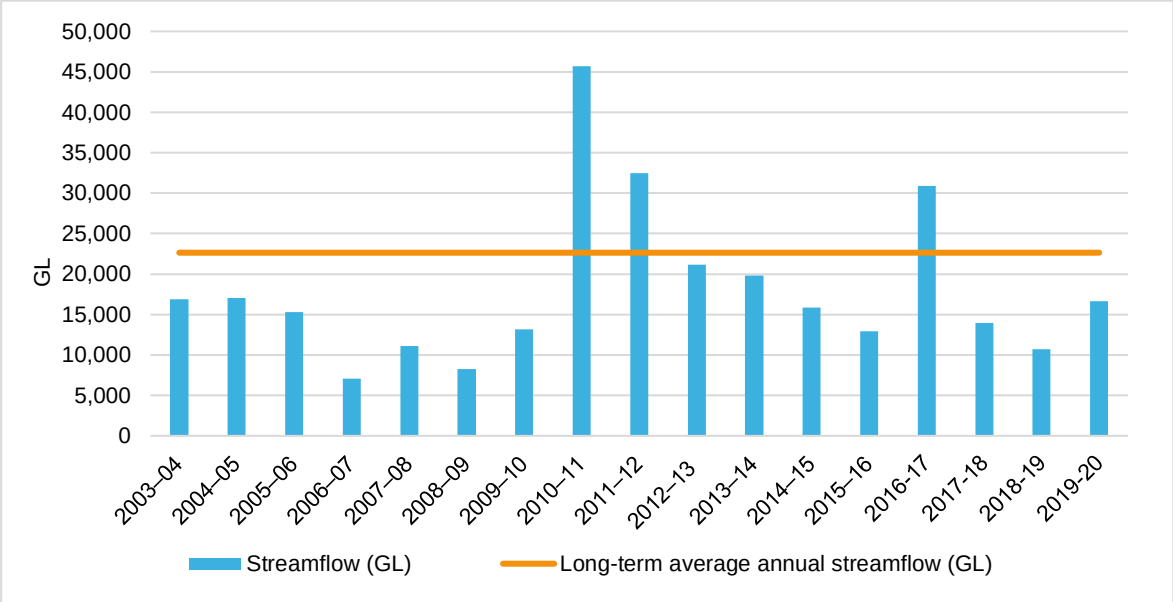
(1) 'Streamflow' is equivalent to 'catchment inflow' in the water balances in chapter 6.

(2) Only includes inflows within the Goulburn basin.

(3) Surface water resources within the Mallee and Millicent Coast basins are limited and there are currently no streamflow gauges in these basins. Streamflows in the Millicent Coast basin are estimated be equal to the volume of licensed diversion from unregulated streams within the basin. There are no licensed diversions in the Mallee basin, and it is assumed it has no streamflows.

(4) Volumes shown for the Snowy basin exclude catchment inflows from New South Wales (upstream of Burnt Hut Crossing).

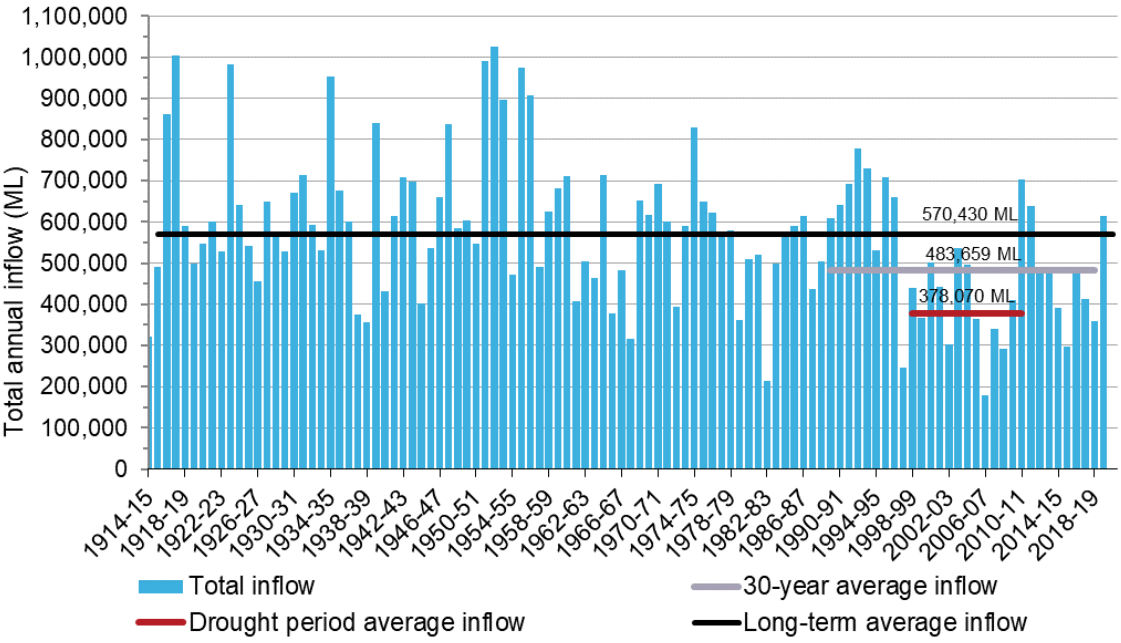
Figure 2-6 Total streamflow, Victoria, compared to 1975–2019 average



Streamflows have a major influence on Victoria's water storages. Figure 2-6 shows Victoria's total annual streamflows in 2019–20 were higher than in the previous two years. Figure 2-7 shows that total annual streamflows received in Melbourne's main reservoirs were not only higher than in the previous eight years, but for the first time since 2011–12 they were above the 30-year long-term annual average.

This year, the accounts have used the 30-year long-term average (1990–91 to 2018–19) for comparison instead of the 100-year average. The annual inflows to Melbourne's harvesting reservoirs in the Yarra and Thomson basins in 2019–20 were 127% (615,401 ML) of the 30-year long-term average of 483,659 ML, which is 109% of the 100-year average of 570,430 ML. This is almost double the volume (359,585 ML) received in 2018–19, which was 74% of the 30-year long-term average, 63% of the 100-year long-term average and notably lower than the average inflows during the last drought, which were 378,070 ML (Figure 2-7). Although 2019–20 is the first year since 2011–12 that Melbourne has received above-long term-average inflows into storages, inflows into storages have been below average in 15 out 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.

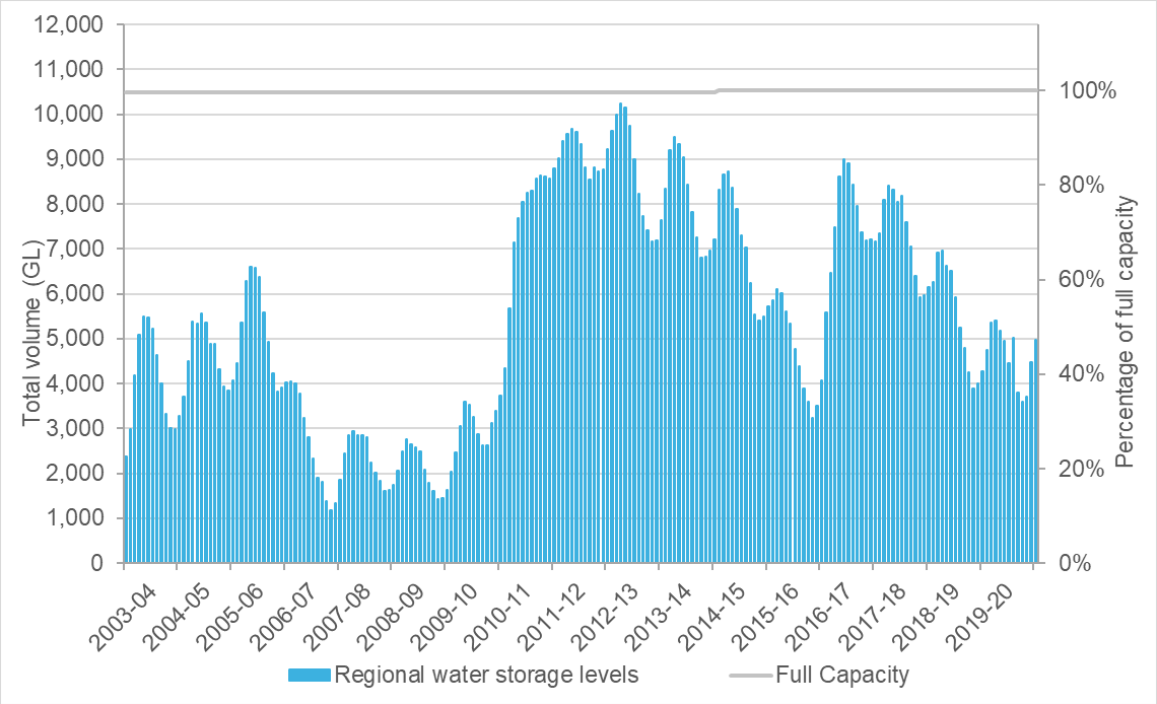
2.3 Storages

Victoria's major water storages can hold 12,405,848 ML. Of this, Melbourne's storage capacity is 1,812,175 ML and the combined capacity of the state's major regional storages is 10,593,673 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 2019–20, Victoria's total storage levels started the year at 5,174,515 ML (42% of capacity) and ended at 6,125,561 ML (49% of capacity). Storage levels only reached a peak of 53% of capacity in September 2019, compared to 66% 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 4,266,309 ML (40% of capacity) and ended at 4,969,749 ML (47% of capacity). 25 of Victoria's regional storages reached at least 90% of capacity by September 2019 (compared to 13 the previous year) and 14 of those reached full capacity and were spilling, compared to five the previous year. Despite this, in 2019–20 levels only reached a peak of 51% of capacity by September, compared to 66% the previous year. Storage levels declined through the summer to a minimum of 38% of capacity by March 2020 (Figure 2-8).

Figure 2-8 Volume in major regional water storages, 1 July 2003 to 30 June 2020 (1) (2) (3)



Notes

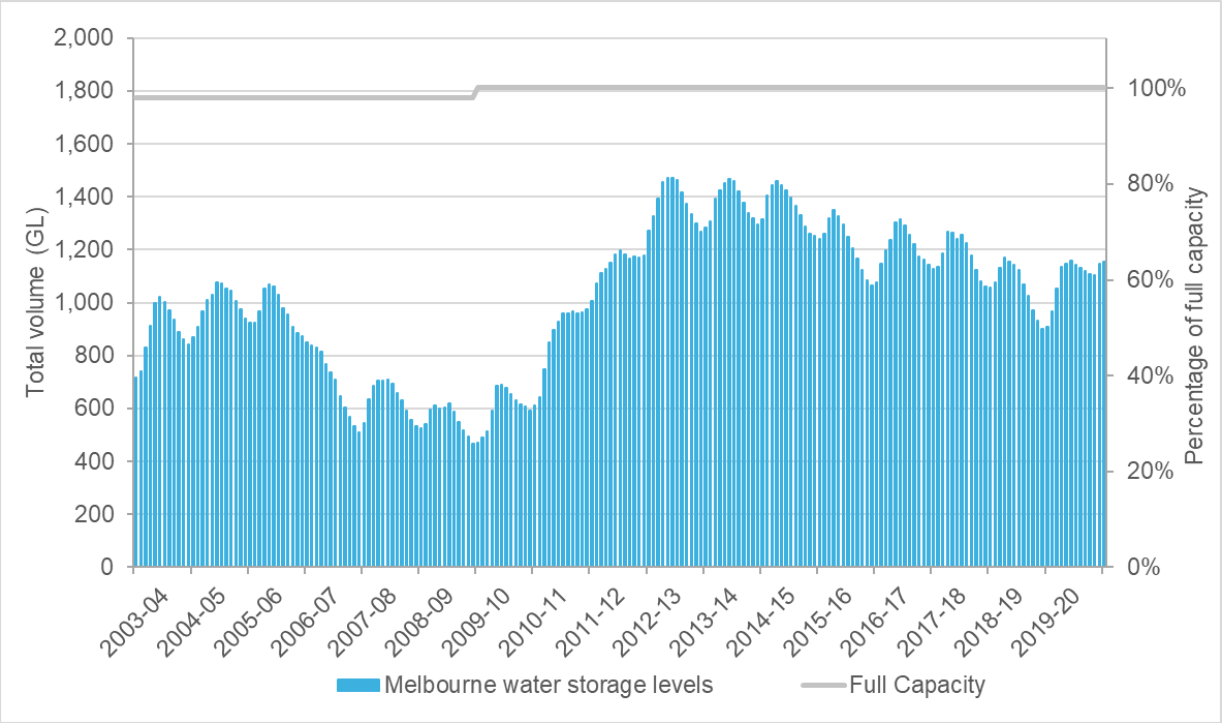
(1) The Y axis percentage relates to the current storage capacity (i.e. after the addition of the Menindee Lakes 240,000 ML in 2015–16).

(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.

Melbourne's water storages fared better than the regional storages in 2019–20, starting the year at 908,206 ML (50% of total capacity) and ending it at 1,155,812 (64% of total capacity) after reaching a peak of 64% in November 2019 (Figure 2-9). This is the first water year since 2016–17 when Melbourne's storage levels were 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 every month except October and December 2019 (unlike in 2018–19 when 11 out of 12 months received below-average inflows). Although four months in 2019–20 had below-average rainfall (October 2019, December 2019, March 2020 and June 2020), Melbourne had its second-wettest start to the year (after 1924). There was also a 125 GL Victorian Desalination Project water order which contributed to Melbourne's water storage levels, with 118 GL delivered in 2019–20 and 7 GL delivered in advance in June 2019. 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 2020 (1)



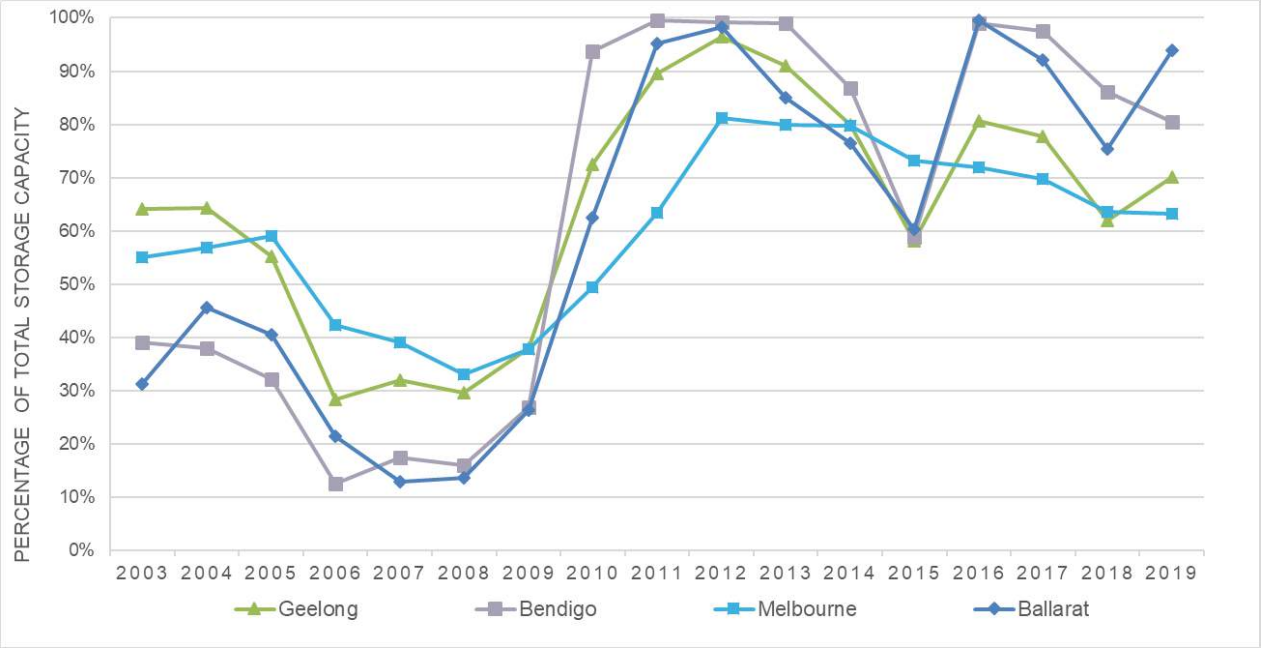
Note
(1) The Y axis percentage relates to the current storage capacity (i.e. after the addition of Tarago's 37,580 ML in 2010).

The Victorian Desalination Project began producing water in March 2017. The total volume delivered for the year to 30 June 2020 was 118 GL (representing 6.52% of Melbourne's storage capacity), compared to 22 GL (or 1.21%) delivered in 2018–19. The 2019–20 water order was for 125 GL, with 7 GL delivered in advance in June 2019. Without the water delivered since 2016–17, Melbourne's storages would have finished the year at 51.4% in 2019–20. 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 2019.

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 2019, storages in Melbourne and the selected regional centres were between 63% and 94%. The regional storages were between 70% and 94%, which was on average higher than in the previous year when regional storages were between 62% and 86%. Melbourne storages in October 2018 were at 63%, just slightly lower than in the previous year, when they were at 64% (Figure 2-10).

Figure 2-10 Percentage of total storage capacity of reservoirs for major urban centres, at 31 October 2003–19



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 they are affected by 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 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 2019–20, WSPA trends were similar to the previous year, whereas there were more GMAs with stable and rising groundwater-level trends than there were in 2018–19.

In the WSPAs in 2019–20, seven were categorised as declining, three as stable and one as rising. This compared to six declining and five stable in 2018–19 (Table 2-2 and Figure 2-11). In the state's GMAs in 2019–20, 16 were declining, compared to 22 in 2018–19; 17 were stable, compared to 16 in 2018–19; and seven were rising, compared to two in 2018–19 (Table 2-3 and Figure 2-12).

Groundwater levels in some bores remained within historical averages, while others ended the year at historical lows. 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 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Central groundwater management basin					
Westernport groundwater catchment					
Koo Wee Rup	Declining	Declining	Declining	**Stable**	**Declining**
West Port Phillip Bay groundwater catchment					
Deutgam	Declining	Declining	Declining	**Declining**	**Declining**
Gippsland groundwater management basin					
Central Gippsland groundwater catchment					
Sale	Stable	Declining	Declining	**Declining**	**Stable**
Yarram [(1)]	Declining	Declining	Declining	**Declining**	**Declining**
Goulburn-Murray groundwater management basin					
Campaspe groundwater catchment					
Lower Campaspe Valley	Declining	Declining	Declining	**Declining**	**Declining**

Goulburn–Broken groundwater catchment					
Katunga	Declining	Declining	Declining	**Declining**	**Declining**
Loddon groundwater catchment					
Loddon Highlands	Declining	Declining	Rising	**Declining**	**Declining**
Ovens groundwater catchment					
Upper Ovens	Stable	Stable	Stable	**Rising**	**Stable**
Otway–Torquay groundwater management basin					
Glenelg groundwater catchment					
Glenelg	Stable	Stable	Stable	**Stable**	**Stable**
Hopkins–Corangamite groundwater catchment					
Warrion	Stable	Stable	Stable	**Stable**	**Stable**
Portland groundwater catchment					
Condah	Stable	Rising	Rising	**Declining**	**Stable**

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

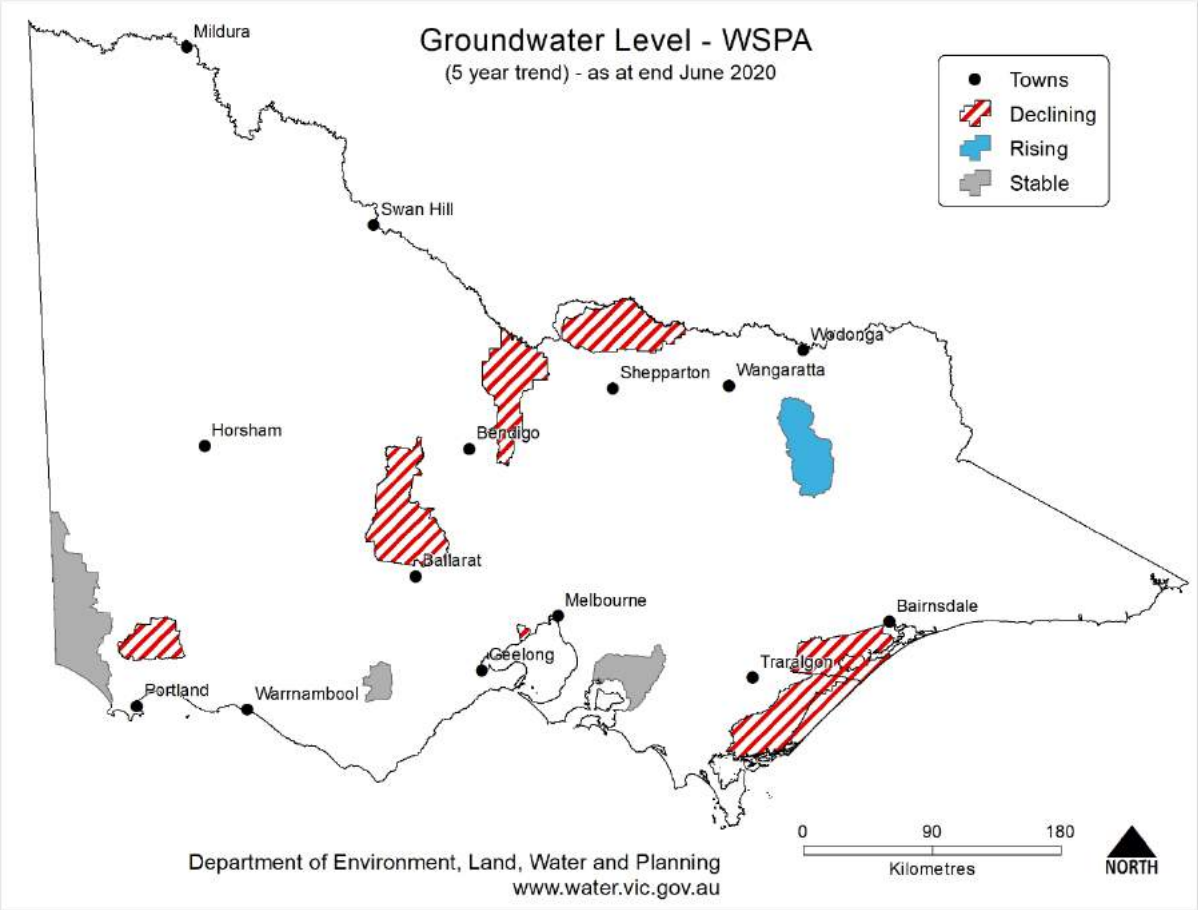


Table 2-3 Groundwater level trends in groundwater management areas

Groundwater management area [1]	Groundwater level trend 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Central groundwater management basin					
East Port Phillip Bay groundwater catchment					
Frankston	Declining	Declining	Declining	**Declining**	**Declining**
Moorabbin	Declining	Stable	Rising	**Rising**	**Declining**
Nepean	Stable	Declining	Stable	**Stable**	**Stable**
Wandin Yallock [2]	Declining	Declining	Declining	**Declining**	**Declining**
Tarwin groundwater catchment					
Leongatha	Stable	Stable	Stable	**Stable**	**Stable**

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

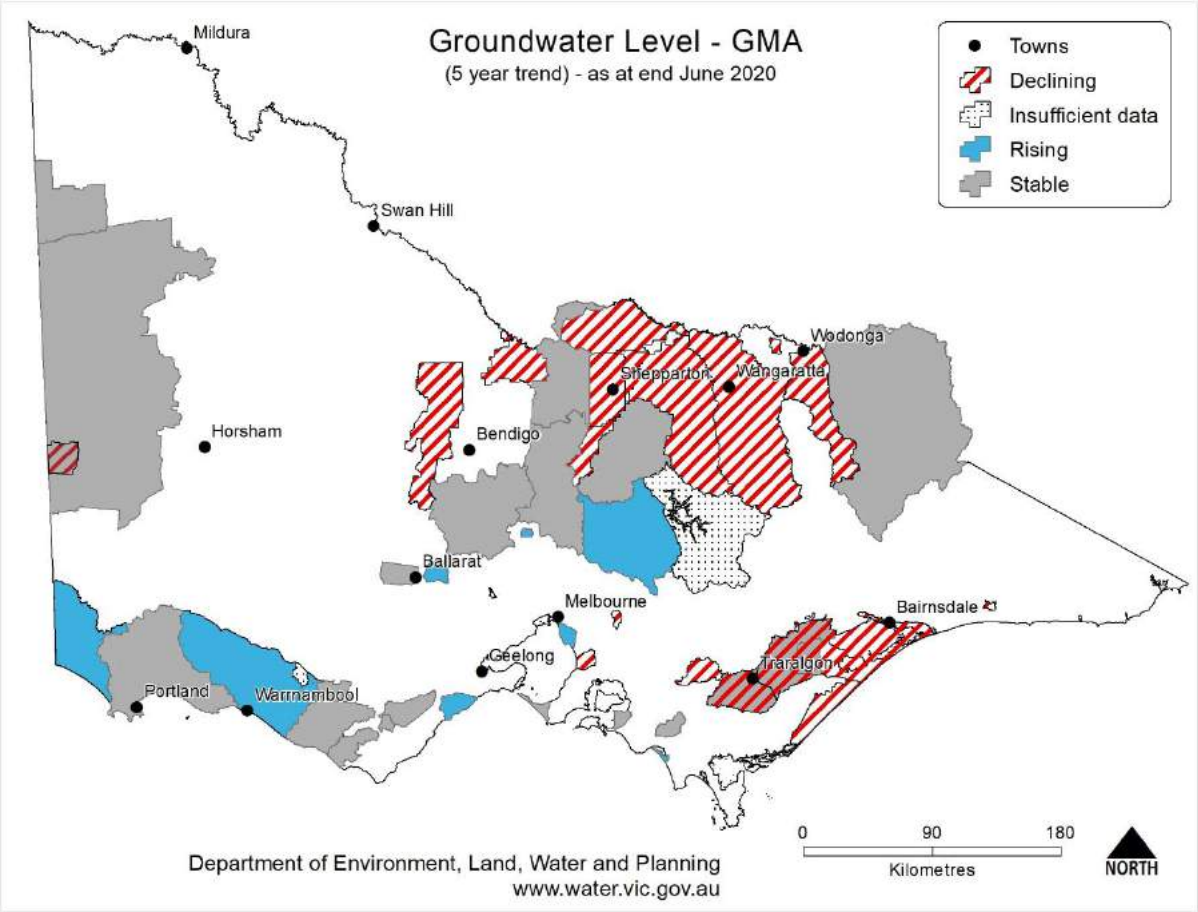
Notes

(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) The Central Victorian Mineral Springs GMA is partly contained within the Campaspe and Loddon groundwater catchments.
(4) The South West Limestone GMA extends into the Hopkins–Corangamite, Portland and Glenelg groundwater catchments.
(5) A trend could not be determined for the January to March 2020 quarter in the Portland GMA because monitoring data was not available.
(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

While overall water availability in 2019–20 was greater than in the previous year, surface water availability was still below average (74% of the long-term average, compared to 47% in 2018–19). Above-average rainfall from January to April 2020 contributed to the higher-than-previous-year water availability. Dry conditions extending through to December 2019 resulted in lower seasonal determinations, more urban water restrictions and more groundwater licence restrictions than in the previous year.

2.5.1 Urban water restrictions

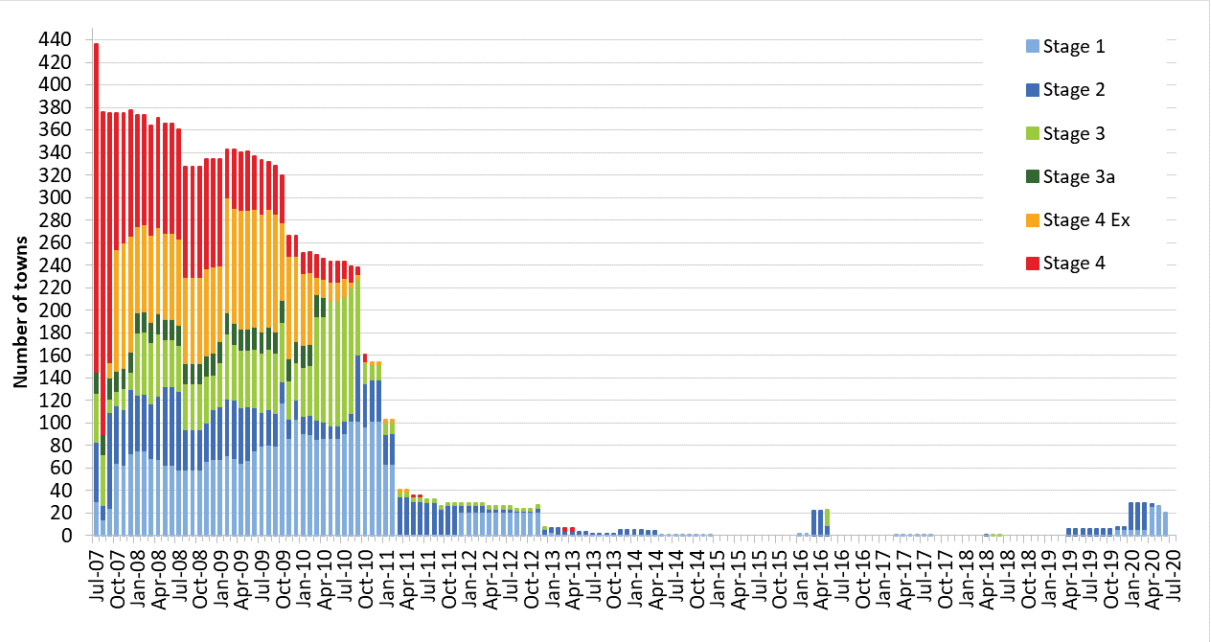
Urban water restrictions were applied to 32 towns in 2019–20, 26 more than in the previous year. The stage 2 restrictions that Goulburn Valley Water (GVW) implemented in Kilmore, Kilmore East, Wandong, Heathcote Junction, Euroa and Violet Town from the previous year remained in place until October 2019, when four of GVW's towns were taken off stage 2 restrictions and placed on permanent water-saving rules. Euroa and Violet Town remained on stage 2 restrictions until April 2020; they were then placed on permanent water-saving rules until the end of June 2020.

East Gippsland Water (EGW) introduced stage 2 water restrictions on 13 January 2020 for the Buchan and Mitchell systems (20 towns). These were lowered to stage 1 from 27 March 2020, and as at end June 2020 all restrictions in EGW's area were lifted and towns were on permanent water-saving rules.

All towns in Lower Murray Water's operational area — Mildura, Swan Hill, Kerang, Irymple, Merbein and Red Cliffs — were on stage 1 restrictions from 21 November 2019 until the end of June 2020.

All other towns were on permanent water-savings rules throughout the year (Table 2-4). 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 2020



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 2019–20
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	Six towns	Stage 2 restrictions
Lower Murray Water	Six towns	Stage 2 restrictions
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	20 towns	Stage 1 and 2 restrictions
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

In declared water systems in 2019–20, seasonal determinations to high-reliability entitlements did not reach 100% in any major northern systems. Southern systems fared better, with 100% high-reliability determinations made in the Thomson and Werribee systems. Aside from the Coliban Rural system, opening allocations announced in July 2019 were low for almost all systems. By February 2020, only three systems in Victoria had received seasonal determinations of 100% high-reliability water shares, lower than the previous year when about half were at 100% at this time (Table 2-5).

In Victoria's declared systems in the north, high-reliability entitlements only received 2% allocation in the Broken, 66% in the Murray and 80% in the Goulburn, Campaspe and Loddon systems. This was lower than at any time in the last ten years The only system to reach 100% high-reliability entitlements in 2019–20 was the Bullarook system, compared to almost all the systems the previous year.

In southern Victoria, the Thomson–Macalister and Werribee and Bacchus Marsh systems both received a 100% allocation against high- and low-reliability entitlements, higher than the previous year when only the Thomson–Macalister reached 35% and there was no allocation for low-reliability entitlements in the Werribee and Bacchus Marsh system.

Allocations for the Wimmera Mallee Pipeline Product began with initial allocations of 0%, which then reached 40% in February 2018 and ended slightly higher with 42% in March. In the Coliban Rural system, entitlement holders had access to 100% of their entitlement for the entire year.

Table 2-5 Seasonal water allocations in regulated water systems

Water system	Water shares	2019–20			2018–19
		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	2	57	**66**	**100**
	Low-reliability	0	0	**0**	**0**
Goulburn	High-reliability	2	71	**80**	**100**
	Low-reliability	0	0	**0**	**0**
Broken	High-reliability	0	0	**2**	**37**
	Low-reliability	0	0	**0**	**0**
Campaspe	High-reliability	26	71	**80**	**100**
	Low-reliability	0	0	**0**	**0**
Loddon	High-reliability	2	71	**80**	**100**
	Low-reliability	0	0	**0**	**0**
Bullarook	High-reliability	19	100	**100**	**100**
	Low-reliability	0	100	**100**	**100**
Southern declared systems					
Thomson–Macalister	High-reliability	45	100	**100**	**100**
	Low-reliability	0	35	**100**	**35**
Werribee and Bacchus Marsh	High-reliability	45	100	**100**	**45**
	Low-reliability	0	80	**100**	**0**
Non-declared systems					
Wimmera Mallee	Pipeline product	0	40	**42**	**55**
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.

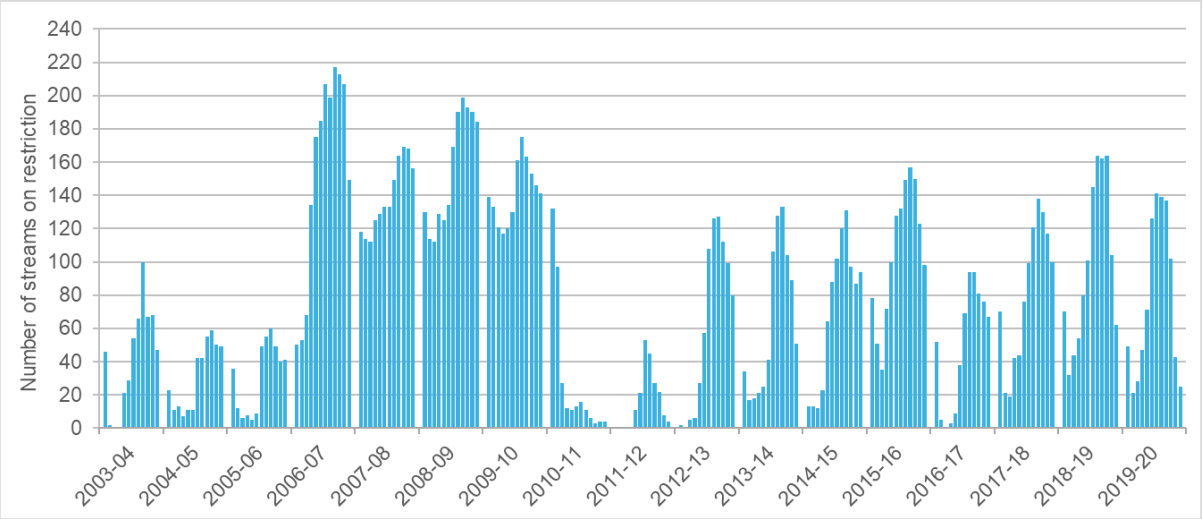
(2) Allocations in February are provided as an indication of mid-season allocations.

(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 141 in January 2020, compared to 164 in the previous year (Figure 2-14). There were 43 streams subject to restrictions in May 2020, almost a third of the number of streams restricted at the same time in the previous year. There were 25 streams on restrictions at the end of 2019–20, compared to 62 at the end of 2018–19.

Figure 2-14 Victorian unregulated streams on restrictions, number, June 2003 – June 2020



2.5.4 Groundwater restrictions

Entitlement holders in four GMUs were subject to restrictions on groundwater use in 2019–20, one more than the previous year.

In the Campaspe groundwater catchment, extractions from the Barnadown trading zone in the Lower Campaspe Valley WSPA were restricted to 75% allocation.

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

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 2019–20.

In the West Port Phillip Bay groundwater catchment, the Deutgam WSPA had a seasonal allocation of 25% in 2019–20.

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 2019–20, three towns required water carting, compared to one the previous year. The impacts of the bushfires meant that more towns in 2019–20 required water-carting than the previous year.

As in the previous year, Gippsland Water had short-term water-carting arrangements in place to supply Coongulla from Heyfield in the 2019–20 summer and autumn period. Water for Coongulla is currently sourced from Lake Glenmaggie and treated at the Coongulla water treatment plant. Treating water from the lake can have its challenges: the level of the lake can be low and the water quality poor including due to bushfires upstream.

East Gippsland Water carted water into Buchan to supplement supplies in the early months of 2020 when dirty, bushfire-affected water washed down local rivers.

South Gippsland Water provided Venus Bay with a water trailer with drinking water supplies when smoke tainted the town's tank water. South Gippsland Water carted some 17,000 litres of water into Venus Bay during January and February 2020.

2.5.6 Temporary qualification of rights to water

Due to successive years of very low inflows and dry catchment conditions, the Minister for Water declared a water shortage and temporarily qualified rights to water in the declared Broken system during 2019–20. The temporary qualification of rights enabled all water share holders to access water for critical domestic and stock needs. The temporary qualification of rights took effect from 1 January 2020 until 30 June 2020.

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, the dam must be registered and licensed. The accounts do not include an estimate of the volume of domestic and stock use pumped from a waterway.

As well as consumptive uses, the Act provides for water to be used for environmental purposes (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 2019–20 and 2018–19. The total volume of consumptive entitlements changes each year as new entitlements are issued or existing entitlements are modified. Most of the decrease in surface water entitlement volume in 2019–20 was due to the reduction of loss entitlement volumes in the Murray and Goulburn systems. This reduction occurred due to the modernisation of the Goulburn and Murray irrigation districts under stage 1 and stage 2 of the Connections Project which resulted in additional water for the environment (which was issued in 2018–19). The issue of entitlement to the environment was enabled by the reduction in loss entitlement that is reported in Chapter 6.

Most of the decrease in groundwater entitlement volume resulted from Barwon Water choosing not to apply to have their 20,000 ML groundwater licence renewed. All basins in the state have a cap, which limits the volume of water that can be allocated. Most basins have reached the cap and allocated all available water within the limit, and thus only a minor change in the total number of entitlements will occur from one year to the next. In catchments which have reached the cap, no new entitlements are created unless water savings are made. In a system which has reached its cap, the only way for a customer to get more entitlement is to purchase it from someone selling unwanted or unused entitlement. The cap and trade system ensures no net increase in entitlements in a catchment which has reached the cap.

Table 3-1 Consumptive water entitlements, 2019–20 and 2018–19

Entitlement type	Volume 2019–20 (ML)	Volume 2018–19 (ML)
Surface water		
Bulk entitlements (1)	4,578,846	4,715,665
Licences (2)	228,700	226,958
Small catchment dams (3)	157,666	108,222
Total surface water entitlements	*4,965,212*	*5,050,845*
Groundwater		
Licences	938,037	955,641
Bulk entitlements	10,000	10,000
Total groundwater entitlements	*948,037*	*965,641*
Desalinated water		
Bulk entitlements (4)	150,000	150,000
Total desalinated water entitlements	*150,000*	*150,000*
Total entitlements	**6,063,249**	**6,166,486**

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. This entitlement volume is included in this table for the first time in 2019–20.

The availability and use of Victoria's water resources for 2019–20 is summarised in Table 3-2.

Overall, the total available volume of Victoria's surface water, groundwater, desalinated water and recycled water in 2019–20 was 18,290,988 ML, more than the amount available in the previous year. Of this, 3,340,173 ML was taken for consumptive uses, lower than the 3,958,182 ML taken in 2018–19.

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 2019–20 was 54% 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)	16,662,382	4,965,212	2,703,715
Groundwater (2)	999,699	948,037	438,744
Recycled water (3)	510,583	n/a	79,389
Desalinated water (4)	118,324	150,000	118,324
Total 2019–20	**18,290,988**	**6,063,249**	**3,340,173**
Total 2018–19	12,205,623	6,166,486	3,958,182

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 2019–20. 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 decreased in 2019–20, compared to the previous year. Most of the decrease was in the bulk entitlement volume taken in the Murray and Goulburn systems. The volume of water taken under bulk entitlements in 2019–20 was 55% of the total volume of bulk entitlements, lower than the previous year when 68% was taken. The volume of water taken under unregulated take and use licences was 27% 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, 2019–20

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)	1,414,126	873,649	62%	13,792	3,277	24%	4,658
Kiewa	2,206	1,110	50%	13,662	4,827	35%	2,437
Ovens	49,169	15,309	31%	13,809	4,348	31%	5,715
Broken	24,621	5,165	21%	1,397	645	46%	3,054
Goulburn	1,644,697	794,163	48%	15,772	5,376	34%	15,780
Campaspe	98,658	31,035	31%	962	508	53%	8,093
Loddon	33,236	11,572	35%	15,896	4,974	31%	9,737
East Gippsland	622	86	14%	657	64	10%	211
Snowy	2,201	717	33%	3,919	1,254	32%	784
Tambo	342	24	7%	4,043	573	14%	741
Mitchell	9,208	4,438	48%	16,238	12,782	79%	608
Thomson (4) (5)	404,612	213,471	53%	17,207	4,974	29%	691
Latrobe (4)	221,692	67,363	30%	12,993	782	6%	14,420
South Gippsland	18,887	6,591	35%	12,003	2,119	18%	18,388
Bunyip	36,595	18,839	51%	16,769	3,882	23%	18,061

Yarra	400,000	382,230	96%	39,408	5,202	13%	11,639
Maribyrnong	10,711	2,084	19%	1,895	226	12%	2,915
Werribee (4)	40,285	14,179	35%	697	0	0%	1,701
Moorabool	40,600	16,251	40%	2,143	671	31%	5,208
Barwon	44,233	32,812	74%	4,622	1,087	24%	6,017
Corangamite	0	0	0%	875	68	8%	3,008
Otway Coast	19,667	12,448	63%	4,424	144	3%	8,516
Hopkins	629	167	27%	9,176	2,032	22%	5,429
Portland Coast	0	0	0%	1,003	0	0%	1,322
Glenelg	4,554	1,813	40%	970	124	13%	5,318
Millicent Coast	0	0	0%	4	4	100%	247
Wimmera	57,016	19,461	34%	2,078	670	32%	2,115
Mallee	0	0	0%	0	0	0%	0
Avoca	278	32	12%	2,289	92	4%	852
Total 2019–20	**4,578,846**	**2,525,008**	**55%**	**228,700**	**60,703**	**27%**	**157,666**
Total 2018–19	4,715,665	3,197,352	68%	226,958	64,727	29%	108,222

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 is 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.

During 2019–20, one amendment was made to the following entitlement: *Bulk Entitlement (Werribee System – Western Water) Conversion Order 2004*. The unallocated 10% inflow and 20% storage share of Lake Merrimu was allocated to Western Water and other minor wording changes were made to improve the clarity of the document.

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.

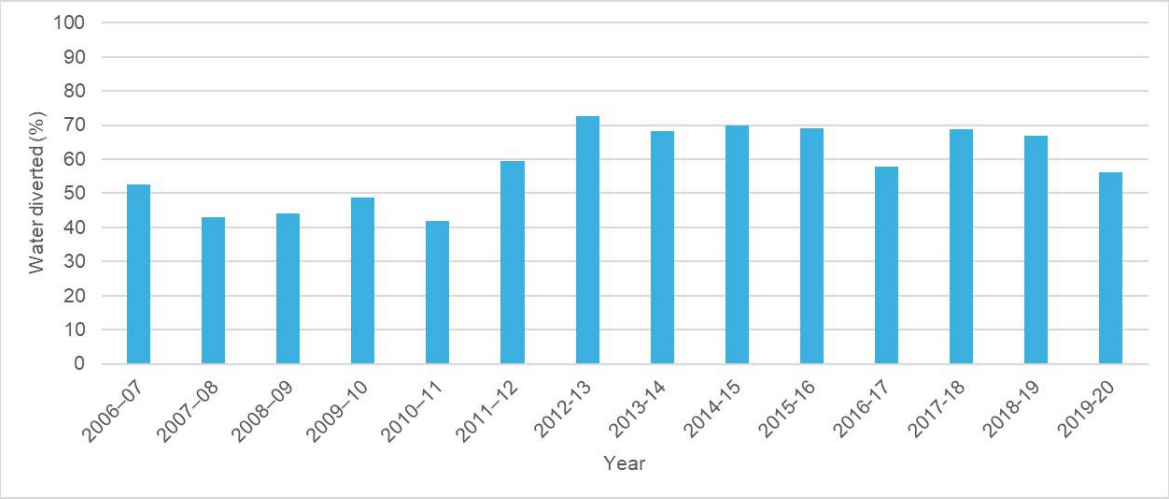
Figure 3-1 shows the volume of water taken under surface water entitlements in the past 14 years.

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. Lower water use was again observed in 2019–20, likely due to low water availability in the first half of the water year and lower demand in the second half due to above-average rainfall.

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).

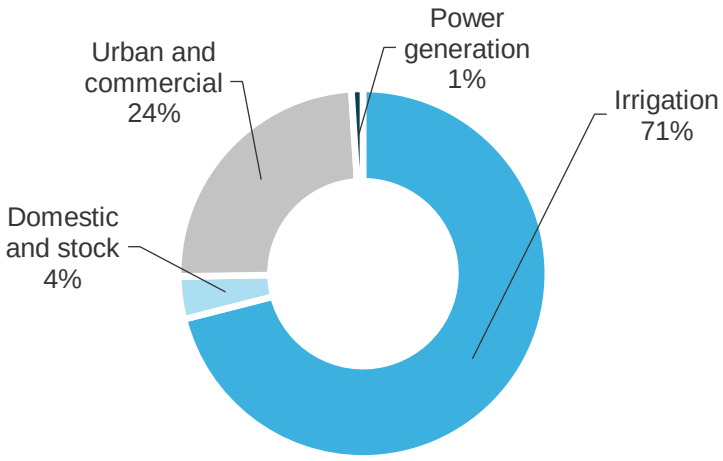
As Table 3-4 shows, the volume of water taken for consumptive use under surface water entitlements in 2019–20 was less than in 2018–19.

Irrigation is the largest consumptive use of surface water in the state, comprising 71% of all water taken in 2019–20, as shown in Figure 3-2.

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

Consumptive end use	2019–20		2018–19	
	Volume diverted (ML)	Proportion of total consumptive diversions (%)	Volume diverted (ML)	Proportion of total consumptive diversions (%)
Irrigation	1,910,166	71%	2,560,038	77%
Domestic and stock	100,375	4%	72,208	2%
Urban and commercial	651,765	24%	655,646	20%
Power generation	41,409	1%	49,753	1%
Total	**2,703,715**	**100%**	**3,337,645**	**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 2019–20. Full details of water entitlements and use from each GMA and WSPA in 2019–20 are in Appendix C.

In 2019–20, total groundwater licensed entitlement was 948,037 ML across the state. The total groundwater use across the state including domestic and stock use was 438,744 ML, which was less than the volume used in 2018–19 (498,229 ML).

There are 19,338 stock and domestic bores in Victoria. Domestic and stock use (32,307 ML) was estimated to account for about 7% of total groundwater use.

In 2019–20, metered use was lower than in 2018–19. In Victoria's GMAs, licensed groundwater entitlements totalled 609,390 ML (compared to 629,597 ML in 2018–19) with total metered use of 263,531 ML (292,099 ML in 2018–19). Licensed groundwater entitlements in WSPAs totalled 242,354 ML with total metered use of 123,013 ML (242,367 ML entitlements and 153,898 ML use in 2018–19). The volume of groundwater entitlements outside GMUs was 96,293 ML, with 19,894 ML of metered extraction (93,677 ML entitlements and 20,516 ML use in 2018–19).

The total volume of groundwater extracted for urban use in 2019–20 was 11,328 ML — higher than the 9,576 ML in the previous year — which was about 3% of the total groundwater extracted.

A total of 70 cities and towns have a groundwater entitlement for primary or supplementary water supply. In 2019–20, 56 of these recorded some level of groundwater extraction. The largest urban users were Greater Geelong and Sale, with extractions of 2,177 ML and 1,844 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 2019–20.

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

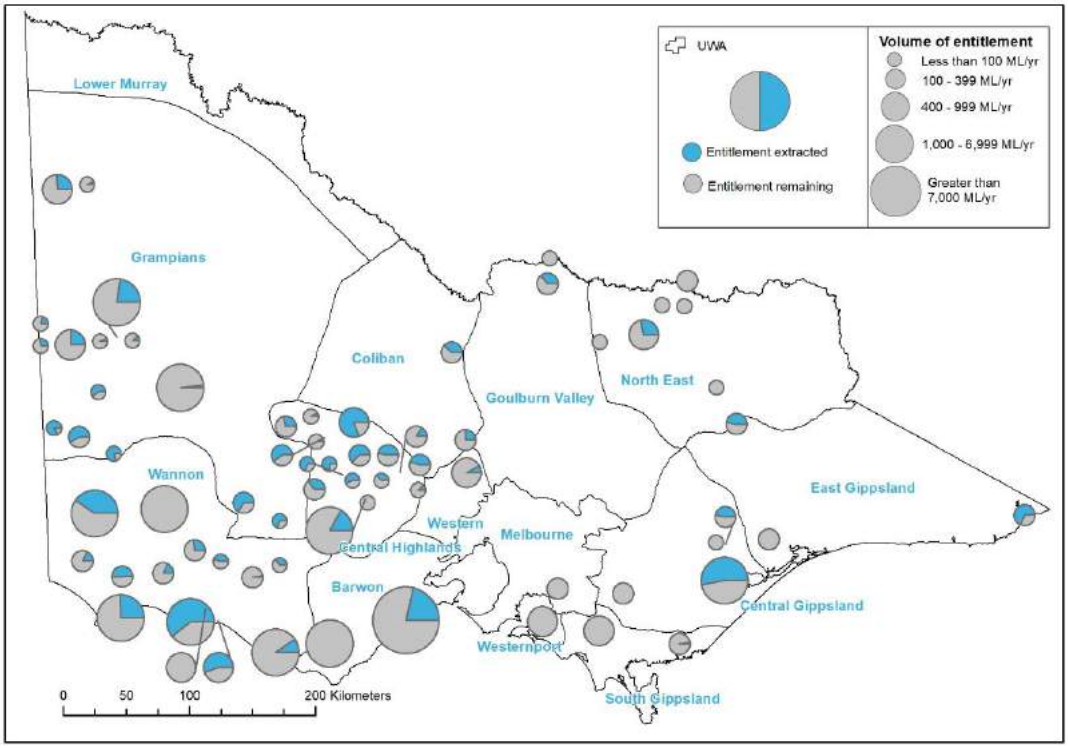
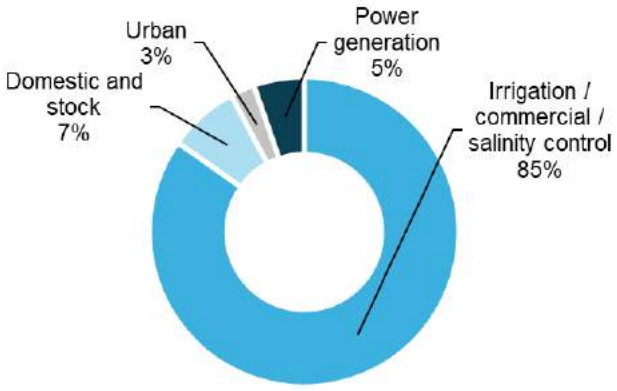


Table 3-5 and Figure 3-4 show the groundwater extraction by type of use in 2019–20.

Table 3-5 Groundwater extraction by type of end use

Consumptive end use	2019–20		2018–19	
	Volume diverted (ML)	Proportion of total consumptive diversions (%)	Volume diverted (ML)	Proportion of total consumptive diversions (%)
Irrigation / commercial / salinity control	372,016	85%	433,109	87%
Domestic and stock	32,307	7%	31,716	6%
Urban	11,328	3%	9,576	2%
Power generation	23,094	5%	23,828	5%
Total	**438,744**	**100%**	**498,229**	**100%**

Figure 3-4 Groundwater extraction by type of end use



3.3 Recycled water production

The total volume of 510,583 ML of water produced by wastewater treatment plants in 2019–20 was more than the 461,285 ML produced in 2018–19 (Table 3-6). The volume of water recycled by Victoria's water corporations decreased from the previous year. In 2019–20, use of recycled water was 79,389 ML, which was less than the 100,342 ML recycled in 2018–19. The recycled water use included 12,313 ML that was used in wastewater treatment processes.

The volume of water recycled in Melbourne (which is defined as water treated in the Bunyip, Werribee and Yarra basins less the regional towns in those basins) was 43,988 ML (12% recycled). This was lower than the 59,366 ML or 18% recycled the previous year. The percentage of recycled water 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 35,401 ML (27% recycled) of the water available for re-use. This was less than the previous year, when 40,976 ML (or 33%) 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 2019–20, the volume of water recycled by the Eastern Treatment Plant was 14,373 ML, less than the 16,880 ML recycled the previous year. The volume of water recycled by the Western Treatment Plant decreased from 31,744 ML in 2018–19 to 22,157 ML in 2019–20.

Table 3-6 Volume and use of recycled water

Basin	Volume produced (ML)	Volume recycled (ML)	Percent recycled (1)	Type of end use				Volume discharged to the environment (ML)	Volume discharged to ocean/other (ML)
				Urban and industrial	Agriculture	Beneficial allocation (2)	Within plant process (3)		
Avoca	125	121	97%	35	86	0	0	0	4
Barwon	37,155	3,843	10%	1,438	1,121	147	1,137	10,376	22,936
Broken	390	390	100%	0	390	0	0	0	0
Bunyip	172,316	17,925	10%	5,857	1,931	0	10,137	1,557	152,834
Campaspe	2,218	1,458	66%	366	1,092	0	0	756	4
Corangamite	2,657	559	21%	10	474	0	75	2,097	1
East Gippsland	30	30	100%	0	30	0	0	0	0
Glenelg	698	698	100%	50	648	0	0	0	0
Goulburn	8,025	6,981	87%	657	6,324	0	0	1,044	0
Hopkins	6,570	1,045	16%	137	854	0	54	64	5,461
Kiewa	369	174	47%	5	169	0	0	195	0
Latrobe	25,151	774	3%	13	39	722	0	4,673	19,704
Loddon	8,996	2,016	22%	876	1,140	0	0	6,440	540
Mallee	0	0	0%	0	0	0	0	0	0
Maribyrnong	3,574	1,013	28%	374	617	0	22	2,555	6
Millicent Coast	2	2	100%	2	0	0	0	0	0

Mitchell	1,324	1,324	100%	0	252	1,072	0	0	0
Moorabool	1,200	1,200	100%	1,048	27	0	125	0	0
Murray	10,466	4,542	43%	213	4,177	0	152	3,957	1,967
Otway Coast	1,441	280	19%	30	210	0	40	68	1,093
Ovens	2,609	1,156	44%	59	1,097	0	0	1,453	0
Portland Coast	2,706	86	3%	0	86	0	0	168	2,452
Snowy	231	231	100%	0	231	0	0	0	0
South Gippsland	6,352	361	6%	50	294	0	17	1,552	4,439
Tambo	739	739	100%	0	739	0	0	0	0
Thomson	1,149	1,119	97%	0	1,119	0	0	30	0
Werribee	200,375	27,727	14%	7,328	16,611	3,611	177	1,548	171,100
Wimmera	2,110	1,796	85%	494	1,302	0	0	0	314
Yarra	11,605	1,799	16%	657	765	0	377	8,471	1,335
Total 2019–20	**510,583**	**79,389**	**16%**	**19,699**	**41,825**	**5,552**	**12,313**	**47,004**	**384,190**
Total 2018–19	461,285	100,342	22%	25,182	51,740	6,922	16,490	38,655	322,288

Notes

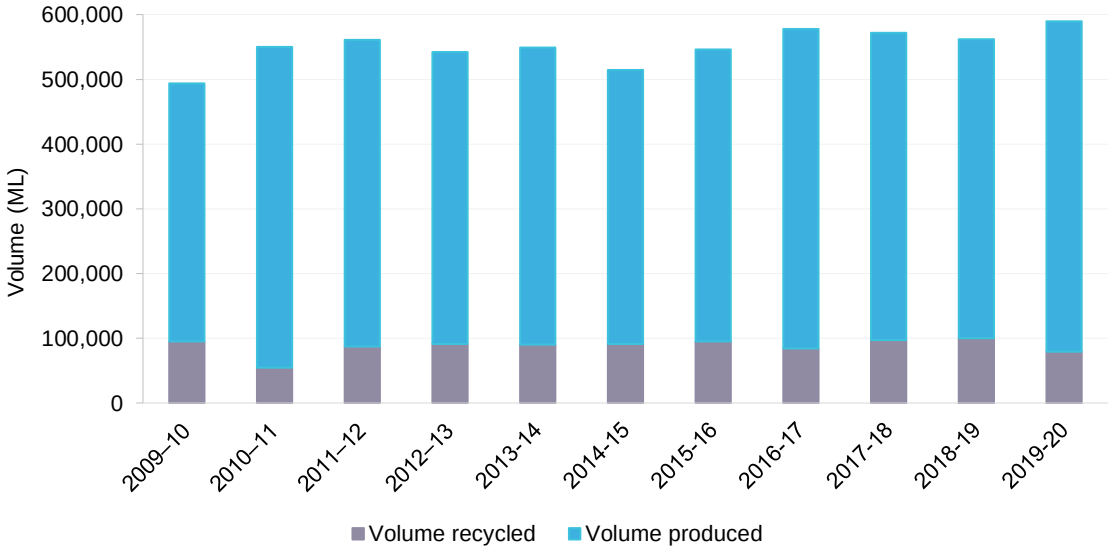
(1) The percentage of wastewater recycled includes water recycled 'within plant process', which refers to water reused in treatment processes. This treatment is consistent with the Essential Service Commission's performance report.

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

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

Figure 3-5 shows the trend in recycled water over the ten years to 2019–20.

Figure 3-5 Recycled water volume and percentage, 2009–10 to 2019–20



3.4 Desalination water production

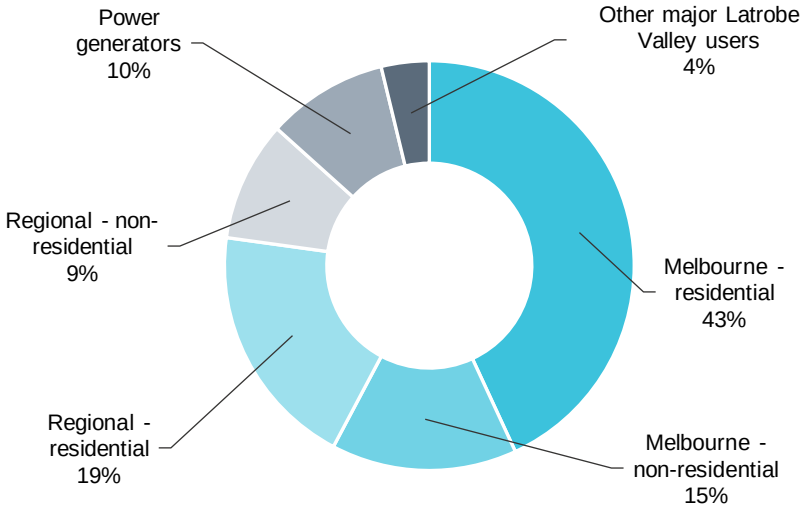
Water produced by the Victorian Desalination Project is transferred into Cardinia Reservoir and combined with the water available for consumptive uses. Chapter 1.1.4 has more information about the project.

The total volume delivered for the year to 30 June 2020 was 118 GL, representing 6.52% of Melbourne's storage capacity. This was more than the 22 GL (or 1.21%) delivered in 2018–19. The 2019–20 water order was for 125 GL, with 7 GL delivered in advance in June 2019.

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. As a result, these waterways are not able to function as they would naturally, and it is necessary to manage flows in them and to wetlands. 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.

4.1 Managed environmental water

Managing and delivering water for the environment involves careful planning by a range of people and organisations (section 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, 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 2019–20* identified 278 potential watering actions across Victoria that could be delivered under a range of planning scenarios, and 214 of these actions were required in 2019–20.

The VEWH has adopted a new method for assessing achievement of potential watering actions. The new method uses direct measures of streamflow and debited environmental water use to determine the extent to which the required magnitude, duration, timing and frequency of each required watering action is met. It then combines those measures to produce an achievement score for each action. The scoring system is used to determine whether each individual watering action is fully, partially or not achieved. The new method is more quantitative than previous methods and can be more consistently applied across systems. These attributes improve the reliability of the assessment, but direct comparisons between the results from 2019–20 and previous years cannot be made at this time.

In 2019–20, 87% (187) of the 214 required watering actions either fully or partially achieved their intended hydrological outcomes (Table 4-1). Of the 187, 151 relied on the contribution of managed water for the environment. The remaining 36 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 2019–20, the VEWH coordinated delivery of environmental water to 92 priority river reaches and 76 wetlands, a total of 168 sites across Victoria: this was the same as the previous year.

Table 4-1 Watering actions achieved

Managed environmental watering sites	2019–20	2018–19
Number of river reaches delivered to	92	90
Number of wetlands delivered to	76	78
Number of required watering actions achieved	187	223
Percentage of required watering actions achieved (new assessment method)	87%	n/a
Percentage of required watering actions achieved using managed environmental water (new assessment method)	81%	n/a
Percentage of required watering actions achieved (old assessment method)	n/a	92%
Percentage of required watering actions achieved using managed environmental water (old assessment method)	n/a	75%

The total volume of VEWH, CEWH and Living Murray managed environmental water available in 2019–20 was 2,138,089 ML, which was more than the year before. Of this, 891,788 ML was delivered during the year to priority river reaches and wetlands in Victoria. Table 4-2 summarises Victoria's managed environmental watering in 2019–20.

Table 4-2 Summary of managed environmental watering

Managed environmental water	2019–20 (ML)	2018–19 (ML)
Availability		
Carryover	900,287	666,593
Seasonal allocations	860,658	1,042,647
Return flows (1)	668,814	373,620
Less carryover/allocation written-off (2)	8,920	96
Less borrowed BMF EWA at 30 June (3)	282,750	76,000
Total available (4)	**2,138,089**	**2,006,763**
Environmental deliveries		
Volume delivered to off-stream wetlands	64,724	71,028
Volume delivered in-stream	827,065	474,581
Total volume delivered	**891,788**	**545,609**

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 2019–20, 282,750 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 2019–20, a total of 648,352 ML was re-credited to the VEWH's accounts for return flows delivered through upstream sites to the Murray River, more than the 363,713 ML available the previous year. Also, 20,284 ML delivered in the Goulburn River between Lake Eildon and Goulburn Weir was re-credited to the VEWH in Waranga Basin (9,665 ML in 2018–19), and 178 ML delivered from Lake Merrimu in the Werribee system was re-credited in Melton Reservoir.

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 2019–20, 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 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
- selling and buying water allocation to non-environmental users commercially.

In 2019–20, the following transfers occurred:

- a net volume of 588,626 ML of CEWH allocation 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
- 6,000 ML of The Living Murray allocation held in trust by the VEWH was transferred to a The Living Murray account held in New South Wales for delivery in Koondrook-Perricoota Forest in that state
- 619,507 ML of return flows was recredited 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, 506,730 ML was Commonwealth environmental water, 21,313 ML The Living Murray water and 91,464 ML VEWH water
- a net volume of 4,000 ML of Victorian River Murray Increased Flows water was traded to the South Australian Murray system
- 53,766 ML was transferred from the VEWH to the Snowy inter-valley transfer account.
- The Taungurung Land and Water Council Aboriginal Corporation transferred 39 ML of water allocation to the VEWH for delivery in the Ovens system (King River) for environmental and Aboriginal outcomes
- Melbourne Water transferred 1,095 ML of allocation to the VEWH for environmental flow deliveries in the Werribee system. The transfer of allocation was from water allocated to water shares held by Melbourne Water during 2019–20. In June 2020, the water shares were permanently transferred to the VEWH.
- 15 ML of privately-owned water in the Murray system was donated to the VEWH.

Table 4-3 presents key trade activities undertaken by environmental water holders in 2019–20.

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

Managed environmental water – key trade activities	2019–20 (ML)	2018–19 (ML)
Net volume sold to non-environmental users (ML)	-301	31,478
Volume transferred to the Snowy Mountains Scheme (ML) (1)	53,766	81,165
Volume delivered via the Murray River to South Australia (ML)	723,507	526,776

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 at 30 June 2020 and the volumes made available and used during 2019–20. A total of 2,138,089 ML was made available under these entitlements during the year (before trade), of which 891,788 ML was used for environmental benefits within Victoria. This was more than the volumes available (2,082,763 ML) and used (545,609 ML) in 2018–19.

During 2019–20, amendments and adjustments were made to two of the VEWH's environmental and bulk entitlements to reflect identified savings achieved through the Northern Victoria Irrigation Renewal Project (NVIRP) project to date. See page 22 of the VEWH 2019–20 annual report for more information on the changes to entitlements.

Table 4-4 includes entitlements held in Victorian river basins for environmental purposes by the VEWH, the CEWH and the MDBA (for The Living Murray program). Entitlements in each system can have different level 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, carryover rules allow environmental water holders to retain unused water in storage at the end of the year. This can then be used to meet environmental watering priorities in future years. The environmental water holders use carryover and trade to achieve the best environmental outcomes.

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

Entitlement type / reliability	Entitlement volume at 1 July 2020	Net carryover at July 2019 (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 2020 [3] (h) = (e)+(f)+(g)
NORTHERN SYSTEMS									
Murray [4]									
High	475,102	609,366	362,050	-282,750	648,352	1,337,018	-757,718	364,739	214,561
Low	152,210								
Provisional	75,024								
Unregulated	83,300								
Ovens									
High	123	0	123	0	0	123	39	162	0
Broken									
High	624	208	12	0	0	220	500	597	123
Low	23								
Goulburn									
High	429,163	192,007	364,324	-8,594	20,284	568,022	-18,870	421,525	127,627
Low	231,247								
Campaspe									
High	27,372	13,619	23,156	0	0	36,775	-8,800	20,802	7,174
Low	8,409								
Passing flows	0								
Loddon									
High	8,134	6,658	14,130	-100	0	20,688	-3,523	14,861	2,305
Low	2,551								
Provisional [5]	7,590								
Passing flows	0								
Total northern systems		**821,858**	**763,797**	**-291,444**	**668,636**	**1,962,846**	**-788,372**	**822,685**	**351,790**
WESTERN SYSTEMS									
Wimmera & Glenelg									
High	40,560	30,879	20,449	0	0	51,327	0	24,634	26,693
Provisional	1,000								
Passing flows	0								
Supply by agreement	28,000								
Total western systems		**30,879**	**20,449**	**0**	**0**	**51,327**	**0**	**24,634**	**26,693**
CENTRAL SYSTEMS									
Tarago									
Share of inflows	10.3%	1,524	2,282	0	0	3,806	0	40	3,766
Yarra									
High	17,000	13,137	17,000	0	0	30,137	0	4,000	26,137
Werribee									
High	734	791	442	-226	178	1,185	1,095	1,174	1,107
Low	361								
Share of inflows	10%								
Maribyrnong									
n/a	n/a	0	0	0	0	0	0	0	0
Moorabool									
Share of inflows	11.9%	1,786	4,857	0	0	6,643	1,000	3,652	3,991
Barwon									
Share of inflows	3.8%	732	712	0	0	1,444	0	908	537
Unregulated	n/a								
Total central systems		**17,970**	**25,293**	**-226**	**178**	**43,215**	**2,095**	**9,773**	**35,537**
GIPPSLAND SYSTEMS									

Latrobe									
Unregulated	n/a	9,260	12,187	0	0	21,447	0	2,702	18,746
Share of inflows	9.45%								
Thomson / Macalister									
High + share of inflows	22,461	20,320	38,932	0	0	59,252	0	31,994	27,258
Low	6,230								
Total Gippsland systems		**29,580**	**51,120**	**0**	**0**	**80,700**	**0**	**34,696**	**46,004**
Total		**900,287**	**860,658**	**-291,670**	**668,814**	**2,138,089**	**-786,277**	**891,788**	**460,024**

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 the remaining volume at 30 June 2020. Where carryover provisions exist, it is the amount that would be carried over into 2020–21 before any deduction for evaporation. Where carryover provisions are not available, water is written off.
(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 at 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 2019, the VEWH transferred a total of 53,766 ML allocation to the Snowy Scheme. This is less than the volume made available in the previous year (81,165 ML). Including contributions from New South Wales, a total of 124,464 ML was transferred to the Snowy Scheme in 2019–20 (Table 4-5). Of this volume, 82,976 ML was assigned for release to the Snowy River and 41,488 ML to the Murray River.

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

Entitlement source	Entitlement volume (ML)	Allocation in 2019–20 (ML)	Allocation in 2018–19 (ML)
Victoria (2)	115,939	53,766	81,165
New South Wales (3)	192,219	70,698	84,092
Total	**308,158**	**124,464**	**165,257**
Volume apportioned to Snowy River Increased Flows		*82,976*	*110,171*
Volume apportioned to Murray River Increased Flows		*41,488*	*55,086*

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 2019–20, water allocation recovered under the Snowy Water Initiative was released for environmental benefit in both the Snowy and Murray rivers. A total of 109,300 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. No 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 benefit 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 2019–20. However, four minor failures to meet passing flow requirements occurred, as reported below.

Goulburn-Murray Water was unable to meet passing flow requirements once in 2019–20. Due to maintenance works at Lake Eppalock, the flows were less than the minimum required flow for three days in July in the Campaspe system. Minimum passing flows not provided were credited to the passing flow account for later use.

Western Water was unable to meet passing flow requirements three times in 2019–20.

- Passing flow requirements for Willimigongon Creek required manual operation for the first half of the financial year, with the site being automated in December 2019. As a result, there were failures to meet daily passing flow requirements from July to December 2019, but there were far fewer non-compliance events between January and June 2020. Western Water compensated for these non-compliance events by releasing extra flows when possible, resulting in overall compliance with the bulk entitlement.
- Western Water released an 36 ML more than needed to compensate for passing flow shortfalls of 1.2 ML over 17 occurrences at Riddells Creek.
- Western Water had difficulty complying with passing flow requirements at Woodend due to high rainfall events and delays in receiving data, which delayed its response to adjust the flow. To compensate, it released extra flows to sustain waterway health.

4.2.2 Management plans

Obligations on consumptive entitlements are outlined in statutory and local management plans in unregulated river systems:

- **statutory management plans** follow a legislated process to determine how water in a waterway or groundwater system 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, 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 and the relevant catchment management authority. 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 the order in 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. There were a number of streams on restrictions and bans in 2019–20. In January 2020, the number of waterways with restrictions and bans peaked at 141, less than the 164 peak of the previous year. Chapter 2.5.3 has more information.

In 2019–20, 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.

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 underway	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 underway	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 2019–20, there were four groundwater management units subject to restrictions, one more than the previous year. Chapter 2.5.4 has more information.

In 2019–20, 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 Above cap water

Above cap water is the volume of water available above the volume allocated to water entitlements and provided as passing flows. For the Victorian Water Accounts, this is calculated as the difference between the total inflow to a river basin and the total volume flowing out of the basin.

Figure 4-1 shows the proportion of inflows to all Victorian river basins to the volume flowing out of Victoria for the last 17 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 seasonal variability of streamflow.

Figure 4-1 Volume leaving Victorian river basins, as proportion of total flows, 2003–04 to 2019–20

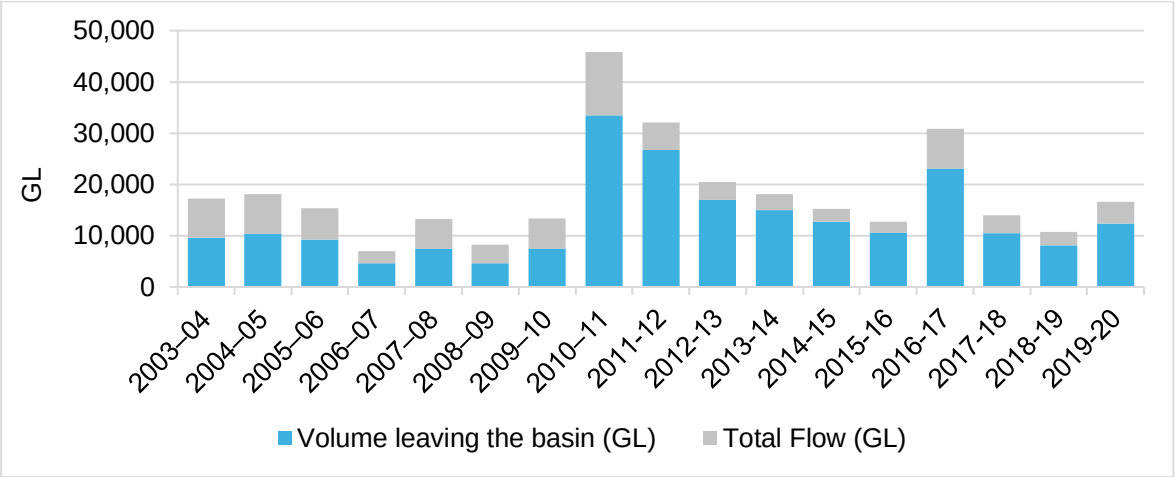


Table 4-8 shows the above cap water for each basin by reporting the total amount of water in each basin together with the amount of water that leaves the basin after water is extracted for consumptive use. The above cap water is expressed as a proportion of the annual flows of water that could have left the basin if there were no diversions. The increase in rainfall and streamflows experienced across parts of the state in 2019–20 meant that above cap water as a total volume of water leaving Victoria's river basins was higher than the previous year (12,363,027 ML, compared to 8,150,558 ML in 2018–19). As a percentage of total inflow volume, the water reaching basin outlets was slightly lower than the previous year, with 74% reaching basin outlets in 2019–20, compared to 76% the previous year (Table 4-8).

In 2019–20, compared to the previous year, the proportion of total flows leaving the basin increased in 16 of the basins, decreased in nine and remained the same in two (Table 4-8, on the next page). The basins that experienced the lowest proportions of water leaving the basin as a percentage of total flows in 2019–20 were the Avoca (0%), Wimmera (26%), Moorabool (32%) and Loddon (38%) basins. The proportion of annual flows leaving the basin was 90% or above in 12 basins, mainly in the south of the state: one less than in 2018–19. Although the East Gippsland and Snowy basins recorded the highest proportion of total flows leaving the basin in 2019–20, the volumes were lower than in the previous year.

Table 4-8 Volume leaving Victorian river basins

Basin	Outflow to	2019–20			2018–19		
		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	3,501,757	1,894,900	54%	2,737,418	1,687,357	62%
Kiewa [2]	Murray River	543,893	503,904	93%	457,330	416,230	91%
Ovens	Murray River	1,007,608	958,488	95%	702,562	647,260	92%
Broken	Murray River	117,935	77,417	66%	32,924	21,287	65%
Goulburn	Murray River	2,155,436	959,052	44%	1,444,085	819,017	57%
Campaspe	Murray River	117,033	48,003	41%	51,918	48,886	94%
Loddon	Murray River	107,751	40,453	38%	58,090	26,988	46%
East Gippsland	Bass Strait	125,854	125,322	100%	182,905	182,294	100%
Snowy (Vic only) [3]	Bass Strait	343,275	473,437	138%	388,996	548,373	141%
Tambo	Gippsland Lakes	72,072	69,893	97%	43,687	41,048	94%
Mitchell	Gippsland Lakes	554,446	535,437	97%	385,870	366,060	95%
Thomson	Gippsland Lakes	1,450,093	960,606	66%	461,302	128,377	28%
Latrobe	Gippsland Lakes	866,562	750,337	87%	379,938	308,503	80%
South Gippsland	Bass Strait, Western Port	1,439,013	1,409,126	98%	528,478	502,238	95%
Bunyip	Bass Strait, Western Port, Port Phillip Bay	1,083,251	1,030,987	95%	487,957	454,534	93%
Yarra [4]	Port Phillip Bay	1,028,892	633,617	62%	512,504	298,736	61%
Maribyrnong	Port Phillip Bay	50,964	43,222	85%	25,740	18,847	72%
Werribee	Port Phillip Bay	73,090	47,448	65%	51,068	23,101	50%
Moorabool	Port Phillip Bay	69,075	22,111	32%	33,905	15,623	42%
Barwon	Port Phillip Bay, Bass Strait	147,415	118,171	80%	97,286	67,833	70%
Corangamite [4]	Corangamite Lakes	194,972	192,049	99%	111,426	110,132	99%
Otway Coast	Bass Strait	884,419	860,164	97%	816,710	790,420	97%
Hopkins	Bass Strait	269,866	258,130	96%	135,766	127,219	94%
Portland Coast	Bass Strait	179,570	177,556	99%	202,080	200,063	99%
Glenelg	Bass Strait	217,010	158,990	73%	347,250	291,592	84%
Millicent Coast [5]	South Australia	-	-	-	-	-	-
Wimmera [4]	Lakes Hindmarsh and Albacutya	54,700	14,188	26%	24,306	8,538	35%
Mallee [5]	Murray River	-	-	-	-	-	-
Avoca [6]	Lake Bael Bael and the Marshes	6,431	19	0%	3,397	2	0%
Total		**16,662,382**	**12,363,027**	**74%**	**10,704,897**	**8,150,558**	**76%**

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) For the purpose of this table, flows leaving the basin are taken as flows entering the terminal lakes.
(6) There are no significant streams in this basin.

5. Water trade

Water-trading is the process of buying, selling or exchanging rights to water. Water trade is used as a tool to facilitate 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.

The ability to report on trade allows the examination of how availability and demand for water influences its movement and efficient use in Victoria. This chapter reports on trade activity during the 2019–20 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

Trade of water in Victoria is governed by trading rules and policies set by the Minister for Water. The rules and policies aim to facilitate trade 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.

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 (chapter 2.5.2 has information about allocations in 2019–20).

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.

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, these 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 2019–20

5.2.1 Allocation trade

A total of 3,433,262 ML of allocation was traded in Victoria in 2019–20, an increase on 2018–19 when 2,845,523 ML was traded. Most of this occurred in northern Victoria (3,403,385 ML) with small volumes in southern Victoria (20,231 ML) and western Victoria (9,646 ML).

The volume of allocation trade in northern Victoria shows the reliance on trade to meet water requirements and to manage accounts for commercial purposes and the environment. Generally, there has been an increasing trend in trade since 2007–08. Commercial trades, where allocation is sold for a specified price, represented 918,777 ML of the total volume of allocation water traded in 2019–20. 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 989,644 ML or 29% of the total volume traded (Figure 5-1). 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. The increase in trade this year compared to 2018–19 is likely due to lower seasonal determinations and low rainfall in the first half of the water year.

Across the state, trades of environmental water represented a large proportion of the volume traded. The VEWH uses trade to move water between areas across Victoria, depending on its environmental watering plan. As in previous years, environmental trades made up a significant portion of the volume traded in 2019–20: there was 1,524,751 ML of within-environment allocation trade in northern Victoria (Table 5-1), which equates to 44% of the total volume traded. For information about the assumptions made to distinguish between environmental and consumptive trading, see the *Victorian Water Trading 2019–20 Annual Report*.

Table 5-1 Summary of trade of seasonal allocation trade

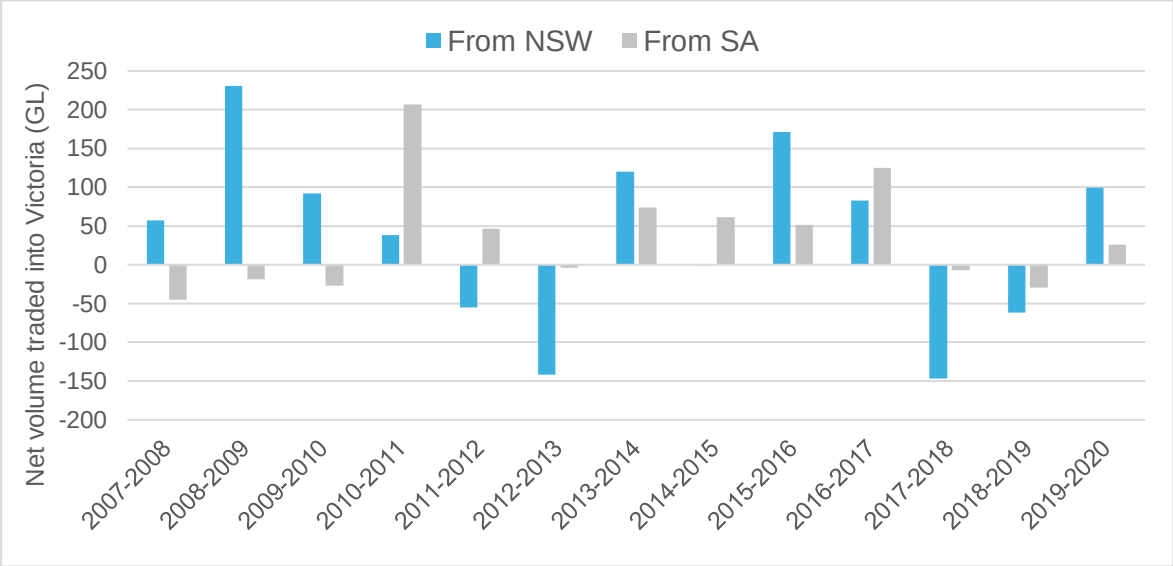
Trade type	2019–20		2018–19	
	Number of trades	Volume (ML)	Number of trades	Volume (ML)
Northern Victoria				
Commercial trades	12,518	913,458	14,571	1,038,229
Zero-priced allocation trades	7,182	965,086	5,198	716,024
Within-environment trades	108	1,524,751	93	1,059,161
Northern Victoria subtotal	***19,808***	***3,403,385***	***19,862***	***2,813,414***
Southern Victoria				
Commercial trades	98	5,319	331	12,102
Non-commercial trades	151	14,912	401	18,352
Southern Victoria subtotal	***249***	***20,231***	***732***	***30,454***
Western Victoria				
Non-Commercial trades	8	9,646	8	1,655
Western Victoria subtotal	***8***	***9,646***	***8***	***1,655***
Total	**20,065**	**3,433,262**	**20,602**	**2,845,523**

Commercial trades, where allocation is sold for a specified price, represented 918,777 ML of the total volume of allocation water traded in 2019–20. 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 989,644 ML or 29% of the total volume traded (Figure 5-1). 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.

Figure 5-1 Volume of allocation trade in northern Victoria

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 99,410 ML and net trade from South Australia into Victoria of 25,490 ML in 2019–20 (Figure 5-2).

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



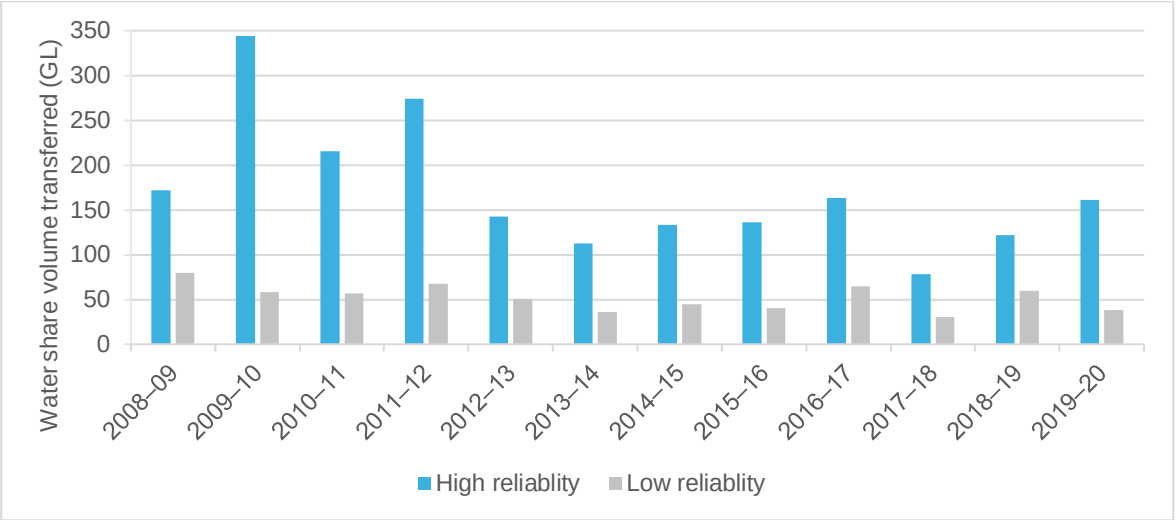
5.2.2 Water share transfers

Water share transfer across Victoria in 2019–20 included 161,442 ML of high-reliability and 38,341 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	2019–20		2018–19	
	Number of transfers	Volume (ML)	Number of transfers	Volume (ML)
High-reliability				
Northern Victoria	1,723	156,345	2,349	112,381
Southern Victoria	91	5,097	174	9,750
High reliability total	**1,814**	**161,442**	**2,523**	**122,131**
Low reliability				
Northern Victoria	442	35,945	748	54,737
Southern Victoria	68	2,396	134	4,764
Low reliability total	**510**	**38,341**	**882**	**59,501**

Figure 5-3 Transfer of ownership of water shares



5.2.3 Unregulated surface water

Surface water take and use licence trading during 2019–20 resulted in 2,383 ML of water permanently traded and 4,735 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. Significantly 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 2019–20, 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	53	1,412	65	590	196	5,706
South	74	3,298	48	1,742	226	6,994
West	1	25	59	52	11	83.8
Total 2019–20	**128**	**4,735**	**172**	**2,383**	**433**	**12,784**
Total 2018–19	247	10,078	168	2,972	434	10,618

5.2.4 Groundwater

The volume of temporary and permanent groundwater take and use licence trading was lower in 2019–20 than in the previous year, with 25,503 ML of temporary trade (compared to 38,418 ML in 2018–19) and 9,251 ML of permanent trade (compared to 7,840 ML in 2018–19).

Table 5-4 shows that in 2019–20, trades of groundwater take and use licences were mostly part of land transfers (take and use licence change of ownership) with 295 trades amounting to 40,813 ML.

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	116	14,093	51	5,572	132	26,238
South	103	7,708	57	2,778	162	14,374
West	27	3,703	3	900	1	200
Total 2019–20	**246**	**25,503**	**111**	**9,251**	**295**	**40,813**
Total 2018–19	374	38,418	89	7,840	372	64,480

Part 2: Water accounts 2019–20

Part 2 of the *Victorian Water Accounts 2019–20* presents an account of surface water, groundwater and distribution systems in Victoria for 2019–20.

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 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).

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:

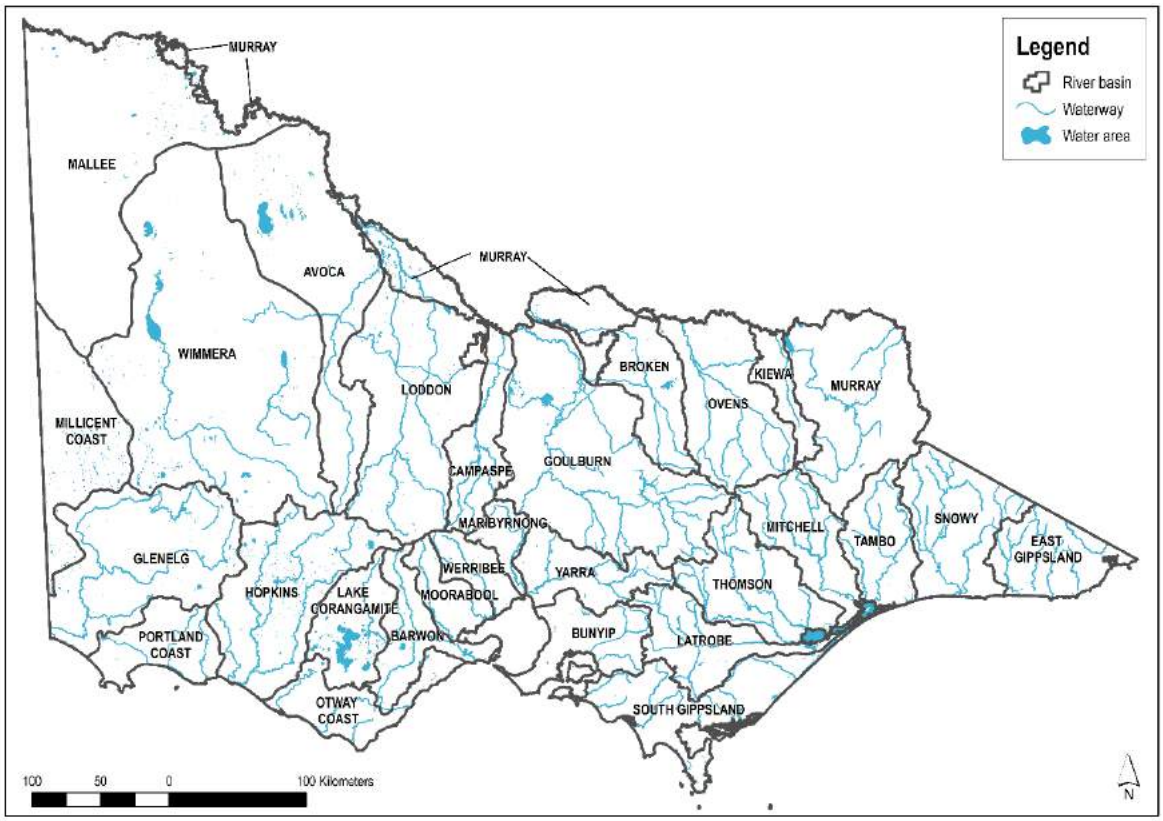
- responses to requests for data from water corporations, the VEWH, DELWP, major users of water and the MDBA
- water consumption and recycled water data collected from water corporations by the Essential Services Commission
- hydrologic information from selected streamflow monitoring sites
- climate 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 2019 to 30 June 2020. River basin boundaries are shown in Figure 6-1. Responsibilities for water management are reported in the accounts as they were in 2019–20. Any changes to responsibilities since the end of June 2019 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 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/. The next phase, with an initial focus on surface water basins, 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 VWA for 2019–20. Users can toggle between the 2019–20 and 2018–19 accounts and there is a new summary of groundwater use and availability. As subsequent VWA reports are produced, more features of the report will be moved online.

6.1.3 Surface water resources

Chapter 6 provides information about surface water in 2019–20, 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, 2019–20 water resources overview, water balance and compliance against entitlements.

6.1.4 Management arrangements

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

6.1.5 2019–20 water resources overview

This part provides a snapshot of the water resource for 2019–20. 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 2019–20
- **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, along with the starting and ending storage volumes for the year. A chart is also presented 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 2018–19 are detailed here, along with a summary of consumptive uses from the water balance and water for the environment.

6.1.6 Water balance

The surface water balance is the principal water accounting tool in the Victorian Water Accounts. 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.

6.1.6.1 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.

6.1.6.2 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: transfers from other basins are 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: return flow from irrigation are the 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 industry 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 percent recycled: this includes 'within plant process', which refers to water reused in sewage treatment processes (for example, to back-flush filters). This value is included in the total percentage recycled, consistent with its treatment in the Essential Services Commission's performance report
- 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 flows 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 on-site effluent storage or other minor items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.1.6.3 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:** environmental water is often used to support streamflows within a waterway and this 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. In previous years, all volumes presented for small catchment dams were annual average figures. From this year onwards, the volumes presented are estimated based on the observed annual climate.
- **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:
  - **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 represents the estimated volume of evaporation losses from small catchment dams within a basin. This volume is determined directly from a water balance calculated for each individual dam
  - **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 ungauged basin area.

6.1.7 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 2019–20 and the volume taken.

In accordance with the 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.

6.1.7.1 Entitlement issued

A table in each basin subchapter shows the volume of entitlements as at 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 at 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 which 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 types 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 catchment.

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.

6.1.7.2 Water taken

This part presents the available water and the water taken in the basin for 2019–20. 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 2018–19 that could be taken in 2019–20.

Allocation issued: this item represents the water allocation made available under the entitlement that was available for use and trade in the 2019–20 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 2019–20 entitlement holders with low-reliability water shares in the Thomson–Macalister system were allocated 35% of their entitlement. That is, for every 100 ML of low-reliability entitlement they owned, they were allocated 35 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 at 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 2019–20. 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.

6.1.8 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.

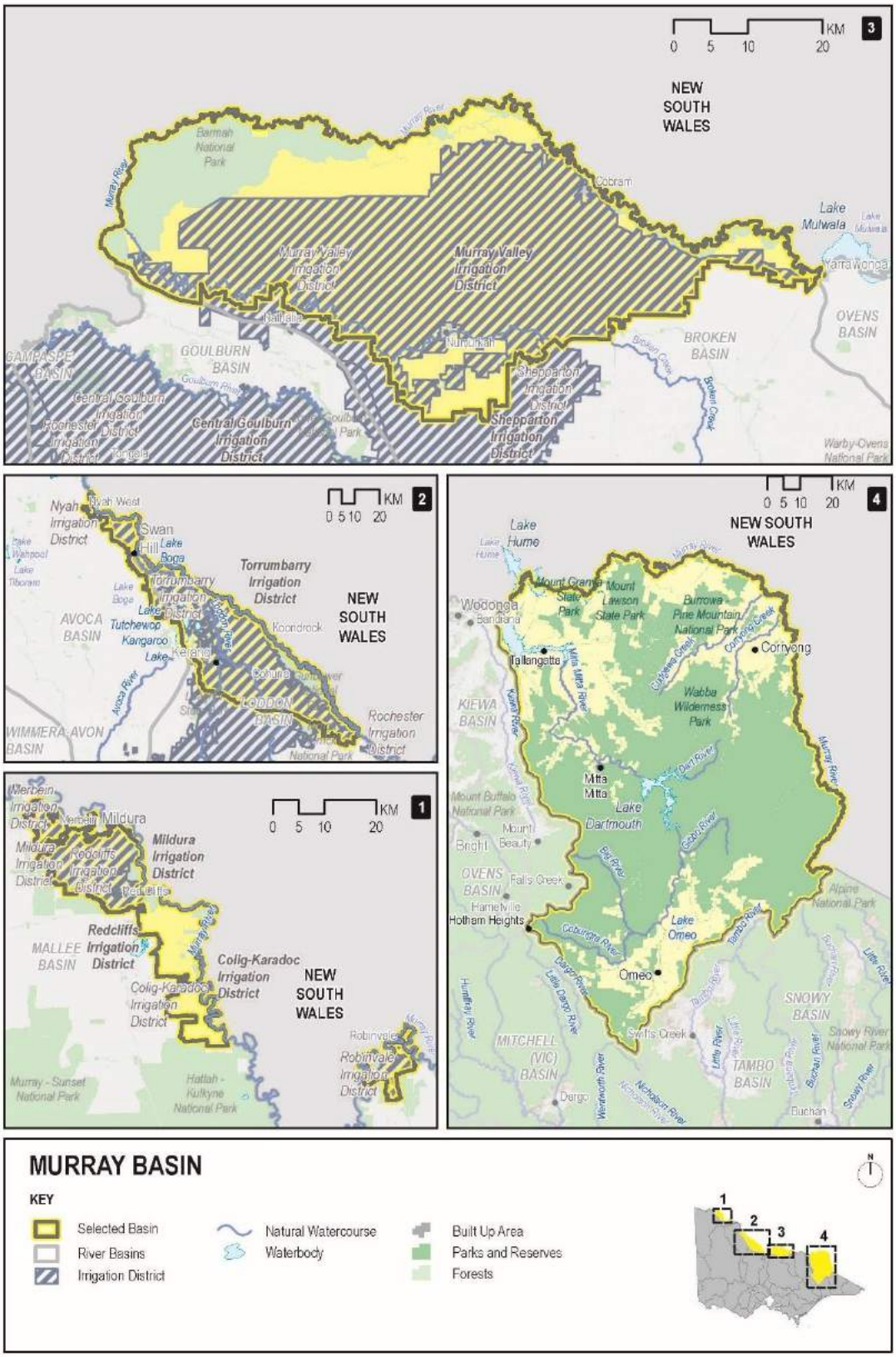
From 2017–18, the method used to estimate the usage, evaporation and harvested volumes from small catchment dams was improved. The key difference is that each dam identified in the GIS data has been individually modelled, to better reflect the water balance around the dam based on the climate for that 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 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 2019–20 water resources overview

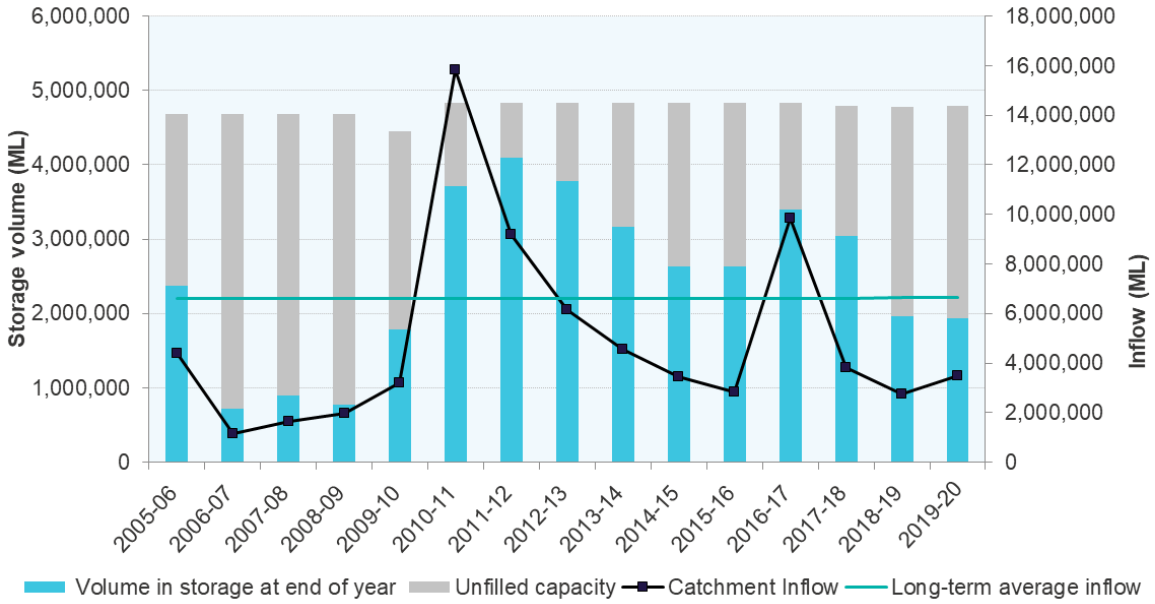
In 2019–20, rainfall:

- over Mildura was 40% to 60% of the long-term average
- over Omeo and downstream of Echuca was 60% to 80% of the long-term average
- in the basin's central sections and most of the north-east (north of Omeo) was 80% to 100% of the long-term average
- in the Murray Valley Irrigation District was up to 120% of the long-term average rainfall.

Catchment inflows to the basin in 2019–20 were 53% of the long-term average annual volume of 6,649,300 ML, greater than in 2018–19 when inflows were 41% of the long-term average.

The volume held in Victoria's share of the major Murray system storages started at 41% of capacity at the beginning of July 2019 and was at 40% of capacity at the end of June 2020. Victoria had no access to a share of Menindee Lakes during 2019–20 as storage levels did not get above the 480,000 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 lower in 2019–20 than in the previous year. Seasonal determinations for high-reliability entitlement began the year with a 2% seasonal determination (on 1 July 2019), increasing to a 57% seasonal determination by February 2020 and reaching a final seasonal determination of 66% by 1 April 2020. This is the lowest seasonal determination in the Murray since 2008–09, when the high-reliability determination reached a maximum of 35%. There was no seasonal determination for low-reliability water shares in 2019–20.

Like in the previous year, total bans on licensed diversions were in place on the same two unregulated streams — Black Dog Creek (upper) and Indigo Creek — in July 2019 in the Murray basin. Total bans were again in place on Black Dog Creek (upper) for the whole of 2019–20: this ban was put in place at the end of November 2017. By November 2019, bans were put in place in seven additional streams, and two more had restrictions in place by January 2020, reaching a peak of 11. Licensed diversions from Indigo Creek were also banned for most of the year, with some relief in May and June 2020 when the bans were removed. Most bans were lifted by April, and only Black Dog Creek (upper) was still on restrictions at the end of June 2020.

There were five towns with restrictions on urban water use in 2019–20. Supplied by the Murray system, Swan Hill, Mildura, Irymple, Red Cliffs and Merbein were on stage 1 restrictions from November 2019 to the end of May 2020. These were then lowered in June, and permanent water-saving rules were applied for the remainder of the month. All other towns in the basin were on permanent water-saving rules throughout the year.

In 2019–20, 1,296,760 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 less than the 1,619,928 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 2019–20, 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 1,155 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. This entitlement was amended in June 2019 and the amendment came into effect on 31 March 2020. Before the amendment came into effect, this entitlement was for 27,219 ML (excluding mitigation water)
- 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 of 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 744,257 ML of environmental water was delivered in the Victorian Murray system in 2019–20: 619,570 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 2019–20 are shown in Table 6-3.

Table 6-3 Water balance, Murray basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	1,836,600	2,875,800
Volume in storage at end of year	1	1,801,400	1,836,600
Change in storage		**(35,200)**	**(1,039,200)**
Inflows			
Catchment inflow	2	3,501,757	2,737,418
Rainfall on major storages	1	64,900	71,000
Net trade from New South Wales	3	88,010	0
Spills from New South Wales	3	0	0
Water returned to the Murray River	4	300,047	283,976
Treated wastewater discharged back to river	5	3,957	3,642
Total inflows		**3,958,671**	**3,096,036**
Outflows			
Diversions			
Urban diversions		40,248	42,194
Irrigation district diversions		749,880	1,002,970
Licensed diversions from regulated streams		456,936	504,026
Licensed diversions from unregulated streams		3,277	3,461
Environmental water diversions		41,762	62,499
Small catchment dams	6	4,658	4,779
Total diversions		*1,296,760*	*1,619,928*
Losses			
Evaporation from major storages	1	152,300	179,100
Net evaporation from small catchment dams	6	3,125	3,492
In-stream infiltration to groundwater, flows to floodplain and evaporation	7	638,386	645,359
Total losses		*793,811*	*827,951*
Water passed to other systems			
Murray River flows to South Australia from Victoria's allocation	8	1,653,200	1,567,850
Ceded to New South Wales	3	53,500	66,800
Spills to New South Wales	3	196,600	0
Net trade to New South Wales	3	0	52,707
Total water passed at outlet of basin		*1,903,300*	*1,687,357*
Total outflows		**3,993,871**	**4,135,236**

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

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.

The volume reported as a closing balance for 2018–19 has been revised from the volume reported in the *Victorian Water Accounts 2018–19.* The adjusted volume is based on new information from data providers.

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	1,399,700	23,300	28,500	(449,700)	944,800
Lake Hume (Vic. share)	1,502,579	289,000	29,600	61,700	300,900	557,800
Lake Victoria (Vic. share)	338,500	147,900	12,000	62,100	201,000	298,800
Menindee Lakes (Vic. share) (1)	865,500	0	0	0	0	0
Subtotal	**4,634,695**	**1,836,600**	**64,900**	**152,300**	**52,200**	**1,801,400**
Off-stream storages						
Kangaroo Lake	39,200	33,240	3,196	10,117	5,151	31,470
Kow Swamp	51,710	40,218	8,285	26,174	19,230	41,559
Lake Boga	37,000	27,036	3,032	9,642	10,003	30,429
Lake Charm	22,000	20,266	1,721	5,445	3,630	20,172
Lake Cullulleraine	5,270	4,444	291	4,322	4,025	4,438
Subtotal	**155,180**	**125,204**	**16,525**	**55,700**	**42,038**	**128,068**
Total 2019–20	**4,789,875**	**1,961,804**	**81,425**	**208,000**	**94,238**	**1,929,468**
Total 2018–19	4,789,875	2,996,316	71,309	184,117	(921,704)	1,961,804

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 2019–20 Victoria ceded a total of 53,500 ML to New South Wales. This volume was all ceded in Hume Dam. There was no water ceded in Menindee Lakes in 2019–20.

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 capacity to store them. In 2019–20, there was 188,200 ML of internal spill from Victoria to New South Wales in Lake Victoria.

In 2019–20, there was net trade from New South Wales to Victoria of 88,010 ML. This included trade between environmental water holders as well as non-environment trade.

4. Water returned to the Murray River

Previously reported as return flow from irrigation, this item now includes water returned to the Murray River after environmental diversions. 40,599 ML was returned to the Murray River following environmental diversions off the

waterway. 259,488 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	Volume 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	17	17	100%	0	17	0	0	0	0
Bundalong (1)	0	0	0%	0	0	0	0	0	0
Cobram	170	170	100%	0	170	0	0	0	0
Cohuna (2)	0	0	0%	0	0	0	0	0	0
Corryong	65	65	100%	0	65	0	0	0	0
Dartmouth	6	0	0%	0	0	0	0	6	0
Gunbower / Leitchville	10	10	100%	0	10	0	0	0	0
Koondrook	100	0	0%	0	0	0	0	0	100
Koorlong	2,398	2,389	100%	0	2,389	0	0	0	9
Lake Boga	45	0	0%	0	0	0	0	0	45
Merbein	138	0	0%	0	0	0	0	0	138
Mildura	1,182	654	55%	0	654	0	0	0	528
Murrabit	5	0	0%	0	0	0	0	0	5
Nathalia	159	159	100%	0	159	0	0	0	0
Numurkah	91	91	100%	0	91	0	0	0	0
Nyah / Nyah West	71	0	0%	0	0	0	0	0	71
Omeo	23	23	100%	0	23	0	0	0	0
Robinvale	267	185	69%	0	185	0	0	0	82
Strathmerton (3)	0	0	0%	0	0	0	0	0	0
Swan Hill	989	0	0%	0	0	0	0	0	989
Tallangatta	80	80	100%	0	80	0	0	0	0
Walwa	8	8	100%	5	3	0	0	0	0
Wodonga (4)	4,311	360	5%	208	0	0	152	3,951	0
Yarrawonga	331	331	100%	0	331	0	0	0	0
Total 2019–20	**10,466**	**4,542**	**42%**	**213**	**4,177**	**0**	**152**	**3,957**	**1,967**
Total 2018–19	10,384	4,593	43%	226	4,220	0	146	3,642	2,149

Notes

(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 reuse application. The treated water is stored in on-site lagoons and evaporates.
(3) The wastewater treatment plant at Strathmerton was operational, but it did not produce any recycled water output this year.
(4) The Baranduda treatment plant transfers all inflows to the Wodonga treatment plant. All reuse 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	3,178	2,710	5,888
Registered/licensed commercial and irrigation	4,123	1,480	415	1,895
Total 2019–20	**16,265**	**4,658**	**3,125**	**7,784**
Total 2018–19	16,265	4,779	3,492	8,271

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 of 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.

The volume of in-stream loss reported for 2018–19 has been adjusted in line with the corrections to the closing storage volumes for that year.

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 497,496 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:**
  - **87 ML of high-reliability and 47 ML of low-reliability Murray water shares were issued for the conversion of an equivalent volume of high- and low-reliability Murray supply-by-agreements**
  - **the volume of loss allowance for the River Murray – Goulburn-Murray Water bulk entitlement decreased by 69,942 ML during 2019–20; the volume was adjusted for water recovery made under stages one and two of GMW's Connections Project.**
- ✓ **The total volume diverted (1,243,138 ML) was within the volume available for the year (1,759,331 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 *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 2019–20.

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 2020	Annual entitlement volume (ML) 30 June 2019
Bulk Entitlement (River Murray – Goulburn-Murray Water) Conversion Order 1999		
High-reliability water shares	986,085	984,149
Low-reliability water shares	314,372	316,055
High-reliability supply by agreements	993	1,084
Low-reliability supply by agreements	409	456
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	231,443
Loss provision – Victorian Mid-Murray Storages [4]	n/a	n/a
Subtotal: Bulk Entitlement (River Murray – Goulburn-Murray Water) Conversion Order 1999	*1,463,361*	*1,533,187*
Bulk Entitlement (River Murray – Lower Murray Urban and Rural Water – Irrigation) Conversion Order 1999		
High-reliability water shares	295,686	297,535
Low-reliability water shares	7,205	5,475
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	*320,118*	*320,237*
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	13,792	13,787
Licensed small catchment dams – on-waterway	2,460	2,460
Licensed small catchment dams – on-waterway	13,725	13,725
Total	**2,228,559**	**2,298,499**

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 was amended in June 2019 to provide an annual allocation for audited mitigation water from the previous year. The amendment came into effect on 31 March 2020. Previously, this entitlement provided the VEWH 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 and the audited mitigation water from the previous year.

(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 at 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 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 specifies 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					Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Spillable write-off	Total available water	
River Murray – Goulburn-Murray Water						
Water shares	381,440	632,934	(410,550)	0	603,824	211,741
Supply by agreements	552	707	216	0	1,474	756
River Murray – Melbourne retailers (1)	15,819	15,658	(19,914)	0	11,562	0
River Murray – NVIRP stage 1 (2)	21,071	16,269	(29,009)	0	8,332	7,179
Loss allowance – irrigation districts (3)	-	-	-	-	-	94,791
Operating provisions (whole of system) (3)	-	-	-	-	-	(25,124)
Net diversion: River Murray – Goulburn-Murray Water (4)					*625,192*	*289,343*
River Murray – Lower Murray Urban and Rural Water – Irrigation						
Water shares	56,597	212,985	339,673	0	609,256	533,524
Millewa Waterworks district	50	462	450	0	962	826
Yelta Wargan Waterworks districts	0	9	(9)	0	0	3
Loss allowance – irrigation districts (5)	-	-	-	-	-	12,774
Diversion: River Murray – Lower Murray Water (6)					*610,217*	*547,126*
River Murray – Lower Murray Water (Urban)	7,060	20,441	293	0	27,794	21,255
River Murray – Wimmera Mallee Water	1,662	2,301	1,606	0	5,569	4,111
River Murray – North East Water (7)	5,016	11,826	(3,476)	0	13,365	10,038
River Murray – Goulburn Valley Water	2,048	3,691	2,015	0	7,755	4,331
River Murray – Coliban Water	4,188	4,148	(300)	0	8,036	4,296
Corryong	-	680	0	-	680	260
Cudgewa	-	29	0	-	29	0
Dartmouth	-	60	0	-	60	0
Omeo	-	77	0	-	77	54
Walwa	-	61	0	-	61	14
River Murray – Flora and Fauna						
High- and low-reliability components (8)	20,386	684,556	(341,426)	0	363,516	311,813
Unregulated entitlement	-	0	0	-	0	0
BMF-EWA (9)	259,750	33,000	(282,750)	-	10,000	0
RMIF (10)	58,016	0	(4,000)	-	54,016	45,740
Subtotal: River Murray – Flora and Fauna (11)					*427,532*	*357,553*
River Murray – Snowy Environmental Reserve (12)	0	19,664	(16,685)	-	2,979	0
Take and use licences – unregulated surface water	-	13,800	0	-	13,800	3,277
Licensed small catchment dams	-	16,185	0	-	16,185	1,480
Total 2019–20	**833,654**	**1,689,543**	**(763,865)**	**0**	**1,759,331**	**1,243,138**
Total 2018–19	668,704	1,899,856	(396,201)	0	2,172,359	1,433,033

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 represents both in-stream use and actual diversions from the waterway. Of the 7,179 ML reported, 7.057 ML represents diversions from the waterway.

(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 2,230 ML credited to North East Water from Wodonga recycled water treatment.

(8) Allocation includes return flows of 648,352 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 33,000 ML against the high-reliability entitlement and 0 ML against the low-reliability entitlement. 282,750 ML — while not a trade, it is shown here in the net trade column — of the BMF EWA allocation available during 2019–2020 was borrowed to support Victorian Murray high-reliability water share allocations in accordance with the BMF EWA rules, and it was therefore unavailable for use during the year.

(10) No new allocation to RMIF was made available in 2019–20. The net allocation traded under this entitlement in 2019–20 was traded to South Australia, where it was used to deliver environmental outcomes in the Chowilla Floodplain.

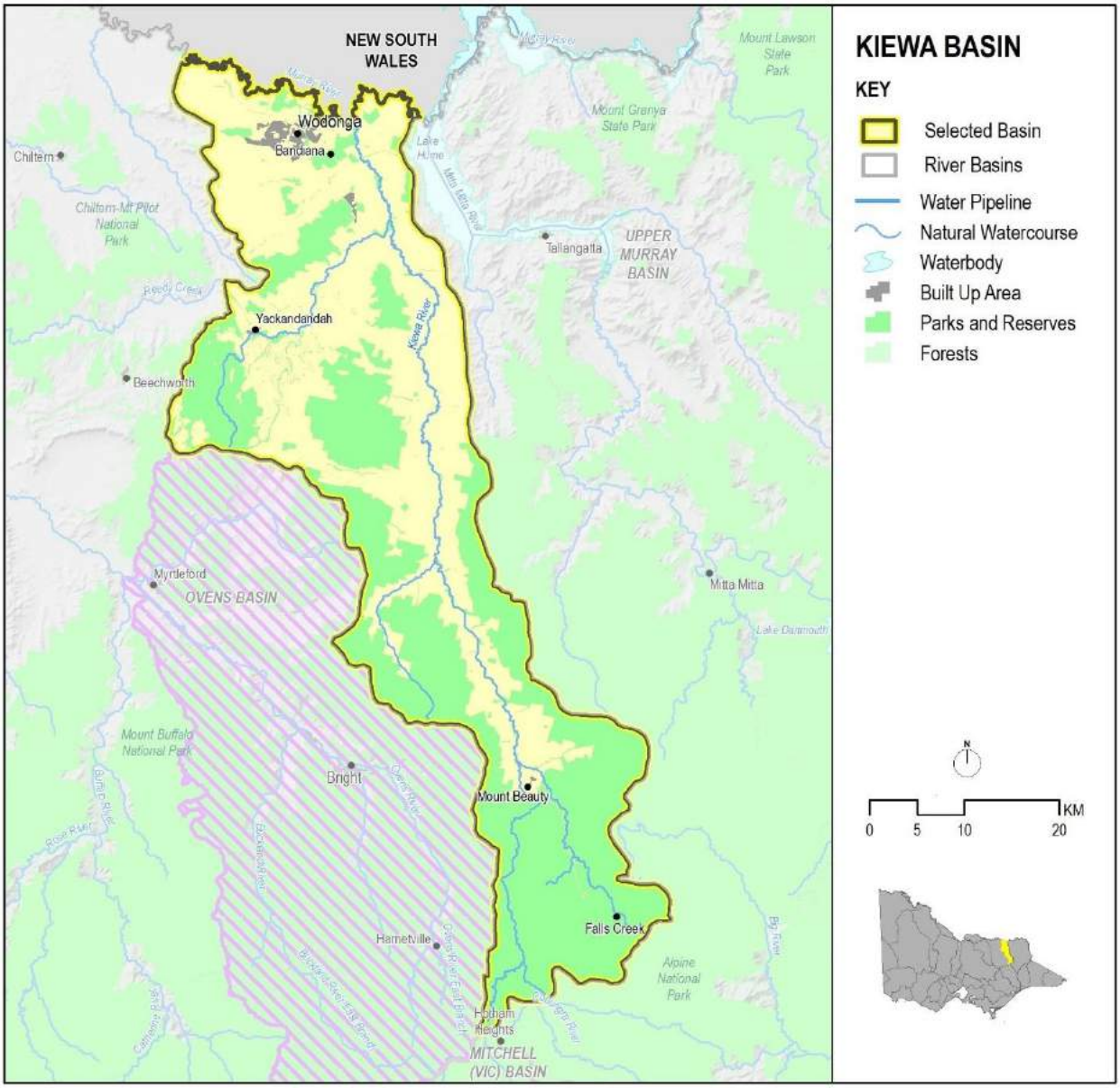
(11) Water use reported under this entitlement represents both in-stream use and actual diversions from the waterway. Of the 357,553 ML reported, 34,700 ML represents diversions from the waterway.

(12) Water allocated to this entitlement between 1 February 2019 and 31 January 2020 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. An additional volume of 2,476 ML of VEWH-held allocation was traded into this account at the end of year for use in 2020–21.

6.3 Kiewa basin

The Kiewa basin (Figure 6-4) is in northern Victoria and drains to the Murray River. 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 2019–20 water resources overview

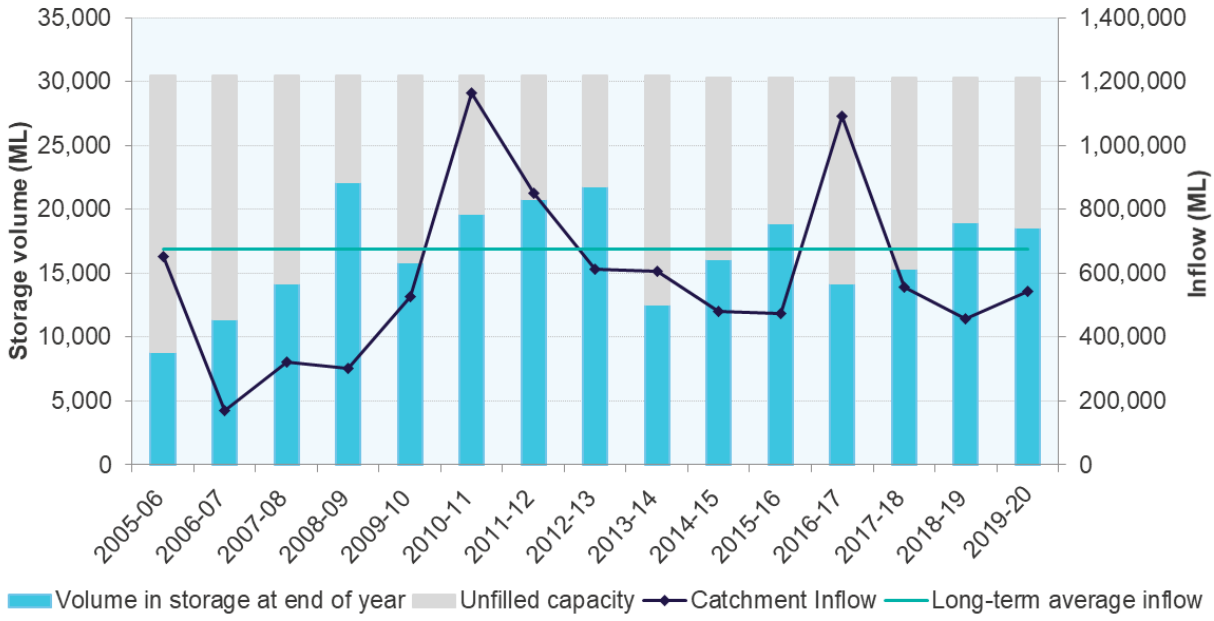
In 2019–20, rainfall:

- in most of the basin was 80% to 100% of the long-term average
- in the southern corner was 60% to 80% of the long-term average.

Catchment inflows to the basin in 2019–20 were 80% of the long-term average annual volume of 676,700 ML, greater than in 2018–19 when inflows were 68% of the long-term average. 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 63% of capacity on 1 July 2019 and slightly lower (at 61% of capacity) on 30 June 2020.

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



In July 2019, Bight Creek was the only stream with a ban on licensed diversions from the previous year in the Kiewa basin. Bans were put in place on an additional 14 streams by November 2019, reaching a peak of 17 streams by December. These bans remained in place until end of April 2020, when all bans were lifted. Six streams were unrestricted for the whole of 2019–20.

There were no restrictions on urban water use in the Kiewa basin in 2019–20, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2019–20, 8,373 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 8,420 ML diverted in the previous year.

6.3.2.1 Water for the environment

Environmental watering sites 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 2019–20, 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 2019–20 are shown in Table 6-10.

Table 6-10 Water balance, Kiewa basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	18,570	14,864
Volume in storage at end of year	1	18,112	18,570
Change in storage		**(458)**	**3,706**
Inflows			
Catchment inflow	2	543,893	457,330
Rainfall on major storages	1	0	0
Treated wastewater discharged back to river	3	331	327
Total inflows		**544,224**	**457,656**
Outflows			
Diversions			
Urban diversions		525	513
Licensed diversions from unregulated streams		4,827	5,023
Transfer to the Ovens basin	4	584	573
Small catchment dams	5	2,436	2,311
Total diversions		*8,373*	*8,420*
Losses			
Evaporation from major storages	1	0	0
Net evaporation from small catchment dams	5	1,528	1,594
In-stream infiltration to groundwater, flows to floodplain and evaporation		30,877	27,707
Total losses		*32,405*	*29,300*
Water passed at outlet of basin			
Kiewa basin outflow to Murray River – Victorian share		251,952	208,115
Kiewa basin outflow to Murray River – New South Wales' share		251,952	208,115
Total water passed at outlet of basin		*503,904*	*416,230*
Total outflows		**544,682**	**453,950**

6.3.3.1 Notes to the water balance

1. Storage

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	842	n/a	n/a	(175)	666
Rocky Valley Lake	28,294	17,728	n/a	n/a	(283)	17,445
Subtotal	*29,710*	*18,570*	*n/a*	*n/a*	*(458)*	*18,112*
Off-stream storages						
Clover Pondage	255	50	n/a	n/a	45	95
Pretty Valley basin	355	355	n/a	n/a	0	355
Subtotal	*610*	*405*	*n/a*	*n/a*	*45*	*450*
Total 2019–20	**30,320**	**18,974**	**n/a**	**n/a**	**(413)**	**18,562**
Total 2018–19	30,320	15,353	0	0	3,622	18,974

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 331 ML returned to the river includes the amount discharged to the environment from wastewater treatment plants as well as an amount of 136 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	Volume 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	93	93	100%	0	93	0	0	0	0
Mount Beauty	200	5	3%	5	0	0	0	195	0
Yackandandah	76	76	100%	0	76	0	0	0	0
Total 2019–20	**369**	**174**	**47%**	**5**	**169**	**0**	**0**	**195**	**0**
Total 2018–19	309	127	41%	3	124	0	0	181	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	1,443	1,224	2,666
Registered/licensed commercial and irrigation	4,528	994	304	1,298
Total 2019–20	**10,925**	**2,437**	**1,527**	**3,964**
Total 2018–19	10,925	2,311	1,594	3,904

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 a net increase of 7 ML in the total entitlement volume from the previous year:**
  - **licensed small catchment dam volume increased by 9 ML, while unregulated take and use licence volume decreased by 2 ML.**
- ✓ **The total volume diverted (6,930 ML) was within the volume available for the year (20,407 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 2020	Annual entitlement volume (ML) 30 June 2019
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)	13,662	13,664
Licensed small catchment dams – on-waterway	1,850	1,841
Licensed small catchment dams – off-waterway	2,679	2,679
Total	**20,396**	**20,389**

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				Water taken
	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	340
Yackandandah	-	209	0	209	185
Take and use licences – unregulated surface water	-	13,673	0	13,673	4,827
Licensed small catchment dams	-	4,528	0	4,528	994
Total 2019–20	**-**	**20,407**	**0**	**20,407**	**6,930**
Total 2018–19	-	20,453	0	20,453	7,040

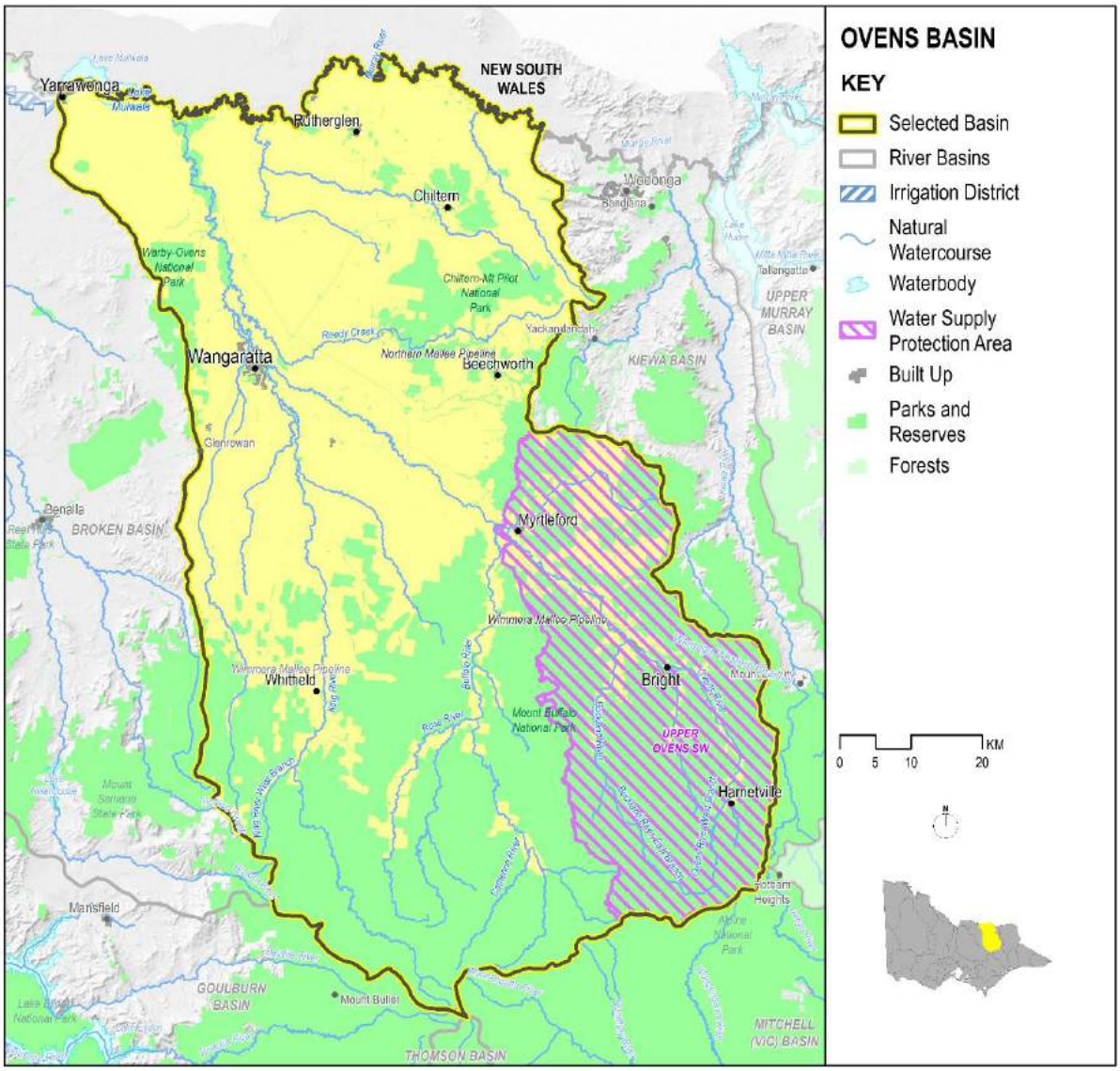
Note

(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 2019–20 water resources overview

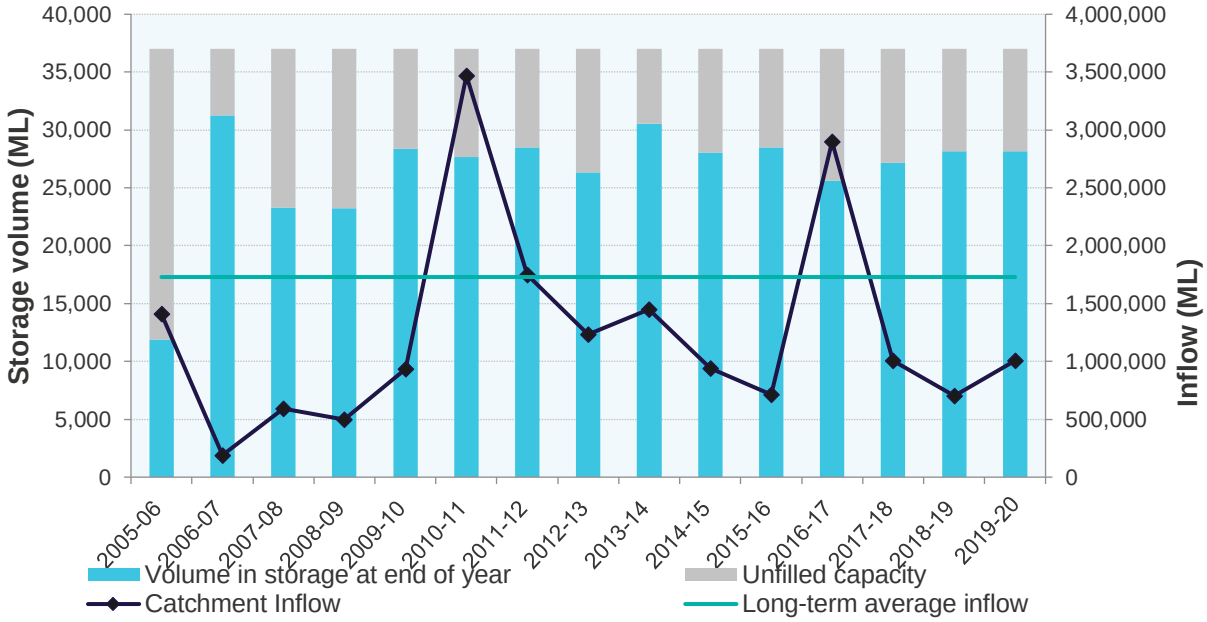
In 2019–20, rainfall:

- in the south-eastern corner and near Mt Buffalo was 60% to 80% of the long-term average
- in most of the basin was 80% to 100% of the long-term average
- in the south-western corner was 100% and 125% of the long-term average.

Catchment inflows to the basin in 2019–20 were 58% of the long-term average annual volume of 1,729,300 ML, greater than in 2018–19 when inflows were 41% of the long-term average. The volume of water flowing out of the Ovens basin into the Murray River represented 95% of the Ovens basin's catchment inflows.

Major storages in the basin were at 76% of capacity on 1 July 2019 and the same (at 76% of capacity) on 30 June 2020.

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



In July 2019, restrictions on diversions remained on two streams, but they were lifted in early August. All unregulated streams were then unrestricted until October 2019, when a roster was applied to three streams and a total ban was placed on one. By January 2020, the number of restricted streams peaked at 20. All these restrictions were lifted in May 2020.

There were no restrictions on urban water use in the Ovens basin in 2019–20, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2019–20, 25,975 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 26,706 ML diverted in the previous year.

6.4.2.1 Water for the environment

Environmental watering sites 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, which is an important site 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 2019–20, 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
- 39 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 2019–20, 142 ML of environmental water was delivered in-stream and 20 ML was diverted off-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 2019–20 are shown in Table 6-17.

Table 6-17 Water balance, Ovens basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	28,183	27,165
Volume in storage at end of year	1	28,172	28,183
Change in storage		**(11)**	**1,018**
Inflows			
Catchment inflow	2	1,007,608	702,562
Rainfall on major storages	1	3,689	3,287
Transfer from Kiewa basin	3	584	573
Treated wastewater discharged back to river	4	1,453	1,320
Total inflows		**1,013,334**	**707,742**
Outflows			
Diversions			
Urban diversions		5,418	5,887
Licensed diversions from regulated streams		10,474	11,135
Licensed diversions from unregulated streams		4,348	4,545
Environmental water diversions		20	0
Small catchment dams	5	5,715	5,138
Total diversions		*25,975*	*26,706*
Losses			
Evaporation from major storages	1	3,951	3,534
Net evaporation from small catchment dams	5	3,420	3,746
In-stream infiltration to groundwater, flows to floodplain and evaporation		21,510	25,478
Total losses		*28,881*	*32,758*
Water passed at outlet of basin			
Ovens basin outflow to Murray River		958,488	647,260
Total water passed at outlet of basin		*958,488*	*647,260*
Total outflows		**1,013,345**	**706,724**

6.4.3.1 Notes to the water balance

1. Storage

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	14,328	2,508	3,170	509	14,175
Lake William Hovell	13,690	13,855	1,181	781	(257)	13,998
Total 2019–20	**37,030**	**28,183**	**3,689**	**3,951**	**252**	**28,172**
Total 2018–19	37,030	27,165	3,287	3,534	1,265	28,183

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	Volume 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	291	60	21%	0	60	0	0	231	0
Bright / Porepunkah	345	10	3%	10	0	0	0	335	0
Chiltern	41	41	100%	0	41	0	0	0	0
Glenrowan	36	36	100%	0	36	0	0	0	0
Moyhu	8	8	100%	0	8	0	0	0	0
Myrtleford	259	0	0%	0	0	0	0	259	0
Rutherglen / Wahgunyah	65	65	100%	38	27	0	0	0	0
Wangaratta	1,521	936	62%	11	925	0	0	585	0
Wangaratta Trade Waste	43	0	0%	0	0	0	0	43	0
Total 2019–20	**2,609**	**1,156**	**44%**	**59**	**1,097**	**0**	**0**	**1,453**	**0**
Total 2018–19	2,611	1,291	49%	71	1,220	0	0	1,320	0

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	3,819	2,903	6,722
Registered/licensed commercial and irrigation	10,919	1,896	517	2,413
Total 2019–20	**37,336**	**5,715**	**3,420**	**9,135**
Total 2018–19	37,336	5,138	3,746	8,884

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

- ✓ **There no net increase to the total entitlement volume from the previous year.**
- ✓ **The total volume diverted (21,714 ML) was within the volume available for the year (64,558 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 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 2020	Annual entitlement volume (ML) 30 June 2019
Bulk Entitlement (Ovens System – Goulburn-Murray Water) Conversion Order 2004 (1)		
High-reliability water shares	26,164	26,164
Spill-reliability water shares	12,525	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	*46,521*	*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)	13,809	13,820
Licensed small catchment dams – on-waterway	3,410	3,442
Licensed small catchment dams – off-waterway	7,509	7,493
Total	**74,020**	**74,047**

Notes

(1) Under this bulk entitlement, Goulburn-Murray Water operates Lake Buffalo and Lake William Hovell to supply to 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				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Ovens system – Goulburn-Murray Water					
Water shares (1)	-	29,067	0	29,067	10,636
Ovens system – Moyhu, Oxley and Wangaratta	-	7,832	0	7,832	3,272
Diversion: Ovens system – Goulburn-Murray Water (2)				*36,899*	*13,908*
Bright	-	870	0	870	862
Chiltern (3)	-	180	0	180	0
Glenrowan (4)	-	90	0	90	16
Harrietville	-	91	0	91	65
Myrtleford	-	1,212	0	1,212	620
Springhurst	-	36	0	36	0
Whitfield	-	34	0	34	0
Take and use licences – unregulated surface water (5)	-	14,094	103	14,197	4,348
Licensed small catchment dams (5)	-	10,935	14	10,949	1,896
Total 2019–20	**-**	**64,441**	**117**	**64,558**	**21,714**
Total 2018–19	-	64,872	291	65,163	23,342

Notes

(1) Water use reported includes 142 ML of environmental in-stream use and 20 ML of off-stream use. The 142 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 (162 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.

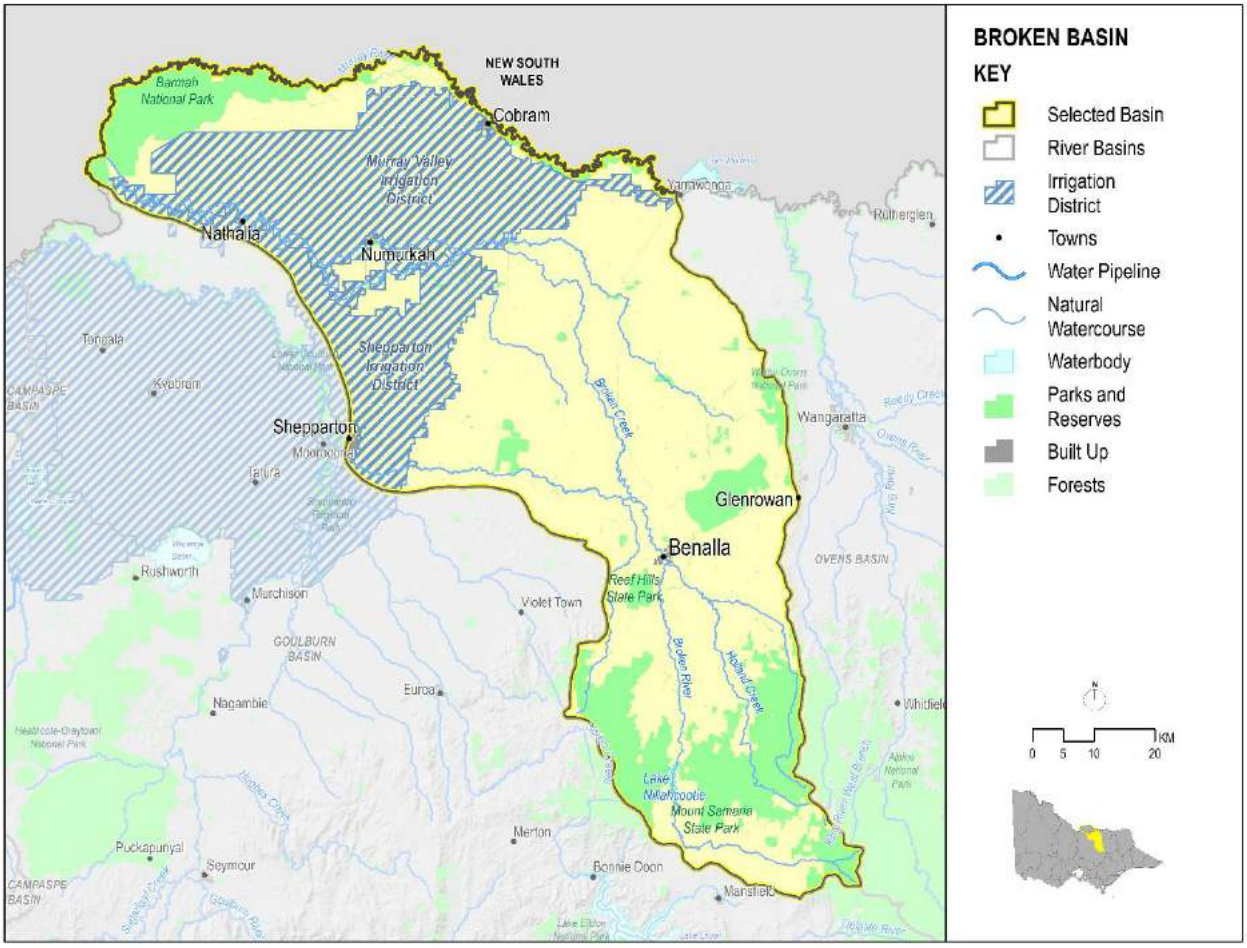
(4) Glenrowan receives urban supply from the Wangaratta system. North East Water diverted 16 ML under the Glenrowan bulk entitlement in 2019–20 to supply water to an irrigation customer via a supply by agreement.

(5) Net trade encompasses temporary and permanent trades in and out of the Ovens basin. The net value of 117 ML (103 ML unregulated and 14 ML small catchment dam licences) represents water traded in from groundwater take and use licences. 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.

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 2019–20 water resources overview

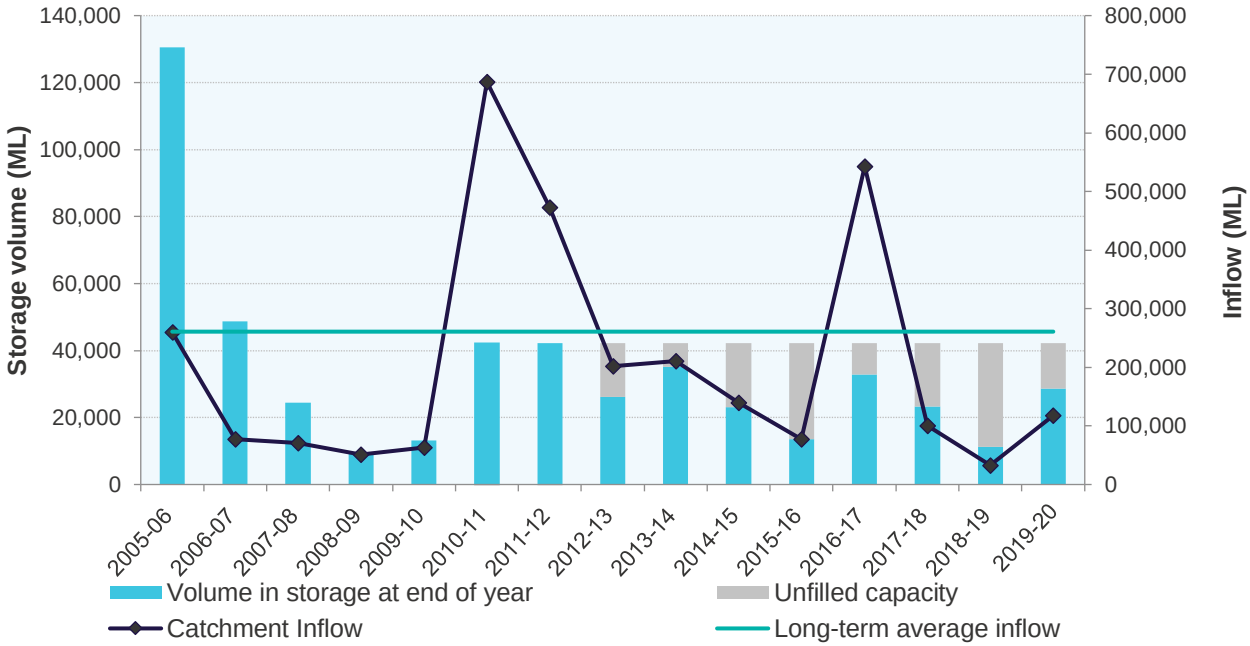
In 2019–20, rainfall:

- in the south-west was 60% to 80% of the long-term average
- in the top half of the Broken basin and alongside the Ovens basin was 80% to 100% of the long-term average.

Catchment inflows to the basin in 2019–20 were 45% of the long-term average annual volume of 260,800 ML, greater than in 2018–19 when inflows were 13% of the long-term average.

Major storages in the basin were at 27% of capacity on 1 July 2019 and higher (at 68% of capacity) on 30 June 2020.

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



Note

(1) 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 Broken basin.

A 2% high-reliability seasonal determination was announced for the Broken system on 16 March 2020. There were no further seasonal determination increases for the 2019–20 season. Due to the extremely low allocation, successive years of very low inflows and dry catchment conditions, the Minister for Water declared a water shortage and announced a temporary qualification of rights to water in the Broken system for 2019–20 to enable all water share holders to access water for critical domestic and stock needs. The temporary qualification of rights took effect from 1 January 2020 until 30 June 2020.

In 2019–20, all licensed diversions from Boosey Creek were banned for the whole year except August 2019. Hollands and Ryans creeks were banned for almost the entire year, except for September 2019 and May to June 2020. Licensed diversions on the Lima and Lima East creeks again remained unrestricted.

There were no restrictions on urban water use in the Broken basin in 2019–20, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2019–20, 9,460 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 11,949 ML diverted in the previous year.

6.5.2.1 Water for the environment

Environmental watering sites 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, 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 2019–20, 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 of 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 597 ML of environmental water was delivered in the Broken basin in 2019–20. The volume is considered to be an off-stream diversion as it is typically lost via evaporation and seepage along the 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 2019–20 are shown in Table 6-24.

Table 6-24 Water balance, Broken basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	11,206	23,200
Volume in storage at end of year	1	28,664	11,206
Change in storage		**17,458**	**(11,995)**
Inflows			
Catchment inflow	2	117,935	32,924
Rainfall on major storages	1	2,518	2,328
Treated wastewater discharged back to river	3	0	0
Total inflows		**120,452**	**35,252**
Outflows			
Diversions			
Urban diversions		1,642	1,658
Licensed diversions from regulated streams		3,523	7,760
Licensed diversions from unregulated streams		645	722
Environmental water diversions		597	0
Small catchment dams	4	3,053	1,809
Total diversions		*9,460*	*11,949*
Losses			
Evaporation from major storages	1	3,135	3,808
Net evaporation from small catchment dams	4	2,219	1,872
In-stream infiltration to groundwater, flows to floodplain and evaporation		10,763	8,330
Total losses		*16,117*	*14,010*
Water passed at outlet of basin			
Broken River at Gowangardie to Goulburn basin		76,464	20,709
Boosey Creek at Tungamah to Murray basin		0	0
Broken Creek at Katamatite to Murray basin		953	578
Total water passed at outlet of basin		*77,417*	*21,287*
Total outflows		**102,994**	**47,247**

6.5.3.1 Notes to the water balance

1. Storage

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	10,389	2,181	2,352	16,699	26,917
Loombah-McCall Say	1,747	817	336	783	1,377	1,747
Total 2019–20	**42,147**	**11,206**	**2,518**	**3,135**	**18,076**	**28,664**
Total 2018–19	42,147	23,200	2,328	3,808	(10,514)	11,206

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	Volume 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		
Benalla	381	381	100%	0	381	0	0	0	0
Tungamah	9	9	100%	0	9	0	0	0	0
Total 2019–20	**390**	**390**	**100%**	**0**	**390**	**0**	**0**	**0**	**0**
Total 2018–19	443	443	100%	0	443	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)	16,857	1,866	1,822	3,687
Registered/licensed commercial and irrigation	8,796	1,188	397	1,585
Total 2019–20	**25,654**	**3,054**	**2,218**	**5,272**
Total 2018–19	25,654	1,809	1,872	3,681

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 (7,594 ML) was within the volume available for the year (18,577 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 147 ML above the annual allowance of 1,850 ML under regulated conditions. GMW were 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. 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 6-28 Entitlement volumes, Broken basin

Water entitlement	Annual entitlement volume (ML) 30 June 2020	Annual entitlement volume (ML) 30 June 2019
Bulk Entitlement (Broken System Goulburn-Murray Water) Conversion Order 2004 (1)		
High-reliability water shares	17,623	17,625
Low-reliability water shares	3,336	3,345
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*	*22,955*
Bulk Entitlement (Loombah McCall–Say) Conversion Order 2001	2,324	2,324
Take and use licences – unregulated surface water (3)	1,397	1,411
Licensed small catchment dams – on-waterway	1,308	1,308
Licensed small catchment dams – off-waterway	7,489	7,489
Total	**35,462**	**35,486**

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 is 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				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Broken system – Goulburn-Murray Water					
Water shares (1)	3,091	482	510	4,083	2,123
Tungamah, Devenish and St. James (2)	64	68	0	132	0
Broken supplement to Lower Goulburn and Murray	-	0	-	0	0
Loss allowance (3)	-	1,850	-	1,850	1,997
Diversion: Broken System – Goulburn-Murray Water (4)				*6,065*	*4,120*
Loombah–McCall Say (Benalla)	-	2,324	0	2,324	1,642
Take and use licences – unregulated surface water	-	1,488	0	1,488	645
Licensed small catchment dams	-	8,700	0	8,700	1,188
Total 2019–20	**3,156**	**14,912**	**510**	**18,577**	**7,594**
Total 2018–19	4,929	20,950	(1,839)	24,040	11,043

Notes

(1) Water use reported includes 597 ML of environmental off-stream use. The allocation issued and water taken includes 130 ML issued under a qualification of rights: see section 6.5.2 for details.

(2) North East Water transferred its offtake for this bulk entitlement to upstream of Benalla Weir in October 2009, but it does not have infrastructure in place to supply water under this entitlement. In 2018–19, Tungamah, Devenish and St. James continued to be supplied with water via a pipeline from Yarrawonga in the Murray system.

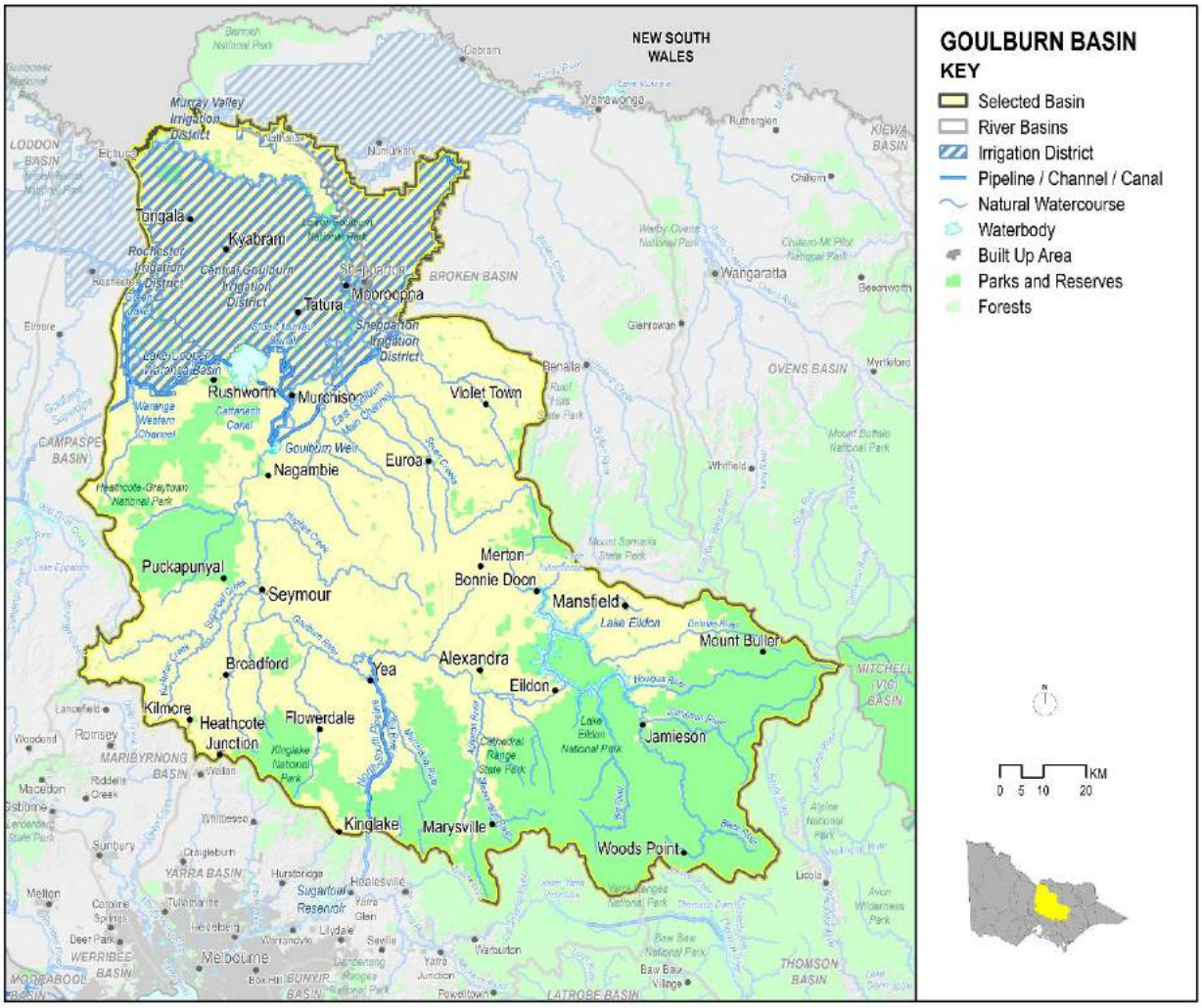
(3) Goulburn-Murray Water has an annual average loss allowance of 1,850 ML. In 2019–20, Goulburn-Murray Water reported that during regulated conditions, losses from Broken Creek were 147 ML over the loss allowance.

(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 located in the Goulburn basin including Shepparton, Alexandra and Seymour
Coliban Water	Can supply towns located 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 2019–20 water resources overview

In 2019–20, rainfall:

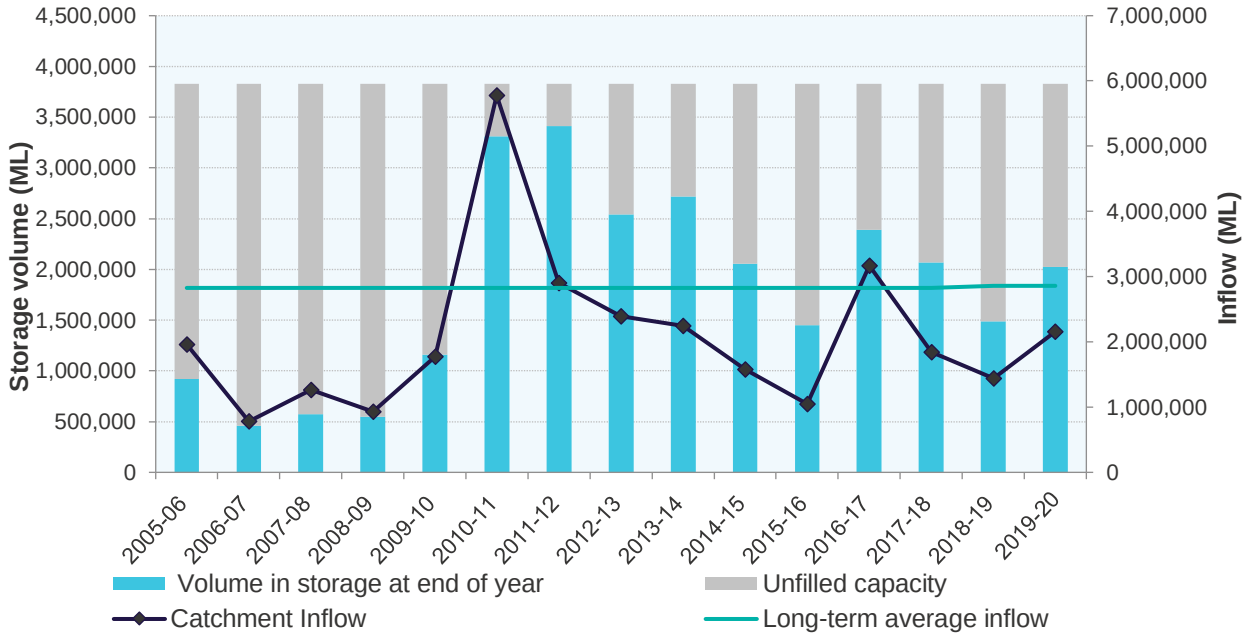
- in the north-east and a small area of the south-west was 80% to 100% of the long-term average rainfall

- in most of the basin was 100% to 125% of the long-term average.

Catchment inflows to the basin in 2019–20 were 75% of the long-term average annual volume of 2,859,000 ML, greater than in 2018–19 when inflows were 51% of the long-term average.

Major storages in the basin were at 38% of capacity on 1 July 2019 and higher (at 49% of capacity) on 30 June 2020.

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



As was the case for all the northern systems, allocations in 2019–20 in the Goulburn system were lower than the previous year. The first seasonal determination for high-reliability water shares of 2% for the Goulburn basin was announced on 1 July 2019. It increased to 71% by February 2020 and the year ended with a final allocation of 80%. There was no seasonal determination allocation for low-reliability water shares in 2019–20.

In July 2019, licensed diversions from Sunday Creek were banned, but the ban was lifted in early August. All unregulated streams were then unrestricted until October 2019, when a ban was again applied to Sunday Creek. By January 2020, licensed diversions were restricted on eight streams. These restrictions were lifted on all streams by May 2020.

In 2019–20, water restrictions were in place in six towns in the Goulburn basin. Stage 2 restrictions remained in place in Kilmore, Kilmore East, Wandong and Heathcote Junction until the end of October 2019 when permanent water-saving rules were applied. Stage 2 restrictions in Euroa and Violet Town were lifted in April 2020 and permanent water-saving rules were in place for the rest of the year. All other towns were on permanent water-saving rules throughout the year.

In 2019–20, 820,879 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 1,026,454 ML diverted in the previous year.

6.6.2.1 Water for the environment

Environmental watering sites 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 2019–20, 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 1,398 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. This entitlement was amended in June 2019 and the amendment came into effect on 31 March 2020, before which this entitlement was for 29,781 ML (excluding mitigation water)
- 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
- 331,437 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 428,867 ML of environmental water was sourced from the Goulburn basin in 2019–20. 9,048 ML of this was diverted off-stream, and the remaining 419,819 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 2019–20 are shown in Table 6-31.

Table 6-31 Water balance, Goulburn basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	1,285,943	1,849,267
Volume in storage at end of year	1	1,641,535	1,285,943
Change in storage		**355,592**	**(563,324)**
Inflows			
Catchment inflow	2	2,155,436	1,444,085
Rainfall on major storages	1	68,735	63,946
Inflow from Broken River at Gowangardie		76,464	20,709
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	1,199	391
Total inflows		**2,301,835**	**1,529,131**
Outflows			
Diversions			
Urban diversions		27,291	28,237
Irrigation district diversions		749,379	953,489
Licensed diversions from regulated streams		13,187	19,350
Licensed diversions from unregulated streams		5,376	5,887
Transfer from Silver and Wallaby creeks to Yarra basin		808	356
Transfers to Melbourne via North-South pipeline	4	11	0
Environmental water diversions	5	9,048	7,553
Small catchment dams	6	15,779	11,581
Total diversions		*820,879*	*1,026,454*
Losses			
Evaporation from major storages	1	71,511	86,215
Net evaporation from small catchment dams	6	8,562	10,618
In-stream infiltration to groundwater, flows to floodplain and evaporation		86,240	150,151
Total losses		*166,313*	*246,984*
Water passed at outlet of basin			
Goulburn River to Campaspe River via Waranga Western Channel		3,487	0
Goulburn River outflow to Murray River		906,684	791,425

Goulburn River outflow to Murray River via Broken Creek	48,881	27,592
Total water passed at outlet of basin	959,052	*819,017*
Total outflows	**1,946,243**	**2,092,455**

6.6.3.1 Notes to the water balance

1. Storage

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	21,860	5,521	11,317	4,393	20,457
Lake Eildon	3,334,158	1,263,700	63,087	60,049	353,216	1,619,953
Sunday Creek Reservoir	1,650	383	128	144	759	1,125
Subtotal	*3,361,308*	*1,285,943*	*68,735*	*71,511*	*358,367*	*1,641,535*
Off-stream storages						
Greens Lake	32,500	15,658	n/a	n/a	(5,122)	10,536
Waranga Basin	432,360	184,376	24,556	54,931	216,329	370,329
Subtotal	*464,860*	*200,034*	*24,556*	*54,931*	*211,207*	*380,865*
Total 2019–20	**3,826,168**	**1,485,977**	**93,291**	**126,442**	**569,574**	**2,022,401**
Total 2018–19	3,826,168	2,067,692	81,111	153,946	(508,880)	1,485,977

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, 155 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	Volume 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	233	190	82%	175	15	0	0	43	0
Avenel	15	15	100%	0	15	0	0	0	0
Bonnie Doon	21	21	100%	0	21	0	0	0	0
Broadford	190	190	100%	0	190	0	0	0	0
Eildon	213	175	82%	175	0	0	0	38	0
Euroa	290	290	100%	70	220	0	0	0	0
Girgarre [1]	0	0	0%	0	0	0	0	0	0
Kilmore	416	280	67%	0	280	0	0	136	0
Kyabram / Merrigum	425	425	100%	0	425	0	0	0	0
Mansfield	258	214	83%	77	137	0	0	44	0
Marysville	62	62	100%	38	24	0	0	0	0
Mooroopna	823	823	100%	0	823	0	0	0	0
Murchison [1]	0	0	0%	0	0	0	0	0	0

Nagambie	113	113	100%	0	113	0	0	0	0
Seymour	469	441	94%	81	360	0	0	28	0
Shepparton	3,224	2,469	77%	0	2,469	0	0	755	0
Stanhope / Rushworth	60	60	100%	0	60	0	0	0	0
Tatura	898	898	100%	0	898	0	0	0	0
Tongala	182	182	100%	0	182	0	0	0	0
Upper Delatite	34	34	100%	0	34	0	0	0	0
Violet Town (1)	0	0	0%	0	0	0	0	0	0
Yea	99	99	100%	41	58	0	0	0	0
Total 2019–20	**8,025**	**6,981**	**87%**	**657**	**6,324**	**0**	**0**	**1,044**	**0**
Total 2018–19	7,627	7,372	97%	516	6,855	0	0	257	0

Note

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

4. Transfers to Melbourne via North-South pipeline

11 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.

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)	51,210	10,325	7,315	17,640
Registered/licensed commercial and irrigation	22,632	5,454	1,247	6,701
Total 2019–20	**73,842**	**15,780**	**8,561**	**24,341**
Total 2018–19	73,842	11,581	10,618	22,199

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:**
  - **35 ML of high-reliability and 16 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 6 ML of low-reliability water share**
  - **the volume of loss allowance for the Eildon – Goulburn Weir bulk entitlement decreased by 58,921 ML during 2019–20; the volume was adjusted for water recovery made under stages 1 and 2 of GMW's Connections Project.**
- ✓ **The total volume diverted (1,226,518 ML) was within the volume available for the year (1,377,365 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***

- **under the *Bulk Entitlement (Eildon-Goulburn Weir) Conversion Order 1995*, Goulburn-Murray Water reported that the Normanville Water Works District (WWD) was 7.5 ML over its annual loss allowance of 109.1 ML; the East Loddon South WWD was 57 ML over its annual allowed loss volume, due to a delay in filling the pipeline storage due to blue-green algae in 2018–19, and the East Loddon North WWD exceeded the maximum diversion volume allowed in 2019–20 (430 ML) by 175 ML, partly due to high losses on delivery spurs**
- **in 2019–20, Goulburn Valley Water took 645 ML under its Euroa bulk entitlement which is within the annual entitlement volume of 1,990 ML. However, it transferred 662 ML to Abbinga Reservoir, which is 10% above the maximum annual volume which can be transferred for storage in Abbinga Reservoir under clause 11 of the bulk entitlement.**

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 which 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 2019–20 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 2020	Annual entitlement volume (ML) 30 June 2019
Bulk Entitlement (Eildon – Goulburn Weir) Conversion Order 1995 (1)		
High-reliability water shares	1,083,856	1,083,821
Low-reliability water shares	469,097	469,087
High-reliability supply by agreements	4,421	4,456
Low-reliability supply by agreements	1,825	1,841
Waterworks districts (2)	2,289	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	298,129
Subtotal: Bulk Entitlement (Eildon – Goulburn Weir) Conversion Order 1995	*2,281,504*	*2,340,432*
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	15,772	15,791
Licensed small catchment dams – on-waterway	8,408	8,426
Licensed small catchment dams – off-waterway	14,224	14,219
Total	**2,349,707**	**2,408,666**

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 was amended in June 2019 and the amendment came into effect on 31 March 2020. Before the amendment, this entitlement 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 Goulburn-Murray Water Connections Project stage 1 and the audited mitigation water from the previous year. The entitlement is now only for the audited mitigation water from the previous year.

(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). 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					Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Spillable write-off	Total available water	
Eildon – Goulburn Weir						
Water shares	323,254	867,059	(431,726)	0	758,588	346,038
Supply by agreements	1,823	3,562	(207)	0	5,178	2,808
Waterworks districts [1]	-	1,834	0	-	1,834	1,538
Quambatook – GWMWater	81	100	(35)	0	146	51
Goulburn channel system – CW	1,335	2,420	(2,480)	0	1,275	999
Goulburn River and Eildon – GVW [2]	6,636	26,671	(13,240)	0	20,068	17,727
Goulburn channel system – GVW	776	7,191	0	0	7,967	5,335
Goulburn system – Melbourne retailers	20,000	21,396	(20,520)	0	20,876	11
Environmental Entitlement Goulburn system – Living Murray [3]	28,327	31,700	(2,000)	0	58,027	24,885
Goulburn System – NVIRP Stage 1 [3]	28,572	22,103	(28,902)	0	21,774	20,376
Goulburn system – Snowy Environmental Reserve	1,815	24,202	(22,387)	0	3,630	0
Goulburn River environmental entitlement [3]	3,582	41,528	365,295	0	410,405	376,264
Loss allowance – irrigation district [4]	-	-	-	-	-	109,138
Downstream commitments and waterway losses [5]	-	-	-	-	-	306,576
Diversion: Eildon – Goulburn Weir [6]						*1,211,747*
Broadford, Kilmore and Wallan	-	2,238	0	-	2,238	1,060
Buxton	-	110	0	-	110	0
Euroa system	-	1,990	0	-	1,990	645
Longwood	-	120	0	-	120	58
Mansfield	-	1,300	0	-	1,300	784
Marysville	-	462	0	-	462	207
Pyalong	-	75	0	-	75	62
Strathbogie	-	23	0	-	23	6
Thornton	-	120	0	-	120	0
Upper Delatite	-	235	0	-	235	97
Violet Town	-	20	0	-	20	0
Woods Point	-	30	0	-	30	7
Yea	-	438	0	-	438	207
Rubicon – Hydro Ltd	-	-	-	-	-	-
Silver and Wallaby Creeks – Melbourne Water	-	22,000	0	-	22,000	808
Silver and Wallaby Creeks Environmental Entitlement	-	-	-	-	-	-
Take and use licences – unregulated surface water	-	15,791	2	-	15,793	5,376
Licensed small catchment dams	-	22,647	(2)	-	22,645	5,454
Total 2019–20	**416,201**	**1,117,366**	**(156,202)**	**0**	**1,377,365**	**1,226,518**
Total 2018–19	432,389	1,299,756	(250,379)	0	1,481,766	1,266,080

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 372 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 421,525 ML reported, 1,518 ML represents diversions from the waterway.

(4) This represents the actual losses incurred in 2019–20 in the Central Goulburn, Rochester, Loddon Valley and Shepparton irrigation areas and the Normanville, East Loddon (South), East Loddon (North) and Tungamah waterworks districts.

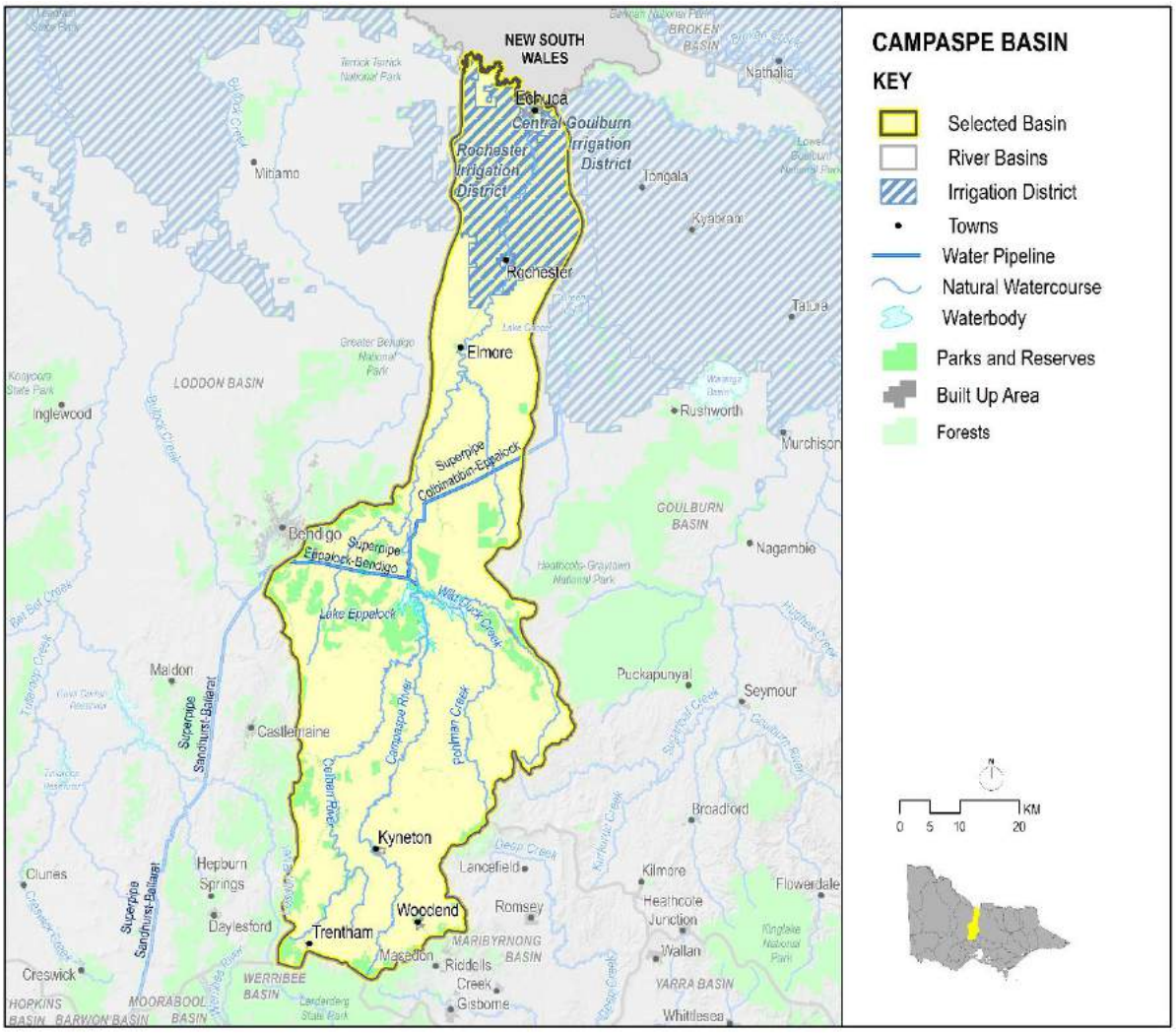
(5) This reflects the use of water to manage the system including the net transfer of water to off-stream storages — Waranga basin and Greens Lake — as well as water supplied to the Campaspe, Loddon and Murray rivers during the water year.

(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 (419,819 ML) as well as environmental diversions off-stream (1,518 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 2019–20 water resources overview

In 2019–20, rainfall:

- in most of the basin was 80% to 100% of the long-term average
- in two small areas — in the north-east and south of Heathcote — was 100% to 125% of the long-term average.

Catchment inflows to the basin in 2019–20 were 45% of the long-term average of 258,600 ML, greater than in 2018–19 when inflows were 20% of the long-term average.

Major storages in the basin were at 42% of capacity on 1 July 2019 and slightly higher (at 45% of capacity) on 30 June 2020.

Figure 6-13 Storage volumes and catchment inflows, Campaspe basin

Seasonal determinations were lower in 2019–20 than the previous year in the Campaspe system. The first seasonal determination for high-reliability water shares was announced on 1 July 2019 at 26%, then rose to 71% in February and reached a final allocation of 80% in April 2020. There was no seasonal determination for low-reliability water shares in 2019–20. Coliban Water opened the water season with a 100% allocation for its rural customers.

In the Campaspe basin, 18 unregulated streams began 2019–20 with bans on licensed diversions in place. These were lifted at the end of August 2019 for all but six streams. Four of these streams remained under bans for the entirety of 2019–20. The number of streams restricted increased to 14 in October 2019 and by January 2020 total bans were in place for 17 streams. Most of these bans were lifted by May 2020. Meadow Valley, Mia and Native Gully creeks were unrestricted for the whole of 2019–20.

There were no restrictions on urban water use in the Campaspe basin in 2019–20, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2019–20, 39,890 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 47,375 ML diverted in the previous year.

6.7.2.1 Water for the environment

Environmental watering sites 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 2019–20, 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 2019–20, a total of 20,438 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 2019–20 are shown in Table 6-38.

Table 6-38 Water balance, Campaspe basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	158,491	234,792
Volume in storage at end of year	1	168,366	158,491
Change in storage		**9,875**	**(76,301)**
Inflows			
Catchment inflow	2	117,033	51,918
Rainfall on major storages	1	11,230	11,861
Transfer from Waranga Western Channel to Lake Eppalock		0	0
Transfer to Campaspe basin from Waranga Western Channel		3,487	0
Treated wastewater discharged back to river	3	756	635
Total inflows		**132,506**	**64,414**
Outflows			
Diversions			
Urban diversions		17,675	20,063
Diversion for Coliban Water rural entitlements		9,332	8,648
Licensed diversions from regulated streams		4,028	10,669
Licensed diversions from unregulated streams		508	546
Small catchment dams	4	8,094	6,519
Transfer from Campaspe basin to Western Waranga Channel		0	0
Transfer from Campaspe basin to White Swan Reservoir		253	931
Total diversions		*39,890*	*47,375*
Losses			
Evaporation from major storages	1	22,723	31,284
Net evaporation from small catchment dams	4	5,172	5,339
In-stream infiltration to groundwater, flows to floodplain and evaporation		6,843	7,831
Total losses		*34,738*	*44,454*
Water passed at outlet of basin			
Campaspe River outflows to Murray River	5	48,003	48,886
Total water passed at outlet of basin		*48,003*	*48,886*
Total outflows		**122,631**	**140,715**

6.7.3.1 Notes to the water balance

1. Storage

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	2,573	n/a	n/a	127	2,700
Lake Eppalock	304,651	110,986	6,345	15,723	13,589	115,198
Lauriston Reservoir	19,790	16,040	1,326	1,884	998	16,480
Malmsbury Reservoir	12,034	2,246	821	1,433	730	2,364
Upper Coliban Reservoir	37,770	26,646	2,738	3,683	5,923	31,624
Total 2019–20	**376,869**	**158,491**	**11,230**	**22,723**	**21,367**	**168,366**
Total 2018–19	376,869	234,792	11,861	31,284	(56,878)	158,491

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	Volume 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		
Axedale	7	7	100%	7	0	0	0	0	0
Echuca [1]	837	837	100%	0	837	0	0	0	0
Elmore [2]	0	0	0%	0	0	0	0	0	0
Heathcote	116	116	100%	116	0	0	0	0	0
Kyneton	935	405	43%	202	203	0	0	530	0
Lockington [2]	0	0	0%	0	0	0	0	0	0
Woodend	323	93	29%	41	52	0	0	226	4
Total 2019–20	**2,218**	**1,458**	**66%**	**366**	**1,092**	**0**	**0**	**756**	**4**
Total 2018–19	2,275	1,639	72%	225	1,412	0	3	635	0

Notes

(1) Water produced from the Echuca and Rochester treatment plants is stored in the same storage lagoon. The reuse 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 2019–20.

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)	29,715	6,428	4,695	11,124
Registered/licensed commercial and irrigation	6,522	1,665	477	2,142
Total 2019–20	**36,237**	**8,093**	**5,172**	**13,265**
Total 2018–19	36,237	6,519	5,339	11,858

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 (53,647 ML) was within the volume available for the year (102,223 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 annual 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 2020	Annual entitlement volume (ML) 30 June 2019
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	962	970
Licensed small catchment dams – on-waterway	1,863	1,918
Licensed small catchment dams – off-waterway	4,659	4,604
Total	**141,924**	**141,932**

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 at 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					Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Spillable write-off	Total available water	
Campaspe system – Goulburn-Murray Water (1)						
Water shares (2)	11,039	18,772	(11,679)	0	18,133	7,319
Axedale, Goornong and Rochester	135	279	(280)	0	135	100
Campaspe River – Living Murray Initiative	0	101	0	0	101	0
Campaspe River Environmental Entitlement (3)	9,607	16,853	(1,021)	0	25,439	20,438
Operating provisions (whole of system) (4)	-	-	-	-	0	0

Diversion: Campaspe system – Goulburn-Murray Water [5]					*43,807*	*27,857*
Campaspe system – Coliban Water [1] [6]	-	50,260	0	-	50,260	23,238
Trentham	-	120	0	-	120	80
Woodend	-	470	0	-	470	298
Take and use licences – unregulated surface water	-	986	0	-	986	508
Licensed small catchment dams	-	6,580	0	-	6,580	1,665
Total 2019–20	**20,782**	**94,421**	**(12,980)**	**0**	**102,223**	**53,647**
Total 2018–19	20,161	103,029	(8,464)	0	114,726	64,593

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) Water taken includes 3,291 ML allocated to and taken by Coliban Water to supply their Coliban Northern system. The amount supplemented water taken under their Campaspe system – Coliban Water bulk entitlement.

(3) 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.

(4) 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 2019–20, the supplement provided to the Goulburn system was 0 ML.

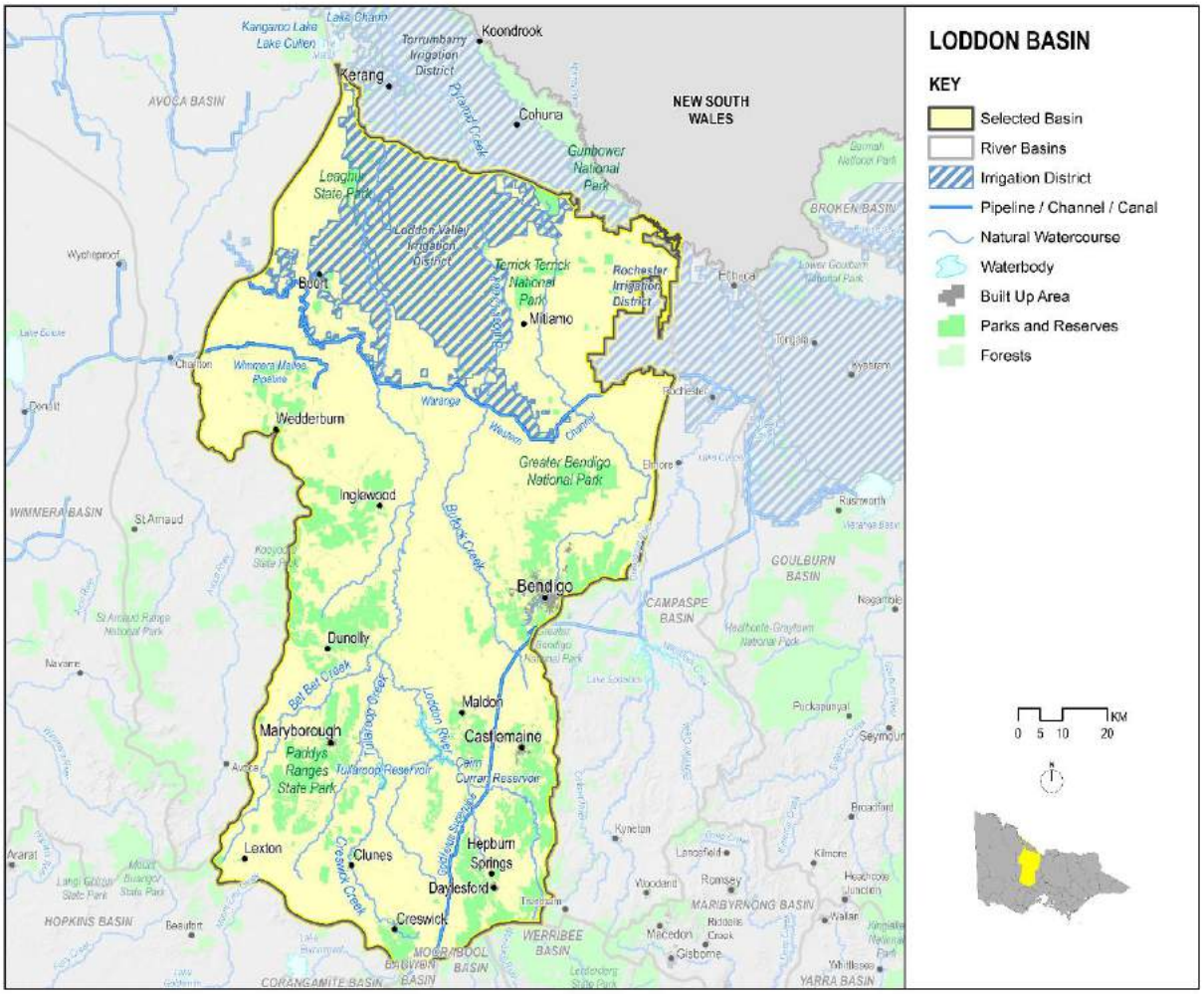
(5) The water taken reported in this line item represents the bulk diversion to supply primary entitlements and fulfil other operating requirements under the Campaspe system source bulk entitlement. It includes environment deliveries in-stream (20,438 ML).

(6) 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.

6.8 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 2019–20 water resources overview

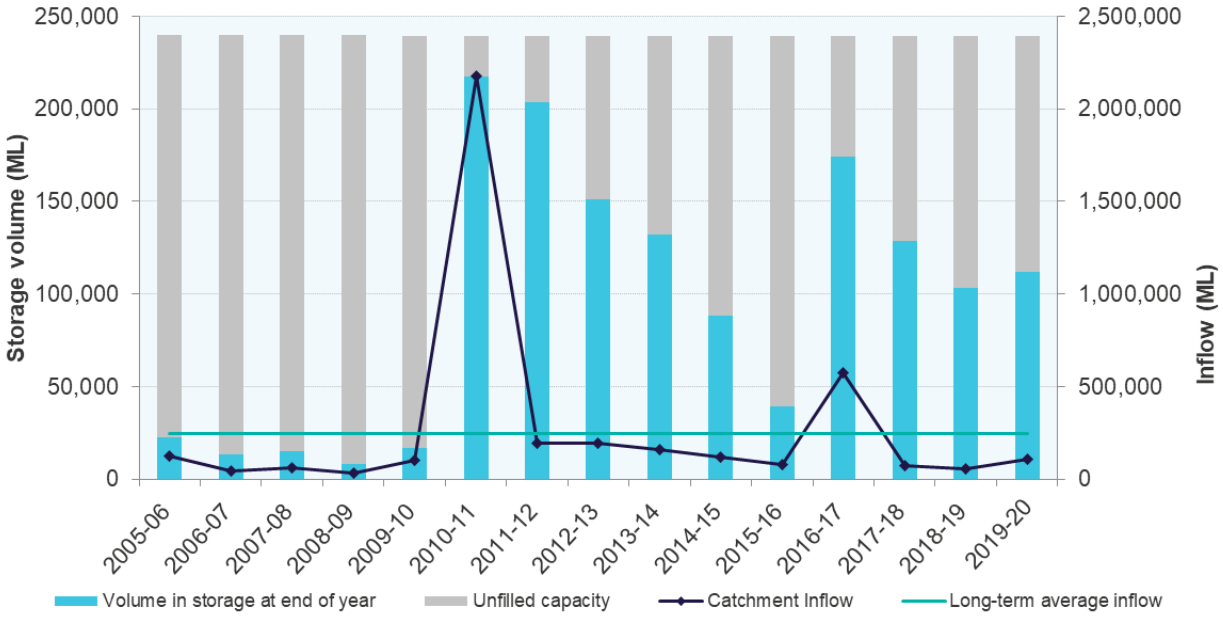
In 2019–20, rainfall:

- in most of the basin was 80% to 100% of the long-term average
- in two areas in the north near Boort and Mitiamo was up to 125% of the long-term average
- in a small area in the south-west was 60% to 80% of the long-term average.

Catchment inflows to the basin in 2019–20 were 44% of the long-term average annual volume of 243,400 ML, greater than in 2018–19 when inflows were 24% of the long-term average.

Major storages in the basin were at 42% of capacity on 1 July 2019 and higher (at 46% of capacity) on 30 June 2020.

Figure 6-15 Storage volumes and catchment inflows, Loddon basin



Seasonal determinations were lower in 2019–20 than the previous year in the Loddon system. On 1 July 2019, the opening determination for high-reliability water shares was announced at 2% allocation. This increased to 71% by February 2020 and reached a final allocation of 80% by April 2020. No seasonal determinations were made to low-reliability water shares during the year. The Bullarook system received an initial seasonal determination of 19% for high-reliability water shares, which quickly reached 100% by 15 July 2019. Low-reliability water shares also reached 100% in July 2019.

On 1 July 2019, Coliban Water announced a 2019–20 seasonal determination of 100% for its rural system (located in the Loddon basin but supplied out of the Campaspe system).

In July 2019, there were total bans on licensed diversions on 12 streams, and these bans were lifted on all but four streams from August to October 2019. Total bans were in place on diversions from most streams from December 2019 to the end of April 2020, with a peak of 29 streams with total bans in place from March to April 2020. Bans on ten streams were in place until the end of June 2020. For the whole year, total bans were in place on two streams (Lake Meran and Muckleford Creek) and two streams remained unrestricted (Bendigo and Grassy Flat creeks).

In 2019–20, there was only one town (Kerang) in the Loddon basin with urban restrictions in place. It was placed on stage 1 restrictions from November 2019 through to the end of May 2020 when permanent water-saving rules were then applied. All other towns in the basin remained on permanent water-saving rules throughout the year.

In 2019–20, 27,946 ML of water was diverted from the Loddon basin for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 28,589 ML diverted in the previous year.

6.8.2.1 Water for the environment

Environmental watering sites 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 2019–20, 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 11,428 ML of environmental water was used in the Loddon basin in 2019–20: 9,004 ML of this was diverted off-stream, and the remaining 2,424 ML was delivered in-stream. 7,342 ML of the diversion was supplied from the Goulburn system to Lake Meran and Loddon Weir, so it is reported as a diversion from the Goulburn system water balance. Only 1,662 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 2019–20 are shown in Table 6-45.

Table 6-45 Water balance, Loddon basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	98,211	124,501
Volume in storage at end of year	1	107,974	98,211
Change in storage		**9,763**	**(26,290)**
Inflows			
Catchment inflow	2	107,751	58,090
Rainfall on major storages	1	9,973	8,554
Treated wastewater discharged back to river	3	6,440	5,167
Total inflows		**124,165**	**71,811**
Outflows			
Diversions			
Urban diversions		3,030	3,191
Licensed diversions and irrigation diversions from regulated streams		8,542	12,136
Transfer to Goulburn basin (through Loddon supplement)	4	0	0
Licensed diversions from unregulated streams		4,974	4,994
Environmental water diversions		1,662	826
Small catchment dams	5	9,738	7,442
Total diversions		*27,946*	*28,589*
Losses			
Evaporation from major storages	1	23,927	22,383
Net evaporation from small catchment dams	5	6,547	6,145
In-stream infiltration to groundwater, flows to floodplain and evaporation		15,528	13,996
Total losses		*46,002*	*42,524*
Water passed at outlet of basin			
Loddon River outflow to Murray River (Appin South)		35,214	25,270
Wandella Creek at Fairley		20	
Mount Hope Creek at Mitiamo		4,820	1,697
Bullock Creek, Calivil Creek and Nine Mile Creek		399	21
Total water passed at outlet of basin		*40,453*	*26,988*
Total outflows		**114,401**	**98,101**

6.8.3.1 Notes to the water balance

1. Storage

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	54,050	4,608	11,811	10,981	57,829
Hepburn Lagoon	2,424	1,378	735	1,162	617	1,568
Laanecoorie Reservoir	8,000	6,255	1,897	3,436	(1,756)	2,960
Newlyn Reservoir	3,012	2,306	398	695	(292)	1,717
Tullaroop Reservoir	72,950	34,222	2,335	6,824	14,168	43,901
Subtotal	*233,516*	*98,211*	*9,973*	*23,927*	*23,717*	*107,974*
Off-stream storages						
Evansford Reservoir	1,346	1,371	99	241	(411)	818
Sandhurst Reservoir	2,595	2,399	166	249	(136)	2,180
Spring Gully Reservoir	1,680	1,017	196	234	38	1,017
Subtotal	*5,621*	*4,787*	*461*	*724*	*(509)*	*4,015*
Total 2019–20	**239,137**	**102,998**	**10,434**	**24,651**	**23,208**	**111,989**
Total 2018–19	239,137	128,607	8,924	23,226	(11,306)	102,998

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 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	Volume 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]	6,251	1,042	17%	737	305	0	0	5,209	0
Boort	15	15	100%	0	15	0	0	0	0
Bridgewater / Inglewood [2]	0	0	0%	0	0	0	0	0	0
Castlemaine	1,340	109	8%	109	0	0	0	1,231	0
Clunes	23	23	100%	0	23	0	0	0	0
Daylesford	347	347	100%	2	345	0	0	0	0
Dunolly	7	7	100%	0	7	0	0	0	0
Kerang	540	0	0%	0	0	0	0	0	540
Maryborough	451	451	100%	28	423	0	0	0	0
Pyramid Hill [2]	0	0	0%	0	0	0	0	0	0
Waubra	6	6	100%	0	6	0	0	0	0
Wedderburn	16	16	100%	0	16	0	0	0	0
Total 2019–20	**8,996**	**2,016**	**22%**	**876**	**1,140**	**0**	**0**	**6,440**	**540**
Total 2018–19	8,323	2,634	32%	1,343	1,290	0	0	5,167	521

Notes

(1) For the Bendigo treatment plant, 137 ML of 'Volume produced' represents effluent received from New Moon Mine water treatment plant, which is discharged to the Bendigo Creek via the Bendigo treatment plant's discharge point.

(2) The Bridgewater/Inglewood and Pyramid Hill 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 2019–20.

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.

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)	42,614	6,166	5,480	11,646
Registered/licensed commercial and irrigation	17,029	3,572	1,067	4,639
Total 2019–20	**59,642**	**9,737**	**6,547**	**16,284**
Total 2018–19	59,642	7,442	6,145	13,587

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 no net increase in the total entitlement volume from the previous year.**
- ✓ **The total volume diverted (31,259 ML) was within the volume available for the year (66,390 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 2020	Annual entitlement volume (ML) 30 June 2019
Bulk Entitlement (Loddon System – Goulburn-Murray Water) Conversion Order 2005 (1)		
High-reliability water shares – Loddon	21,391	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	*44,484*	*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)	15,896	15,954
Licensed small catchment dams – on-waterway	6,195	6,165
Licensed small catchment dams – off-waterway	10,833	10,808
Total	**83,608**	**83,610**

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 to 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 2019–20, so 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 is 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				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Loddon system – Goulburn-Murray Water					
Water shares – Loddon	3,556	16,634	(10,715)	9,476	4,664
Loddon River – Environmental Reserve (1)	2,702	9,867	179	12,749	10,600
Loddon System – Part Maryborough – Central Highlands Water (2)	760	960	(300)	1,420	541
Loddon System – Coliban Water	383	437	(518)	302	241
Loddon supplement to the Goulburn (3)	-	-	-	0	0
Operating provisions (whole of system) (4)	-	3,188	-	3,188	3,188
Diversion: Loddon system – Goulburn-Murray Water (5)				27,135	19,235
Bullarook system – Goulburn-Murray Water					
Water shares – Bullarook	184	954	0	1,139	690
Bullarook System – Central Highlands Water	1	499	0	500	222
Environmental Entitlement Birch Creek – Bullarook System (6)	100	100	0	200	0
Diversion: Bullarook system – Goulburn-Murray Water (7)				1,839	912

Creswick	-	500	0	500	498
Daylesford – Hepburn Springs	-	916	0	916	556
Evansford-Talbot System-Part Maryborough-Central Highlands Water (2)	-	3,000	0	3,000	1,513
Lexton	-	45	0	45	0
Take and use licences – unregulated surface water	-	15,900	29	15,929	4,974
Licensed small catchment dams	-	17,056	(29)	**17,027**	**3,572**
Total 2019–20	**7,686**	**70,058**	**(11,354)**	**66,390**	**31,259**
Total 2018–19	8,350	67,971	(3,676)	72,645	39,503

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 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; 7,342 ML was taken in 2019–20 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, 1,661 ML of the water taken was diverted off-stream.

(2) The water taken under the Loddon system – Part Maryborough – Central Highlands Water bulk entitlement (541 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 1,513 ML supplied to Maryborough, 541 ML was supplied from the 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 2019–20, there were no transfers from the Loddon system to the Goulburn system under this entitlement.

(4) This reflects 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 (1,597 ML).

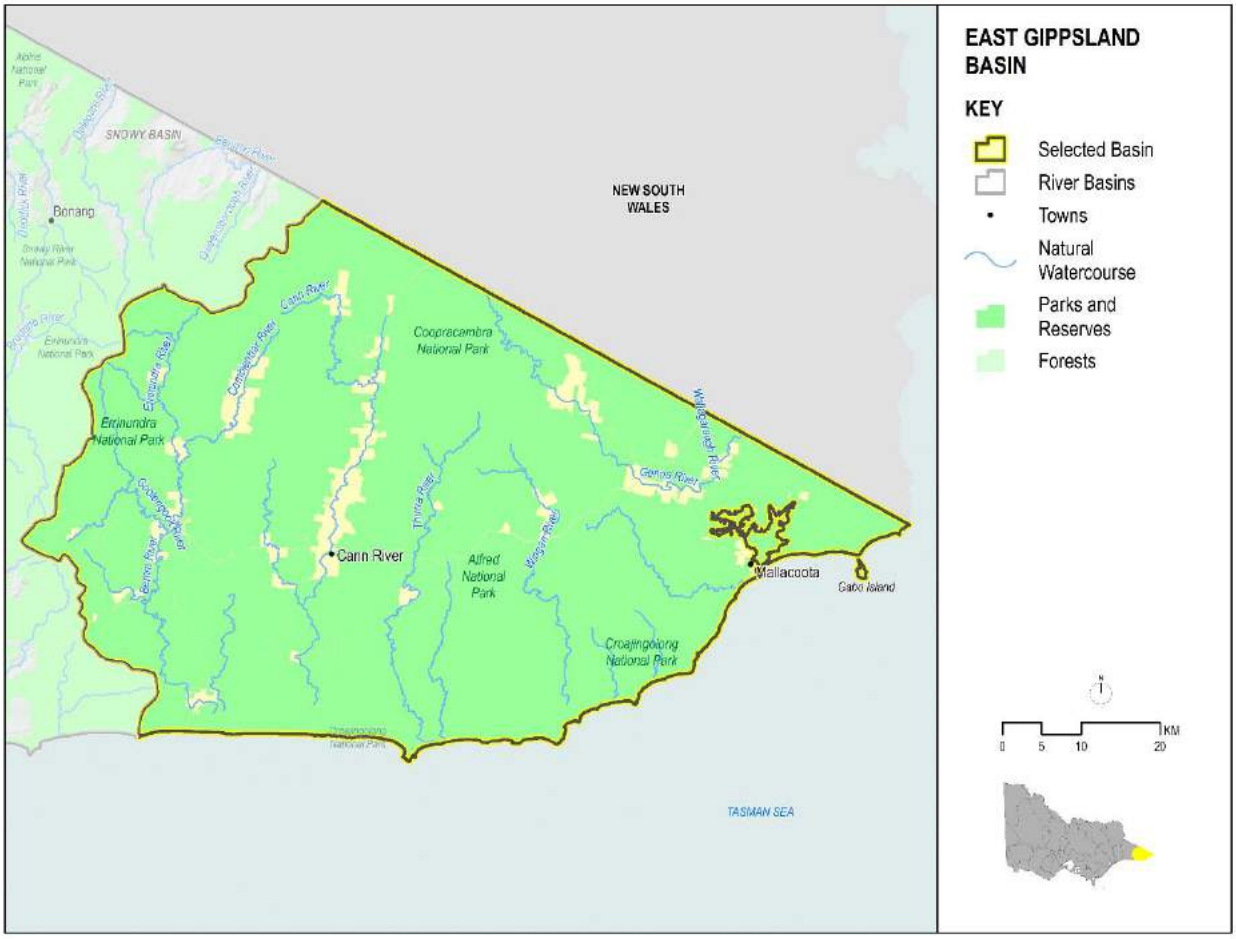
(6) Allocation is only made to this entitlement when high-reliability water shares are greater than 20% in the Bullarook system at the start of December.

(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

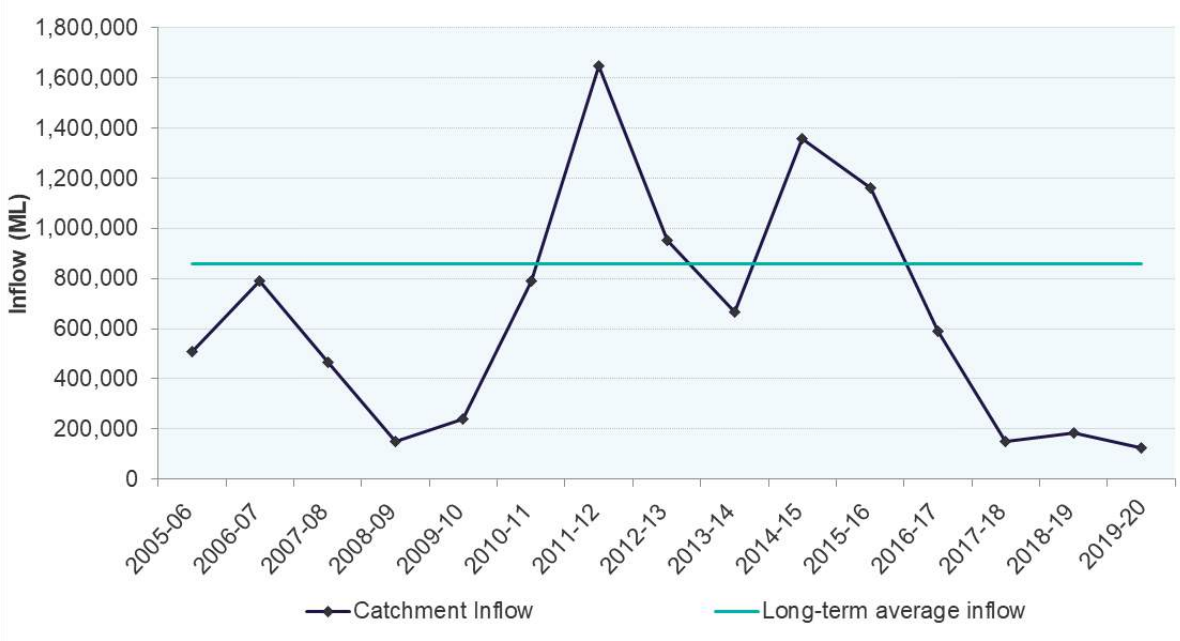
6.9.2 2019–20 water resources overview

In 2019–20, rainfall:

- in the northern half was 40% to 60% of the long-term average
- in the southern half was 60% to 80% of the long-term average.

Catchment inflows to the basin in 2019–20 were 15% of the long-term annual average of 857,700 ML, greater than in 2018–19 when inflows were 21% 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 2019–20.

Figure 6-17 Catchment inflows, East Gippsland basin



The only restriction placed on licensed diversions in the East Gippsland basin during 2019–20 was in March 2020, with a ban implemented for the upstream section of the Cann River East Branch.

There were no restrictions on urban water use in the East Gippsland basin in 2019–20, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2019–20, 361 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 446 ML diverted in the previous year.

6.9.2.1 Water for the environment

Environmental watering sites 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 2019–20, 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 2019–20 are shown in Table 6-52.

Table 6-52 Water balance, East Gippsland basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	-	-
Volume in storage at end of year	1	-	-
Change in storage		**-**	**-**
Inflows			
Catchment inflow	2	125,854	182,905
Rainfall on major storages	1	-	-
Treated wastewater discharged back to river	3	0	0
Total inflows		**125,854**	**182,905**
Outflows			
Diversions			

Urban diversions		86	97
Licensed diversions from unregulated streams		64	64
Small catchment dams	4	211	285
Total diversions		*361*	*446*
Losses			
Evaporation from major storages	1	-	-
Net evaporation from small catchment dams	4	171	165
In-stream infiltration to groundwater, flows to floodplain and evaporation	5	-	-
Total losses		*171*	*165*
Water passed at outlet of basin			
River outflows to the ocean		125,322	182,294
Total water passed at outlet of basin		*125,322*	*182,294*
Total outflows		**125,854**	**182,905**

6.9.3.1 Notes to the water balance

1. Storage

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 2019–20, 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	Volume 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	7	7	100%	0	7	0	0	0	0
Cann River	14	14	100%	0	14	0	0	0	0
Mallacoota	9	9	100%	0	9	0	0	0	0
Total 2019–20	**30**	**30**	**100%**	**0**	**30**	**0**	**0**	**0**	**0**
Total 2018–19	91	91	100%	0	91	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 6-54 provides information about small catchment dams in the basin.

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	182	159	341
Registered/licensed commercial and irrigation	176	29	12	41
Total 2019–20	**1,271**	**211**	**171**	**382**
Total 2018–19	1,271	285	165	450

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 6.1.6.3 for details.

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 (179 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 2020	Annual entitlement volume (ML) 30 June 2019
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.

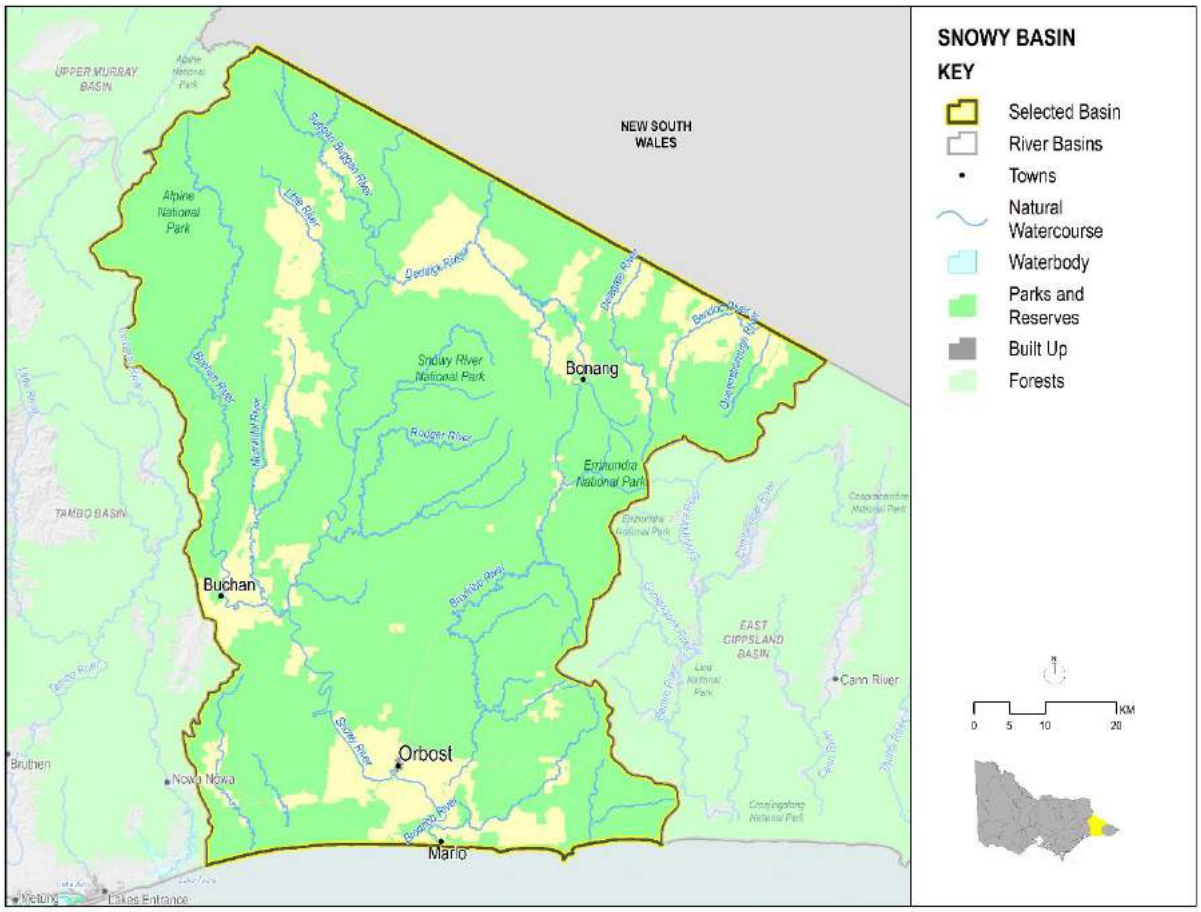
Table 6-56 Available water and take, East Gippsland basin

Water entitlement	Available water				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Bemm River	-	100	0	100	19
Cann River	-	192	0	192	40
Mallacoota	-	330	0	330	26
Take and use licences – unregulated surface water	-	657	0	657	64
Licensed small catchment dams	-	176	0	176	29
Total 2019–20	**-**	**1,455**	**0**	**1,455**	**179**
Total 2018–19	-	1,455	0	1,455	200

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

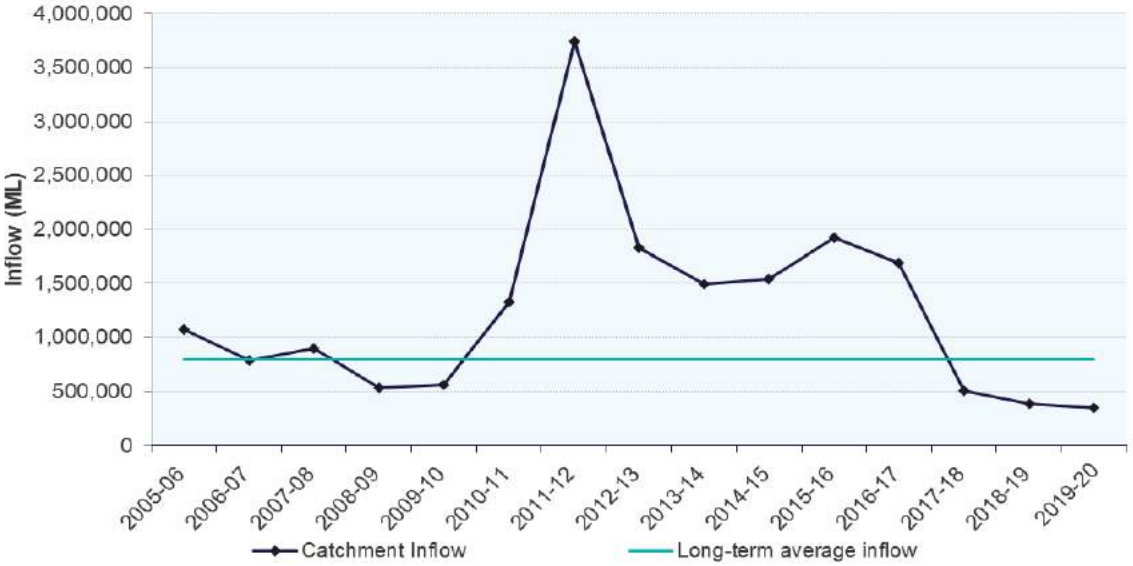
6.10.2 2019–20 water resources overview

In 2019–20, rainfall:

- in the north-east of the basin was 40% to 60% of the long-term average
- in the rest of the basin was 60% to 80% of the long-term average.

Catchment inflows to the basin in 2019–20 were 43% of the long-term annual average of 795,600 ML, greater than in 2018–19 when inflows were 49% of the long-term average.

Figure 6-19 Catchment inflows, Snowy basin



The Jarrahmond section of the Snowy River and the Buchan River were both unrestricted for the entirety of 2019–20.

In 2019–20, water restrictions were in place in one town in the Snowy basin: Buchan. It was on stage 2 restrictions from January to March 2020 and stage 1 restrictions from April to the end of June, when restrictions were lifted. All other towns in the basin remained on permanent water-saving rules throughout the year.

In 2019–20, 2,754 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 3,151 ML diverted in the previous year.

6.10.2.1 Water for the environment

Environmental watering sites 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 2019–20, 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 118,300 ML of environmental water was delivered from the Snowy Mountains Hydro-Electric Scheme to the Snowy River between 1 April 2019 and 31 May 2020: the 2019–20 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 109,300 ML of water recovered as part of the Snowy Water Inquiry.

6.10.3 Water balance

The total volumes of water available and supplied from water resources in the Snowy basin in 2019–20 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	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	-	-
Volume in storage at end of year	1	-	-
Change in storage		**-**	**-**
Inflows			
Catchment inflow from Victoria	2	343,275	388,996
Catchment inflow from New South Wales	2	133,832	163,425
Rainfall on major storages	1	-	-
Treated wastewater discharged back to river	3	0	0
Total inflows		**477,107**	**552,421**
Outflows			
Diversions			
Urban diversions		717	755
Licensed diversions from unregulated streams		1,254	1,433
Small catchment dams	4	783	963
Total diversions		*2,754*	*3,151*
Losses			
Evaporation from major storages	1	-	-
Net evaporation from small catchment dams	4	916	896
In-stream infiltration to groundwater, flows to floodplain and evaporation	5	-	-
Total losses		*916*	*896*
Water passed at outlet of basin			
River outflows to the ocean		473,437	548,373
Total water passed at outlet of basin		*473,437*	*548,373*
Total outflows		**477,107**	**552,421**

6.10.3.1 Notes to the water balance

1. Storage

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 2019–20 there were no such discharges into the Snowy basin's waterways. In 2019–20, 100% of 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	Volume 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		
Orbost	231	231	100%	0	231	0	0	0	0
Total 2019–20	**231**	**231**	**100%**	**0**	**231**	**0**	**0**	**0**	**0**
Total 2018–19	174	174	100%	0	174	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	539	800	1,338
Registered/licensed commercial and irrigation	1,590	245	116	361
Total 2019–20	**4,430**	**784**	**915**	**1,700**
Total 2018–19	4,430	963	896	1,859

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 6.1.6.3).

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 (2,216 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 2020	Annual entitlement volume (ML) 30 June 2019
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.

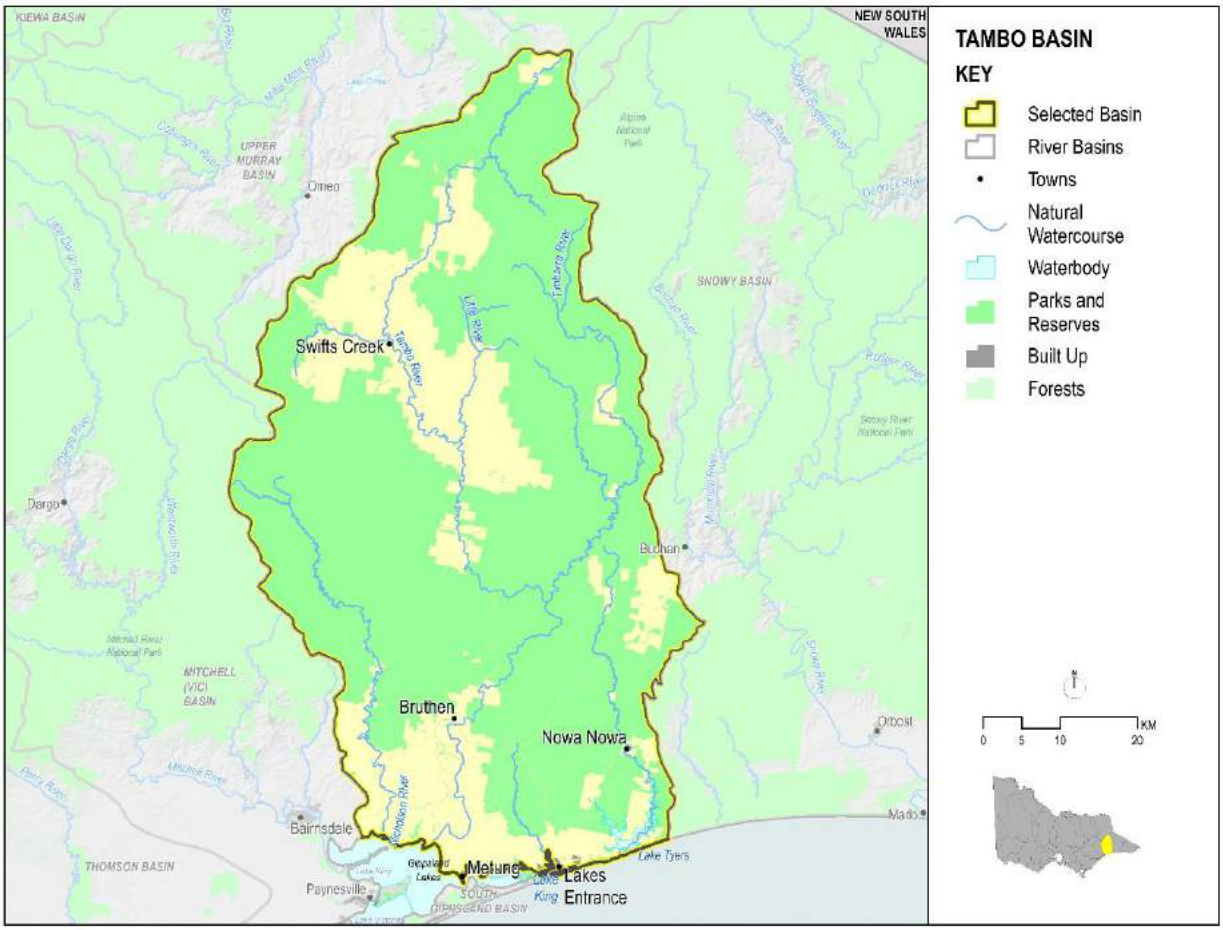
Table 6-62 Available water and take, Snowy basin

Water entitlement	Available water				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Buchan	-	170	0	170	17
Orbost System	-	2,031	0	2,031	700
Take and use licences – unregulated surface water	-	3,919	(5)	3,914	1,254
Licensed small catchment dams	-	1,590	5	1,595	245
Total 2019–20	**-**	**7,710**	**0**	**7,710**	**2,216**
Total 2018–19	-	7,710	0	7,710	2,502

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 2019–20 water resources overview

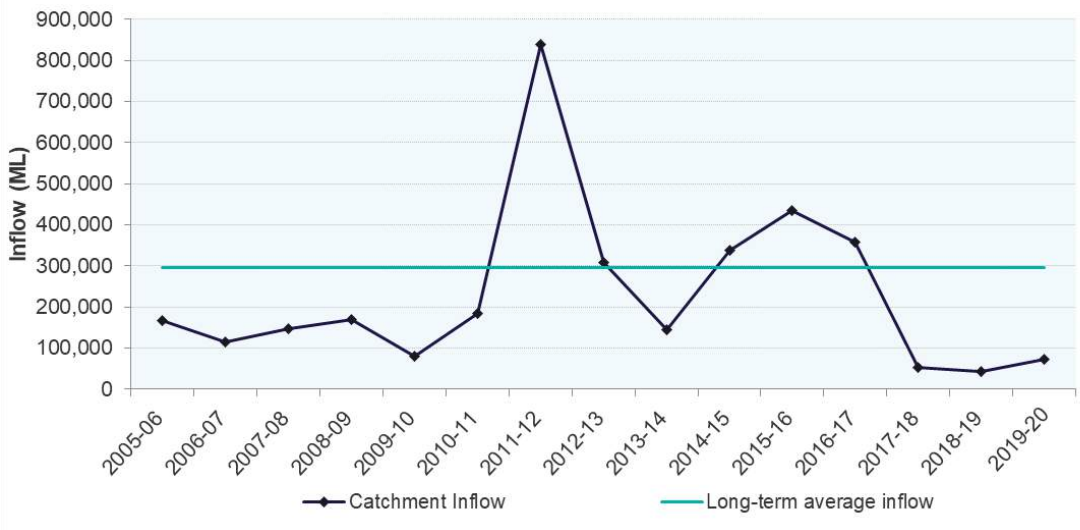
In 2019–20, rainfall:

- in most of the basin was 60% to 80% of the long-term average
- along the Murray basin border was 80% to 100% of the long-term average.

Catchment inflows to the basin in 2019–20 were 24% of the long-term average annual volume of 297,200 ML, greater than in 2018–19 when inflows were 15% 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 97% of the basin inflows passed through to the Gippsland Lakes in 2019–20.

Figure 6-21 Catchment inflows, Tambo basin



There were no restrictions on licensed diversions from unregulated streams in the Tambo basin from July 2019 to January 2020. Total bans on licensed diversions were placed on the Tambo River from February 2020 and were lifted at the end of April 2020. Licensed diversions from the Tambo River downstream of Ramrod Creek were unrestricted for the entirety of 2019–20.

In 2019–20, water restrictions were in place in ten towns in the Tambo basin which are supplied by water from the Mitchell basin. Stage 2 restrictions were in place from January to March 2020 and stage 1 restrictions from April to the end of June 2020 when restrictions were lifted. Swifts Creek, the only town in the basin supplied by the Tambo system, was on permanent water-saving rules throughout the year.

In 2019–20, 1,339 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 1,710 ML diverted in the previous year.

6.11.2.1 Water for the environment

Environmental watering sites 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 2019–20, 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 2019–20 are shown in Table 6-64.

Table 6-64 Water balance, Tambo basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	-	-
Volume in storage at end of year	1	-	-
Change in storage		**-**	**-**
Inflows			
Catchment inflow	2	72,072	43,687
Rainfall on major storages	1	-	-
Treated wastewater discharged back to river	3	0	0
Total inflows		**72,072**	**43,687**
Outflows			
Diversions			
Urban diversions		24	29
Licensed diversions from unregulated streams		573	900
Small catchment dams	4	742	781
Total diversions		*1,339*	*1,710*
Losses			
Evaporation from major storages	1	-	-
Net evaporation from small catchment dams	4	840	929
In-stream infiltration to groundwater, flows to floodplain and evaporation	5	-	-
Total losses		*840*	*929*
Water passed at outlet of basin			
River outflows to the ocean		69,893	41,048
Total water passed at outlet of basin		*69,893*	*41,048*
Total outflows		**72,072**	**43,687**

6.11.3.1 Notes to the water balance

1. Storage

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 2019–20 there were no such discharges into the Tambo basin's waterways. In 2019–20, 100% of 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	Volume 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		
Lakes Entrance	645	645	100%	0	645	0	0	0	0
Metung	94	94	100%	0	94	0	0	0	0
Total 2019–20	**739**	**739**	**100%**	**0**	**739**	**0**	**0**	**0**	**0**
Total 2018–19	801	801	100%	0	801	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	617	788	1,405
Registered/licensed commercial and irrigation	1,357	124	52	177
Total 2019–20	**6,289**	**741**	**840**	**1,581**
Total 2018–19	6,289	781	929	1,710

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 6.1.6.3).

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 (722 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 2020	Annual entitlement volume (ML) 30 June 2019
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	4,043	4,043
Licensed small catchment dams – on-waterway	106	106
Licensed small catchment dams – off-waterway	1,251	1,251
Total	**5,741**	**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				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Nowa Nowa (1)	-	118	0	118	0
Swifts Creek	-	224	0	224	24
Take and use licences – unregulated surface water	-	4,043	0	4,043	573
Licensed small catchment dams	-	1,357	0	1,357	125
Total 2019–20	**-**	**5,741**	**0**	**5,741**	**722**
Total 2018–19	-	5,744	0	5,744	1,064

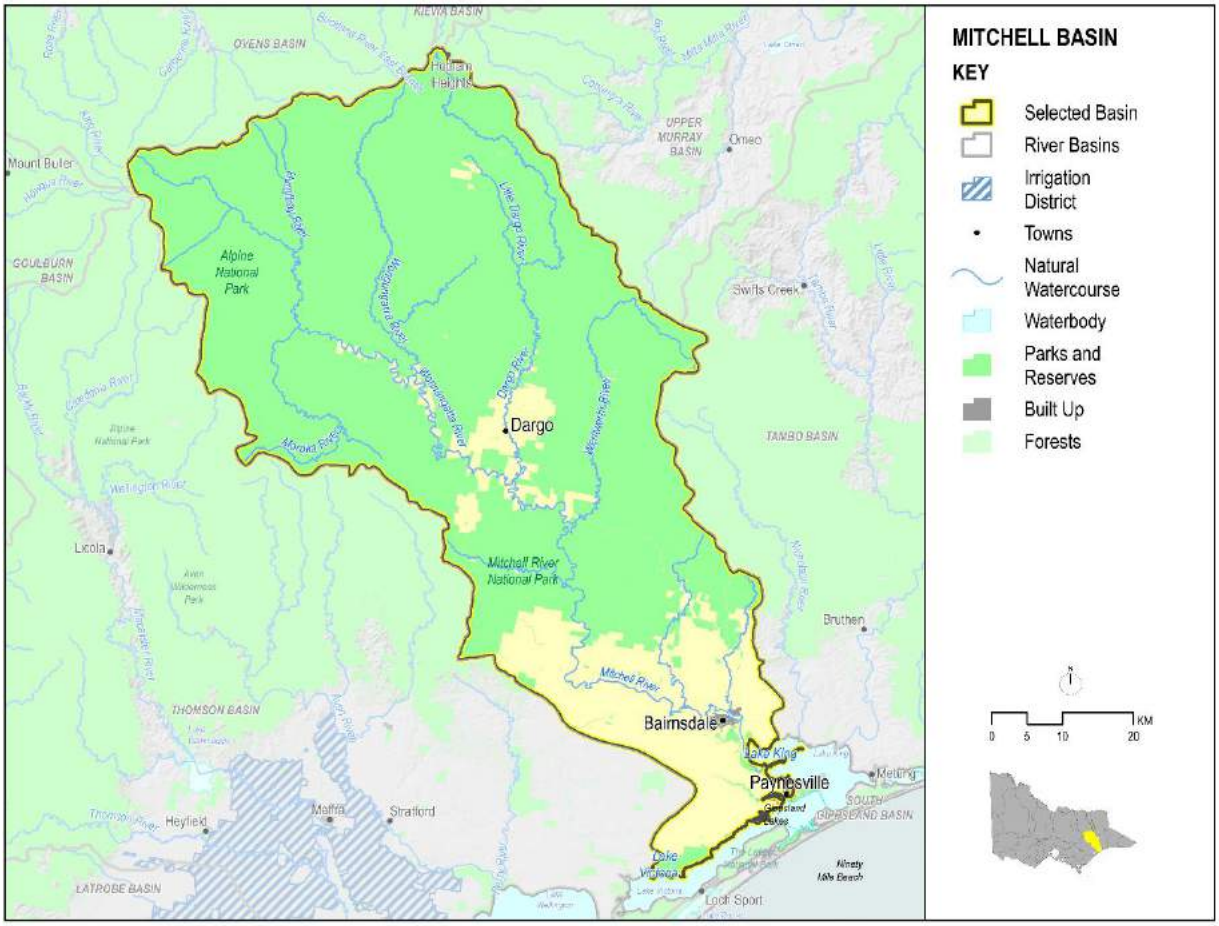
Note

(1) No water was taken under the Nowa Nowa bulk entitlement in 2019–20 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 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

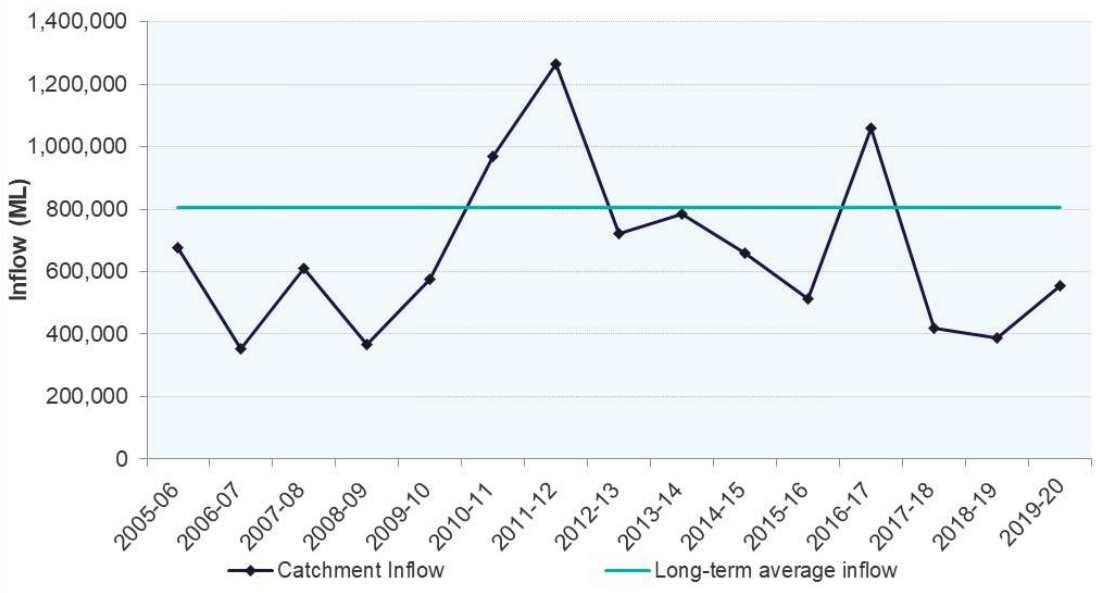
6.12.2 2019–20 water resources overview

In 2019–20, rainfall:

- along the northern border with the Tambo and Murray basins was 60% to 80% of the long-term average
- in the rest of the basin was 80% to 100% of the long-term average.

Catchment inflows to the basin in 2019–20 were 69% of the long-term average of 804,100 ML, greater than in 2018–19 when inflows were 48% of the long-term average. Consumptive use in the basin is low, compared to the total water resource. About 97% of the total inflows were not diverted and flowed through to the Gippsland Lakes.

Figure 6-23 Catchment inflows, Mitchell basin



Unregulated streams within the Mitchell basin remained unrestricted for the whole of 2019–20.

In 2019–20, water restrictions were in place in nine towns in the Mitchell basin. Stage 2 restrictions were in place from January to March 2020 and stage 1 restrictions from April end June 2020 when restrictions were lifted. All other towns were on permanent water-saving rules throughout the year.

In 2019–20, 17,829 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was about the same as the volume diverted in the previous year (17,899 ML).

6.12.2.1 Water for the environment

Environmental watering sites 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 2019–20, 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 2019–20 are shown in Table 6-70.

Table 6-70 Water balance, Mitchell basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	-	-
Volume in storage at end of year	1	-	-
Change in storage		**-**	**-**
Inflows			
Catchment inflow	2	554,446	385,870
Rainfall on major storages	1	-	-
Treated wastewater discharged back to river	3	75	65
Total inflows		**554,522**	**385,935**

Outflows			
Diversions			
Urban diversions		4,438	4,654
Licensed diversions from unregulated streams		12,782	12,746
Small catchment dams	4	609	499
Total diversions		*17,829*	17,899
Losses			
Evaporation from major storages	1	-	-
Net evaporation from small catchment dams	4	608	576
In-stream infiltration to groundwater, flows to floodplain and evaporation		648	1,399
Total losses		*1,256*	1,976
Water passed at outlet of basin			
River outflows to the Gippsland Lakes		535,437	366,060
Total water passed at outlet of basin		*535,437*	366,060
Total outflows		**554,522**	**385,935**

6.12.3.1 Notes to the water balance

1. Storage

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 2019–20 there were no such discharges.

Water for Mount Hotham Alpine Resort is sourced from Swindlers Creek, which is in the upper Murray basin. In 2019–20, 75 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.

Table 6-71 Volume and use of recycled water, Mitchell basin

Wastewater treatment plant	Volume 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	1,154	1,154	100%	0	91	1,063	0	0	0
Lindenow	9	9	100%	0	0	9	0	0	0
Paynesville	161	161	100%	0	161	0	0	0	0
Total 2019–20	**1,324**	**1,324**	**100%**	**0**	**252**	**1,072**	**0**	**0**	**0**
Total 2018–19	1,349	1,349	100%	0	210	1,138	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	395	515	911
Registered/licensed commercial and irrigation	2,912	213	93	306
Total 2019–20	**6,869**	**608**	**609**	**1,217**
Total 2018–19	6,869	499	576	1,076

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 no net increase in the total entitlement volume from the previous year.**
- ✓ **The total volume diverted (17,432 ML) was within the volume available for the year (28,671 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 2020	Annual entitlement volume (ML) 30 June 2019
Bulk Entitlement (Bairnsdale) Conversion Order 2000	9,208	9,208
Take and use licences – unregulated surface water	16,238	16,238
Licensed small catchment dams – on-waterway	147	147
Licensed small catchment dams – off-waterway	2,766	2,766
Total	**28,358**	**28,358**

Table 6-74 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

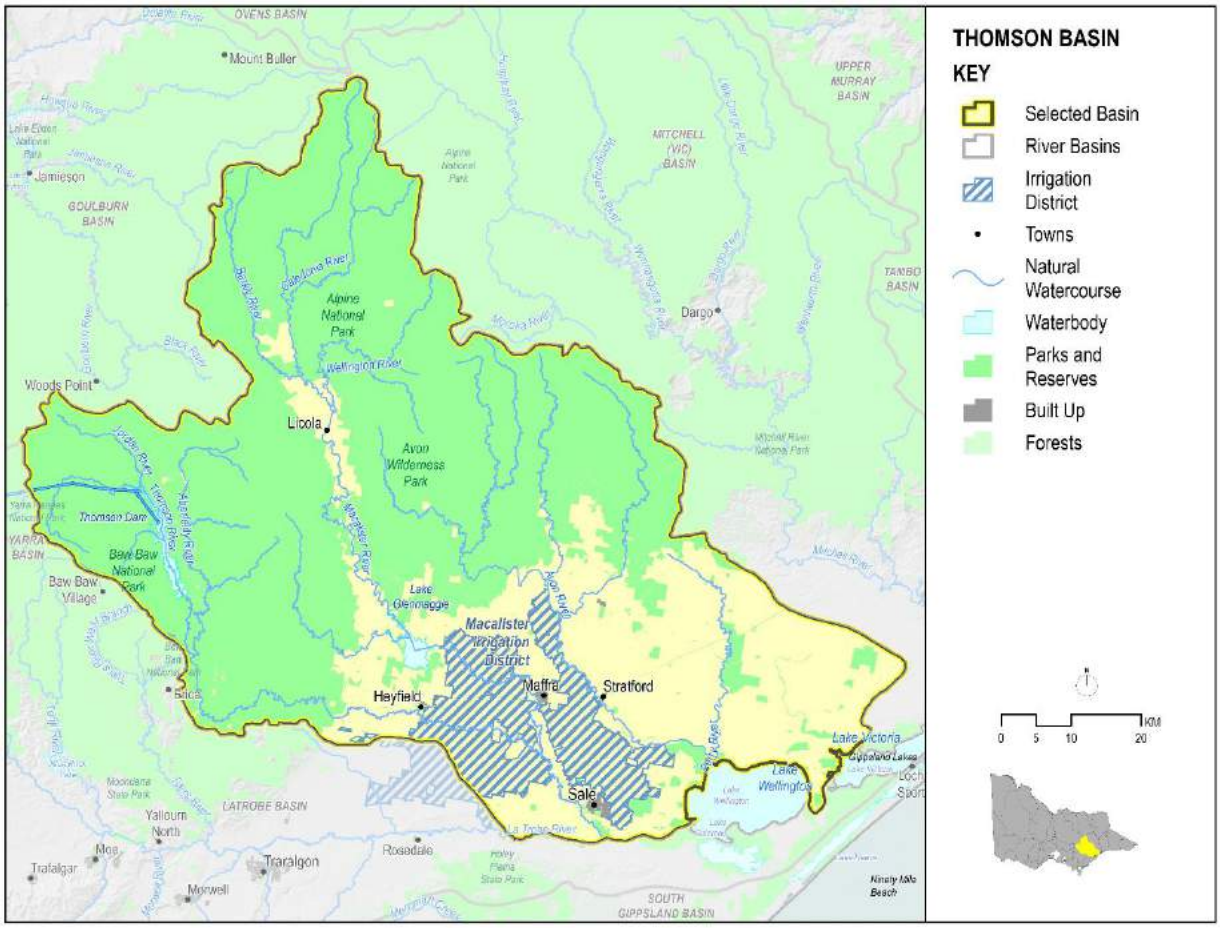
Table 6-74 Available water and take, Mitchell basin

Water entitlement	Available water				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Bairnsdale	-	9,208	0	9,208	4,438
Take and use licences – unregulated surface water	-	16,238	0	16,238	12,782
Licensed small catchment dams	-	2,912	0	2,912	213
Total 2019–20	**-**	**28,358**	**0**	**28,358**	**17,432**
Total 2018–19	-	28,402	0	28,402	17,577

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 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 2019–20 Water resources overview

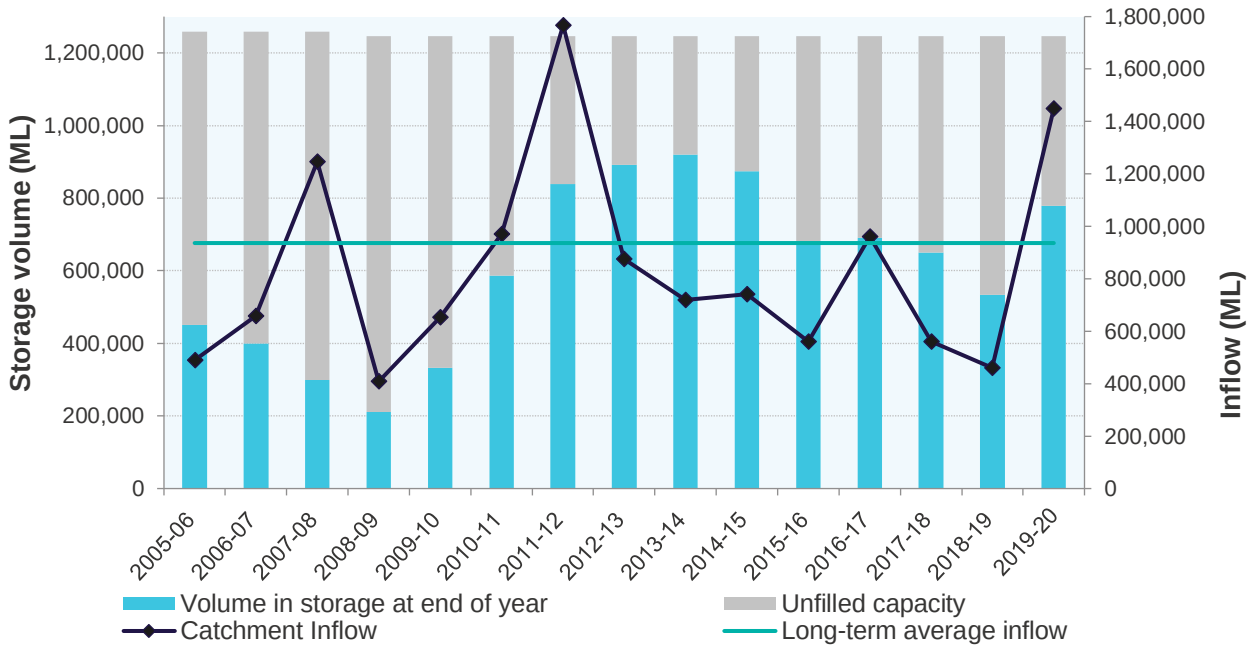
In 2019–20, rainfall:

- in the eastern half of the basin was 80% to 100% of the long-term average
- in the western half was 100% to 125% of the long-term average.

Catchment inflows to the basin in 2019–20 were 155% of the long-term average of 936,400 ML, greater than in 2018–19 when inflows were 49% of the long-term average.

Major storages in the basin were at 43% of capacity on 1 July 2019 and higher (at 63% of capacity) on 30 June 2020.

Figure 6-25 Storage volumes and catchment inflows, Thomson basin



In 2019–20, the first seasonal determination for the Macalister Irrigation District for high-reliability water shares was announced on 4 July 2019 at 45% and increased to 100% by September 2019. A seasonal determination for low-reliability water shares was announced at 20% in January 2020 and reached a final low-reliability determination of 35% by February 2020.

There were rosters in place on both sections of the Avon River from September to December 2019, ranging from stage 1 to stage 3. Licensed diversions were unrestricted for the remainder of the year on the Avon River. Licensed diversions from Valencia Creek were banned from August to December 2019 and were on a stage 1 roster from March to end of June 2020.

In 2019–20, water restrictions were in place in one town in the Thomson basin: Briagolong. Stage 2 restrictions were in place in Briagolong from January to the end of February 2020, when restrictions were lifted and permanent water-saving rules applied. All other towns were on permanent water-saving rules throughout the year.

In 2019–20, 223,017 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 420,406 ML diverted in the previous year.

6.13.2.1 Water for the environment

Environmental watering sites 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 2019–20, 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, 8,000 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 2019–20, a total of 31,979 ML of environmental water was delivered in-stream and 15 ML of environmental water was diverted to Heyfield Wetlands 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 2019–20 are shown in Table 6-76.

Table 6-76 Water balance, Thomson basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	534,357	650,555
Volume in storage at end of year	1	779,170	534,357
Change in storage		**244,813**	**(116,198)**
Inflows			
Catchment inflow	2	1,450,093	461,302
Rainfall on major storages	1	25,898	18,647
Return flow from irrigation		3,866	1,184
Treated wastewater discharged back to river	3	39	28
Total inflows		**1,479,896**	**481,161**
Outflows			
Diversions			
Urban diversions		1,443	1,614
Transfers to Yarra River basin for urban use		36,045	198,850
Irrigation district diversions		160,162	191,057
Licensed diversions from regulated streams	4	19,687	24,954
Licensed diversions from unregulated streams		4,974	3,596
Environmental water diversions		15	0
Small catchment dams	5	691	335
Total diversions		*223,017*	*420,406*
Losses			
Evaporation from major storages	1	36,377	37,467
Net evaporation from small catchment dams	5	594	415
In-stream infiltration to groundwater, flows to floodplain and evaporation		14,489	10,695
Total losses		*51,460*	*48,577*
Water passed at outlet of basin			
River outflows to Latrobe River		184,134	106,794
River outflows to Lake Wellington		776,472	21,583
Total water passed at outlet of basin		*960,606*	*128,377*
Total outflows		**1,235,083**	**597,359**

6.13.3.1 Notes to the water balance

1. Storage

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. The 2018–19 rainfall and evaporation volumes for Lake Glenmaggie have been corrected from the previous accounts.

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	42,355	9,205	20,926	109,657	140,291
Thomson Reservoir [1]	1,068,000	492,002	16,693	15,451	145,635	638,879
Total 2019–20	**1,245,640**	**534,357**	**25,898**	**36,377**	**255,292**	**779,170**
Total 2018–19	1,245,640	650,555	18,647	37,467	(97,378)	534,357

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 2018–19 catchment inflow volume has been corrected from the previous accounts. An error was made with the storage and regulated diversion volumes, 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, 8.8 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	Volume 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	22	22	100%	0	22	0	0	0	0
Maffra	151	151	100%	0	151	0	0	0	0
Rawson	30	0	0%	0	0	0	0	30	0
Sale	875	875	100%	0	875	0	0	0	0
Stratford	71	71	100%	0	71	0	0	0	0
Total 2019–20	**1,149**	**1,119**	**97%**	**0**	**1,119**	**0**	**0**	**30**	**0**
Total 2018–19	1,327	1,300	98%	0	1,300	0	0	27	0

4. Licensed diversions from regulated streams

The volume of diversions from unregulated streams reported in the *Victorian Water Accounts 2018–19* has been amended: it was not correct.

5. 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	502	537	1,038
Registered/licensed commercial and irrigation	3,175	190	57	247
Total 2019–20	**8,572**	**691**	**594**	**1,285**
Total 2018–19	8,572	335	415	749

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 a 54 ML increase in the total entitlement volume from the previous year:**

- **20 ML of high-reliability water share and 34 ML of low-reliability water share was issued for audited water savings.**

✓ **The total volume diverted (250,628 ML) was within the volume available for the year (521,397 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 2020	Annual entitlement volume (ML) 30 June 2019
Bulk Entitlement (Thomson Macalister – Southern Rural Water) Conversion Order 2001 (1)		
High-reliability water shares	155,839	155,819
Low-reliability water shares	74,639	74,605
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	*251,503*	*251,449*
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**	**453,632**

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				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Thomson Macalister – Southern Rural Water [1]					
Water shares [2]	-	232,051	20	232,071	140,407
Thomson Macalister Towns – Gippsland Water	-	2,335	(20)	2,315	1,443
Macalister River Environmental Entitlement 2010 [3]	7,290	18,690	0	25,980	18,333
Operating provisions [4]	-	35,576	-	35,576	35,576
Net diversion: Thomson Macalister – Southern Rural Water [5]				*295,942*	*195,759*
Thomson River – Melbourne Water [1]	-	171,800	0	171,800	36,045
Thomson River – Environment [3]	13,030	20,242	0	33,272	13,661
Take and use licences – unregulated surface water	-	17,207	0	17,207	4,974
Licensed small catchment dams	-	3,175	0	3,175	190
Total 2019–20	**20,320**	**501,077**	**0**	**521,397**	**250,628**
Total 2018–19	16,337	453,383	0	469,720	452,370

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 1,574 ML of spill allocation made available to water shares holders in 2019–20.

(3) The water use reported reflects environmental use, 15 ML of the use under the Thomson River – Environment entitlement was diverted off-stream to the Heyfield wetlands, the remainder was in-stream 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). Allocation and use under the Thomson River – Environment Entitlement included 739 ML allocated and used under the passing flows component of the entitlement.

(4) This reflects 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 18,333 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 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 2019–20 water resources overview

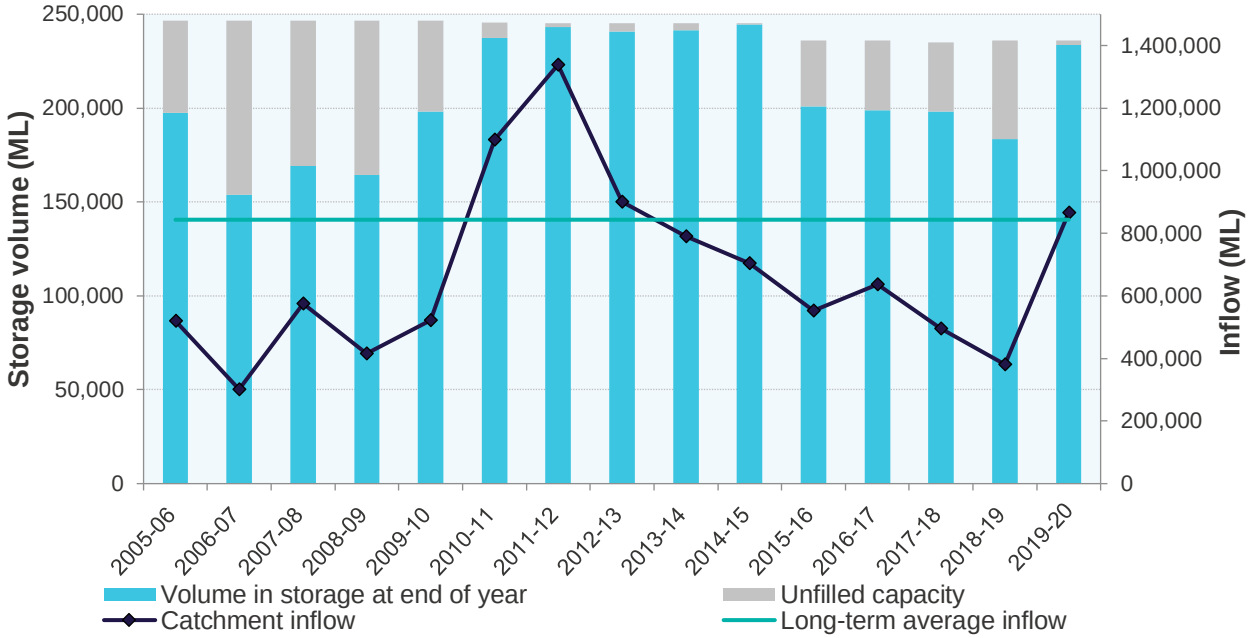
In 2019–20, rainfall:

- in the east arm of the basin extending to the Gippsland Lakes was 80% to 100% of the long-term average
- in the south-west was 125% to 150% of the long-term average
- in the rest of the basin was 100% to 125% of the long-term average.

Catchment inflows to the basin in 2019–20 were 103% of the long-term average of 843,300 ML, greater than in 2018–19 when inflows were 45% of the long-term average.

Major storages in the basin were at 78% of capacity on 1 July 2019 and higher (at 99% of capacity) on 30 June 2020.

Figure 6-27 Storage volumes and catchment inflows, Latrobe basin



In 2019–20, licensed diversions from all streams were unrestricted for the entire year in the Latrobe basin.

There were no restrictions on urban water use in the Latrobe basin in 2019–20, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2019–20, 122,226 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was similar to the 122,451 ML diverted in the previous year.

6.14.2.1 Water for the environment

Environmental watering sites 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 2019–20, 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 2019–20, 2,702 ML of environmental water was delivered in-stream in the Latrobe basin. Water was also diverted to inundate Sale Common, Heart Morass and Dowd Morass, but the volumes delivered to these wetlands are not measured, so a volume is not available.

6.14.3 Water balance

The total volumes of water available and supplied from water resources in the Latrobe basin in 2019–20 are shown in Table 6-83.

Table 6-83 Water balance, Latrobe basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	183,451	198,154
Volume in storage at end of year	1	233,567	183,451
Change in storage		**50,116**	**(14,703)**
Inflows			
Catchment inflow	2	866,562	379,938
Rainfall on major storages	1	12,802	7,087
Inflow from groundwater	3	13,954	15,102
Return flow from power stations and major industry	3	39,661	32,656
Treated wastewater discharged back to river	4	4,673	3,496
Total inflows		**937,652**	**438,279**
Outflows			
Diversions			
Urban and industrial diversions	3	100,647	101,196
Licensed diversions from regulated streams		6,377	13,556
Licensed diversions from unregulated streams		782	1,550
Small catchment dams	5	14,420	6,149
Total diversions		*122,226*	*122,451*
Losses			
Evaporation from major storages	1	14,636	19,442
Net evaporation from small catchment dams	5	337	2,587
In-stream infiltration to groundwater, flows to floodplain and evaporation	6	-	-
Total losses		*14,973*	*22,028*
Water passed at outlet of basin			
River outflows to the Gippsland Lakes (excluding Thomson River)		750,337	308,503
Total water passed at outlet of basin		*750,337*	*308,503*
Total outflows		**887,536**	**452,982**

6.14.3.1 Notes to the water balance

1. Storage

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. The 2018–19 rainfall and evaporation volumes for Blue Rock Lake and Lake Narracan have been corrected from the previous accounts.

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	152,128	8,276	9,036	46,969	198,337
Lake Narracan	7,230	6,348	2,324	3,091	(809)	4,772
Moondarra Reservoir	30,458	24,975	2,202	2,509	5,790	30,458
Total 2019–20	**235,968**	**183,451**	**12,802**	**14,636**	**51,950**	**233,567**
Total 2018–19	235,968	198,154	7,087	19,442	(2,348)	183,451

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 2018–19 catchment inflow volume has been corrected from the previous accounts. An error was made with the rainfall, evaporation and inflow from groundwater volumes, which in turn caused an error in the catchment inflow amount.

3. Other inflows

13,954 ML of water (originating mostly from groundwater) was transferred into the waterway from an industrial site. This volume was erroneously excluded from the *Victorian Water Accounts 2018–19* and the 2018–19 volume has been corrected for the oversight.

Large volumes of water in the Latrobe basin are diverted for power generation and major industrial uses. In 2019–20, 63,354 ML was diverted for power generation, and 21,945 ML of this was returned to the waterway. In addition to power generation, a major industrial user diverted 23,709 ML, returning 17,716 ML to the waterways.

The use of water by other smaller industrial users of water will be included in the remaining urban diversion volume (13,584 ML).

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	Volume 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		
Mirboo North	39	39	100%	13	26	0	0	0	0
Moe	2,566	0	0%	0	0	0	0	2,566	0
Morwell	722	722	100%	0	0	722	0	0	0
Dutson Downs (regional outfall sewer)	9,340	0	0%	0	0	0	0	0	9,340
Saline wastewater outfall pipeline	10,364	0	0%	0	0	0	0	0	10,364
Warragul	2,107	0	0%	0	0	0	0	2,107	0
Willow Grove	13	13	100%	0	13	0	0	0	0
Total 2019–20	**25,151**	**774**	**3%**	**13**	**39**	**722**	**0**	**4,673**	**19,704**
Total 2018–19	22,219	675	3%	57	72	546	0	3,496	18,048

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)	15,392	6,340	421	6,761
Registered/licensed commercial and irrigation	16,117	8,080	(84)	7,996
Total 2019–20	**31,509**	**14,420**	**337**	**14,757**
Total 2018–19	31,509	6,149	2,587	8,736

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 6.1.6.3).

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 (118,588 ML) was within the volume available for the year (267,160 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 2020	Annual entitlement volume (ML) 30 June 2019
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)	12,993	12,967
Licensed small catchment dams – on-waterway	10,875	10,905
Licensed small catchment dams – off-waterway	5,242	5,242
Total	**250,802**	**250,806**

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 11,216 ML of take and use entitlement volume at 30 June 2020.

(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 mode for Thorpdale.

(6) The Latrobe Reserve consists of a 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				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Blue Rock Environmental Entitlement (1)	9,260	12,187	0	21,447	2,702
Boolarra	-	145	0	145	0
Gippsland Water – Blue Rock (2)	-	15,150	(310)	14,840	933
Erica	-	340	0	340	71
Latrobe – Southern Rural Water (3)	-	13,196	510	13,706	6,377
Lower Latrobe Wetlands Environmental Entitlement (4)	-	-	-	-	-
Mirboo North	-	270	0	270	176
Moe – Narracan Creek	-	3,884	0	3,884	2,857
Moondarra Reservoir	-	62,000	0	62,000	33,256
Noojee (5)	-	73	0	73	0
Thorpdale	-	80	0	80	0
Latrobe – Loy Yang B (2)	-	20,000	0	20,000	16,475
Latrobe – Loy Yang A (2)	-	40,000	0	40,000	21,395
Latrobe – Loy Lang 3/4 Bench (2)	-	25,000	0	25,000	0
Latrobe – Yallourn (2)	-	36,500	0	36,500	25,484
Latrobe Reserve (6)	-	0	0	0	0
Take and use licences – unregulated surface water	-	12,823	(170)	12,653	782
Licensed small catchment dams	-	16,252	(30)	16,222	8,080
Total 2019–20	**9,260**	**257,900**	**0**	**267,160**	**118,588**
Total 2018–19	11,670	265,212	0	276,882	138,678

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 2019–20, water under this entitlement was used to inundate Sale Common, Heart Morass and Dowd Morass. Volumes delivered in the wetlands are not measured.

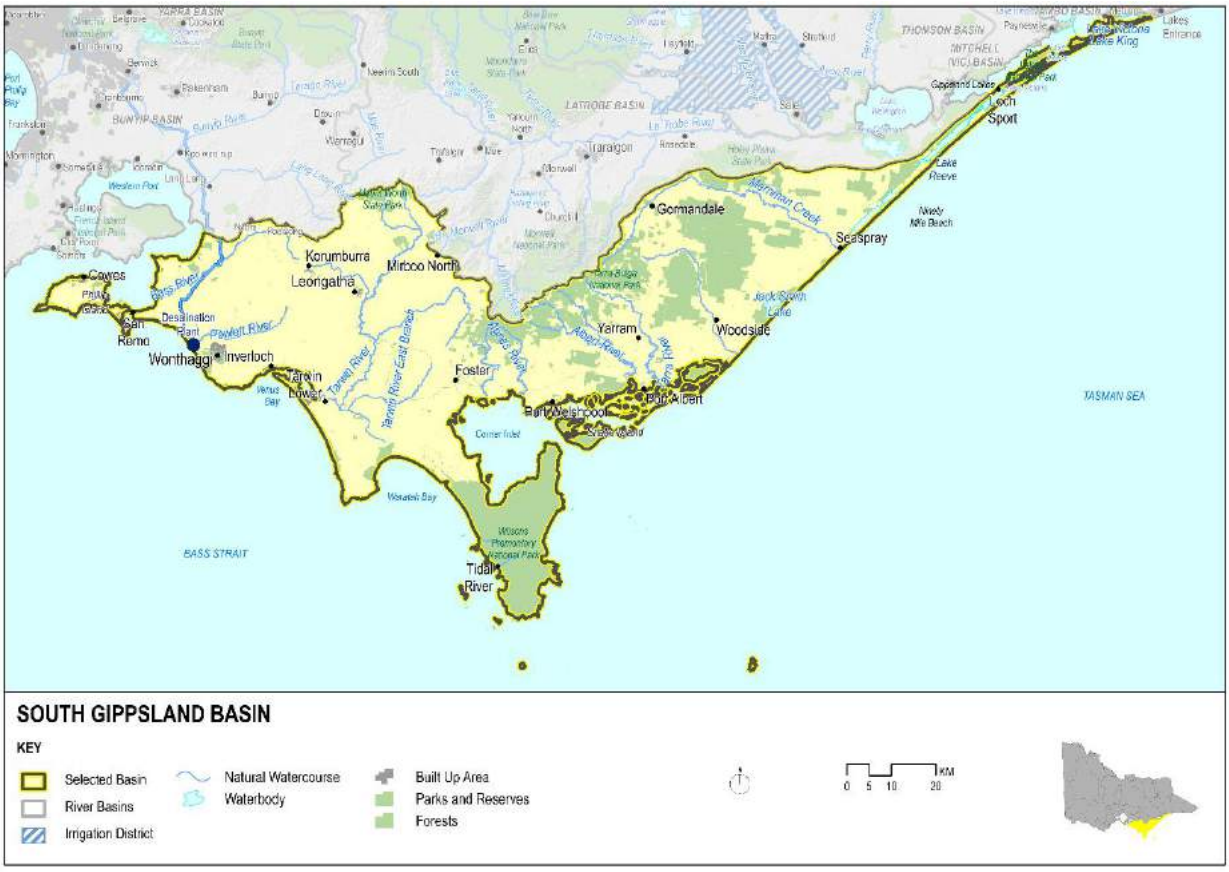
(5) Gippsland Water is not taking water from the Loch River under its Noojee bulk entitlement, and instead it supplies Noojee from Tarago Reservoir in the Bunyip basin.

(6) There was no trade of water in 2019–20 from the Latrobe 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 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 2019–20 water resources overview

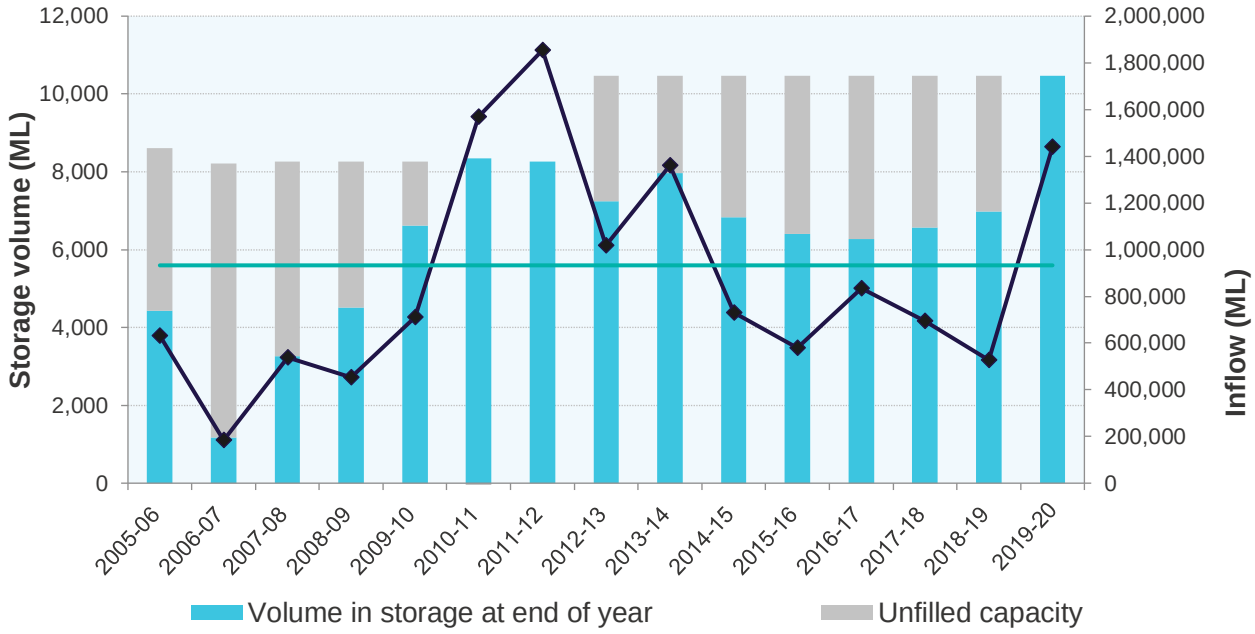
In 2019–20, rainfall:

- in most of the basin — a large area from the western corner to Woodside in the east — was 100% to 125% of the long-term average
- in the rest of the basin in the east was 80% to 100% of the long-term average.

Catchment inflows to the basin in 2019–20 were 154% of the long-term average of 932,900 ML, greater than in 2018–19 when inflows were 57% 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 2019–20.

Major storages in the basin were at 67% of capacity on 1 July 2019 and higher (at 100% of capacity) on 30 June 2020.

Figure 6-29 Storage volumes and catchment inflows, South Gippsland basin



Licensed diversions from streams remained unrestricted in the South Gippsland basin for the entirety of 2019–20.

There were no restrictions on urban water use in the South Gippsland basin in 2019–20, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2019–20, 27,098 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was more than the 21,270 ML diverted in the previous year.

6.15.2.1 Water for the environment

Environmental watering sites 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 2019–20, 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 2019–20 are shown in Table 6-90.

Table 6-90 Water balance, South Gippsland basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	6,974	6,576
Volume in storage at end of year	1	10,471	6,974
Change in storage		**3,497**	**398**
Inflows			
Catchment inflow	2	1,439,013	528,478
Rainfall on major storages	1	1,820	1,275
Treated wastewater discharged back to river	3	1,552	1,218

Total inflows		**1,442,385**	**530,970**
Outflows			
Diversions			
Urban diversions		6,591	7,207
Licensed diversions from unregulated streams		2,119	2,327
Small catchment dams	4	18,388	11,736
Total diversions		*27,098*	*21,270*
Losses			
Evaporation from major storages	1	1,853	1,414
Net evaporation from small catchment dams	4	811	5,650
In-stream infiltration to groundwater, flows to floodplain and evaporation	5	-	-
Total losses		*2,664*	7,064
Water passed at outlet of basin			
River outflows to Bass Strait and Westernport		1,409,126	502,238
Total water passed at outlet of basin		*1,409,126*	*502,238*
Total outflows		**1,438,888**	**530,572**

6.15.3.1 Notes to the water balance

1. Storage

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	2,197	630	663	2,299	4,463
Hyland Reservoir	671	297	106	106	374	671
Lance Creek Reservoir	4,200	3,749	920	920	451	4,200
Western Reservoir	1,137	731	164	164	406	1,137
Total 2019–20	**10,471**	**6,974**	**1,820**	**1,853**	**3,530**	**10,471**
Total 2018–19	10,471	6,576	1,275	1,414	537	6,974

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	Volume 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	244	143	59%	0	143	0	0	0	101
Cowes	1,445	95	5%	47	31	0	17	0	1,350
Foster	182	0	0%	0	0	0	0	0	182
Korumburra	846	0	0%	0	0	0	0	846	0
Leongatha Domestic	663	0	0%	0	0	0	0	663	0
Leongatha Trade Waste	1,062	0	0%	0	0	0	0	0	1,062
Meeniyan	46	3	7%	2	1	0	0	43	0
Seaspray (1)	0	0	0%	0	0	0	0	0	0
Toora	59	1	2%	1	0	0	0	0	58
Waratah Bay	9	9	100%	0	9	0	0	0	0
Welshpool	74	0	0%	0	0	0	0	0	74
Wonthaggi / Cape Paterson / Inverloch	1,612	0	0%	0	0	0	0	0	1,612
Yarram / Tarraville	110	110	100%	0	110	0	0	0	0
Total 2019–20	**6,352**	**361**	**5%**	**50**	**294**	**0**	**17**	**1,552**	**4,439**
Total 2018–19	5,247	462	8%	79	365	0	18	1,217	3,568

Note
(1) The Seaspray wastewater treatment plant was 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 6-93 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)	31,821	12,141	655	12,796
Registered/licensed commercial and irrigation	13,977	6,247	156	6,403
Total 2019–20	**45,798**	**18,388**	**811**	**19,199**
Total 2018–19	45,798	11,736	5,650	17,387

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 (as chapter 6.1.6.3 explains).

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 a net increase of 2,485 ML in the total entitlement volume from the previous year:**

- **2,500 ML of take and use licence volume (2,495 ML irrigation licence volume and 5 ML domestic and stock licence volume) was issued following an auction of water entitlements by**

Southern Rural Water in the Tarwin River catchment; 15 ML of take and use licence was cancelled during the year.

- ✓ **The total volume diverted (14,957 ML) was within the volume available for the year (44,881 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 – South Gippsland	Annual entitlement volume (ML) 30 June 2020	Annual entitlement volume (ML) 30 June 2019
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	12,003	9,510
Licensed small catchment dams – on-waterway	3,222	3,232
Licensed small catchment dams – off-waterway	10,754	10,751
Total	**44,866**	**42,381**

Table 6-95 shows the amount available to be taken by entitlement holders and the amount they took in the water year.

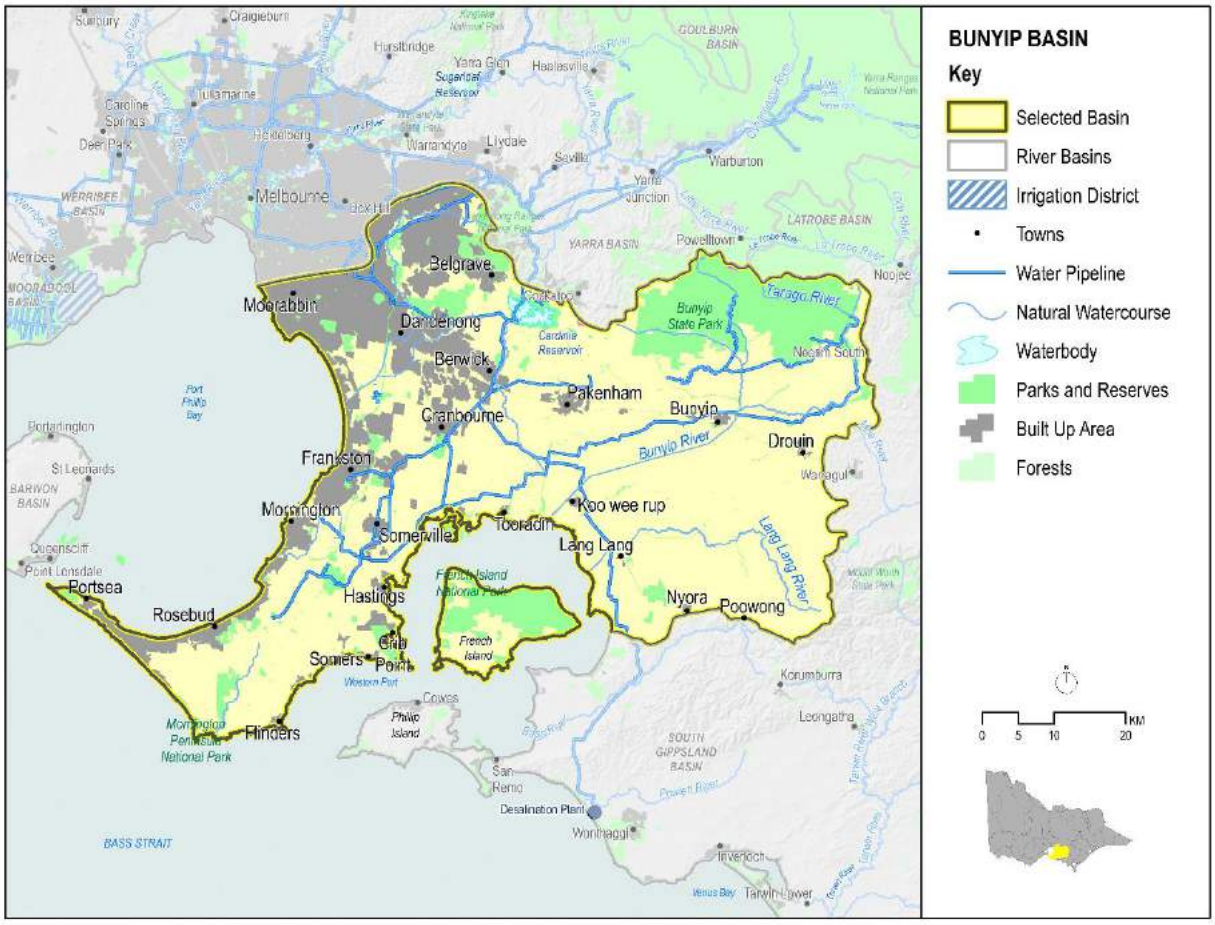
Table 6-95 Available water and take, South Gippsland basin

Water entitlement	Available water				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Devon North Alberton-Yarram and Port Albert	-	853	0	853	407
Dumbalk	-	100	0	100	14
Fish Creek	-	251	0	251	115
Foster	-	326	0	326	186
Korumburra	-	1,000	0	1,000	0
Leongatha	-	2,476	0	2,476	1,800
Loch, Poowong and Nyora	-	420	0	420	0
Meeniyan	-	200	0	200	49
Seaspray	-	133	0	133	50
Toora Port Franklin-Welshpool and Port Welshpool	-	1,617	0	1,617	553
Westernport	-	2,911	0	2,911	1,739
Westernport-Bass River	-	3,000	0	3,000	243
Wonthaggi-Inverloch	-	5,600	0	5,600	1,435
Take and use licences – unregulated surface water	-	12,007	(3)	12,004	2,119
Licensed small catchment dams	-	13,986	3	13,990	6,247
Total 2019–20	**-**	**44,881**	**0**	**44,881**	**14,957**
Total 2018–19	-	42,381	0	42,381	13,201

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 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 2019–20 water resources overview

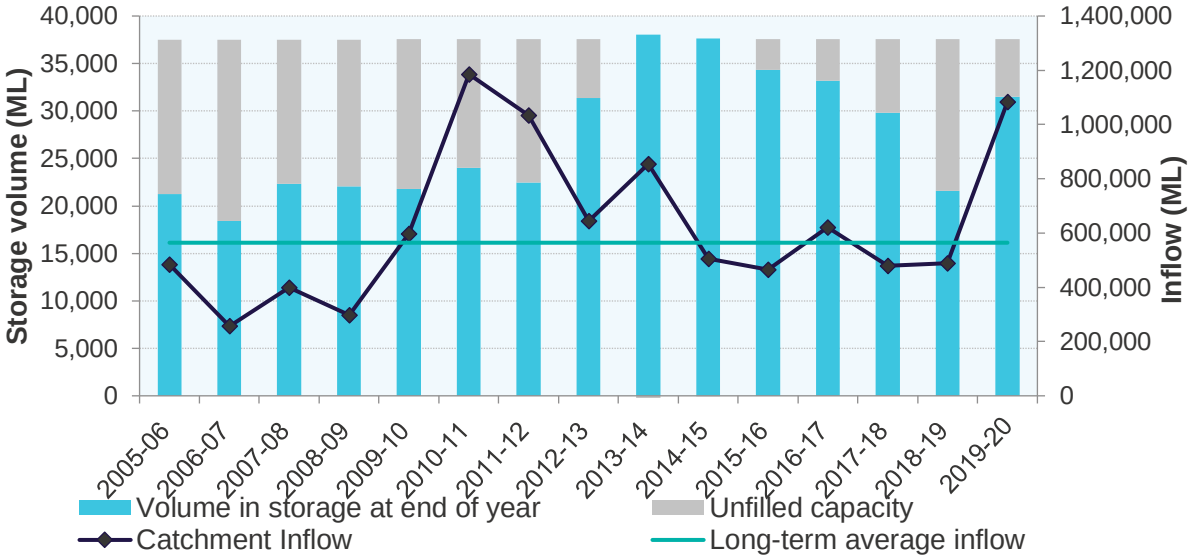
In 2019–20, rainfall:

- in most of the basin was 100% to 125% of the long-term average
- in a large area in the north — from Belgrave to Koo Wee Rup — was 125% to 150% of the long-term average.

Catchment inflows to the basin in 2019–20 were 192% of the long-term average of 564,400 ML, greater than in 2018–19 when inflows were 86% of the long-term average. The amount of water flowing from the Bunyip basin into Port Phillip Bay and Westernport Bay represented 95% of the inflows to the basin in 2019–20.

Major storages in the basin were at 58% of capacity on 1 July 2019 and higher (at 84% of capacity) on 30 June 2020.

Figure 6-31 Storage volumes and catchment inflows, Bunyip basin



All unregulated streams remained unrestricted throughout 2019–20 in the Bunyip basin.

There were no restrictions on urban water use in the Bunyip basin in 2019–20, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2019–20, 40,783 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was more than the 38,492 ML diverted in the previous year.

6.16.2.1 Water for the environment

Environmental watering sites 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 2019–20, 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 2019–20, 40 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 2019–20 are shown in Table 6-97.

Table 6-97 Water balance, Bunyip basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	21,611	29,783
Volume in storage at end of year	1	31,528	21,611
Change in storage		**9,917**	**(8,172)**
Inflows			
Catchment inflow	2	1,083,251	487,957

Rainfall on major storages	1	3,717	2,542
Treated wastewater discharged back to river	3	1,557	2,203
Total inflows		**1,088,525**	**492,702**
Outflows			
Diversions			
Urban diversions		18,737	24,094
Licensed diversions from regulated streams	4	102	1,256
Licensed diversions from unregulated streams	4	3,882	4,116
Small catchment dams	5	18,062	9,027
Total diversions		*40,783*	*38,492*
Losses			
Evaporation from major storages	1	2,837	2,268
Net evaporation from small catchment dams	5	2,687	4,793
In-stream infiltration to groundwater, flows to floodplain and evaporation		1,314	787
Total losses		*6,838*	*7,848*
Water passed at outlet of basin			
River outflows to Port Phillip Bay and Westernport Bay		1,030,987	454,534
Total water passed at outlet of basin		*1,030,987*	*454,534*
Total outflows		**1,078,608**	**500,874**

6.16.3.1 Notes to the water balance

1. Storage

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.

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	21,611	3,717	2,837	9,037	31,528
Total 2019–20	**37,580**	**21,611**	**3,717**	**2,837**	**9,037**	**31,528**
Total 2018–19	37,580	29,783	2,542	2,268	(8,446)	21,611

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 2018–19 catchment inflow volume has been corrected from the previous accounts. An error was made with the unregulated diversion volume, 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 6-99 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	Volume 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		
Blind Bight	194	194	99%	0	193	0	1	0	0
Boneo	5,196	1,375	22%	102	1,039	0	234	0	3,821
Drouin	960	77	8%	7	70	0	0	883	0
Eastern Treatment Plant	154,181	14,373	4%	5,469	0	0	8,904	0	139,808

Koo Wee Rup	128	87	46%	0	59	0	28	0	41
Lang Lang (1)	267	5	0%	0	0	0	5	262	0
Longwarry	418	62	15%	0	62	0	0	353	3
Mt Martha (2)	7,465	771	1%	1	108	0	662	0	6,694
Neerim South	59	0	0%	0	0	0	0	59	0
Pakenham	1,158	433	31%	63	294	0	76	0	725
Somers (3)	2,290	548	14%	215	106	0	227	0	1,742
Total 2019–20	**172,316**	**17,925**	**5%**	**5,857**	**1,931**	**0**	**10,137**	**1,557**	**152,834**
Total 2018–19	150,745	21,746	7%	8,449	2,685	0	10,611	2,204	126,795

Notes

(1) At the Lang Lang treatment plant, 5 ML of the volume produced was created in the previous year and carried over.

(2) At the Mt Martha treatment plant, 1,742 ML of the volume produced represents Class C effluent received from the Somers treatment plant.

(3) At the Somers treatment plant, 12 ML of the 'Volume produced' was created in the previous year and carried over. The 1,742 ML 'Volume of ocean or other discharge' represents a transfer of Class C effluent to the Mt Martha treatment plant.

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.

The volume of diversions from unregulated streams reported for 2018–19 in this item has been updated, due to a correction to the method described above.

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)	23,589	8,552	1,721	10,273
Registered/licensed commercial and irrigation	23,662	9,510	966	10,476
Total 2019–20	**47,251**	**18,061**	**2,687**	**20,749**
Total 2018–19	47,251	9,027	4,793	13,820

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 no net increase in total entitlement volume from the previous year.**
- ✓ **The total volume diverted (32,271 ML) was within the volume available for the year (81,010 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 2020	Annual entitlement volume (ML) 30 June 2019
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)	16,769	16,911
Licensed small catchment dams – on-waterway	2,213	2,219
Licensed small catchment dams – off-waterway	21,450	21,450
Total	**77,026**	**77,174**

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 varying, 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				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Tarago River – Gippsland Water	-	4,825	0	4,825	4,032
Tarago River – Southern Rural Water (1) (3)	-	1,260	0	1,260	102
Tarago and Bunyip rivers – Melbourne Water	-	30,510	0	30,510	14,705
Tarago and Bunyip rivers environmental entitlement (2)	1,524	2,282	0	3,806	40
Take and use licences – unregulated surface water (3)	-	16,925	28	16,953	3,882
Licensed small catchment dams	-	23,655	2	23,657	9,510
Total 2019–20	**-**	**79,456**	**30**	**81,010**	**32,271**
Total 2018–19	1,453	78,724	0	80,177	37,141

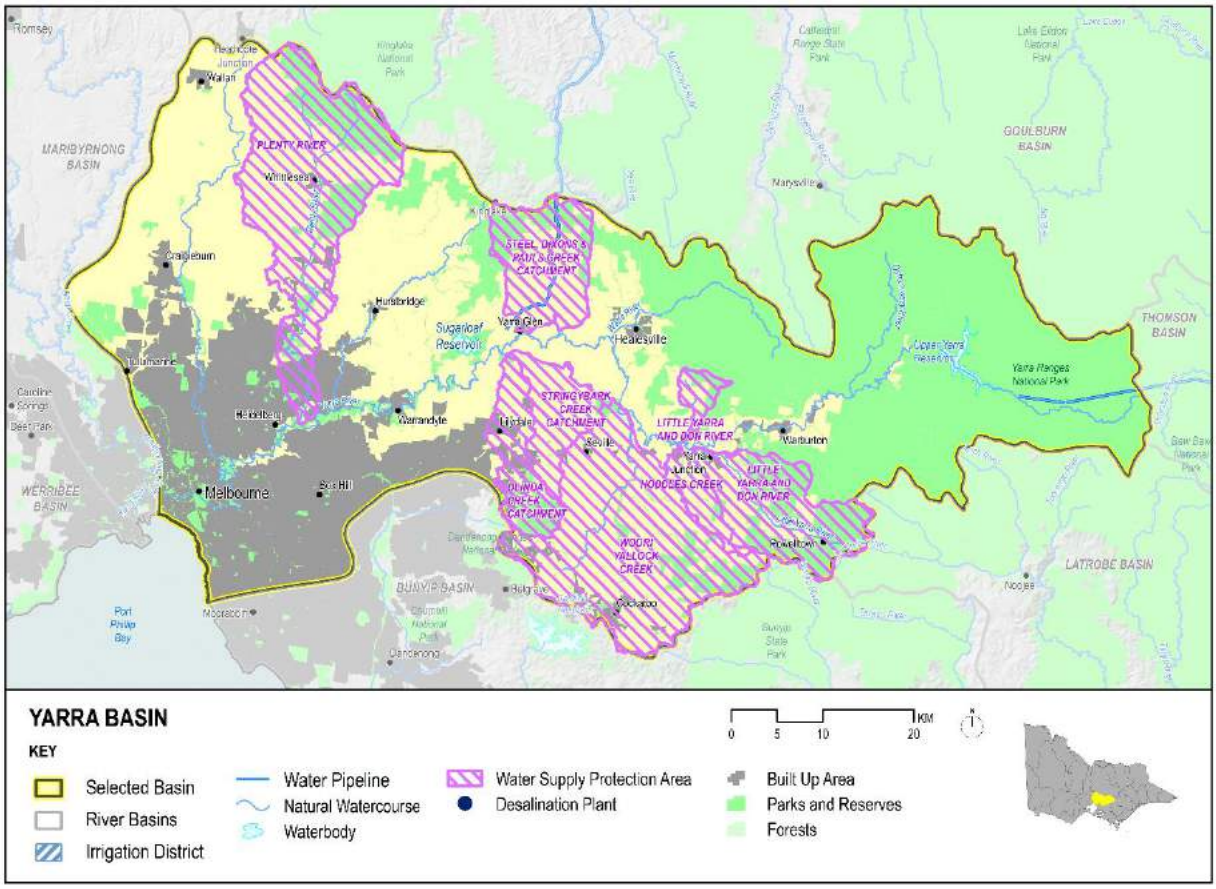
Notes

(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.
(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 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, that 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 2019–20, the allocation reached 85.5%, higher than the previous year when it reached 50.9%.

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 2020	Annual entitlement volume (ML) 30 June 2019
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 2019–20, 118,324 ML 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 2019–20 water order

was for 125,000 ML, with 6,868 ML delivered in advance in June 2019. 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 2020	Annual entitlement volume (ML) 30 June 2019
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 2019–20 water resources overview

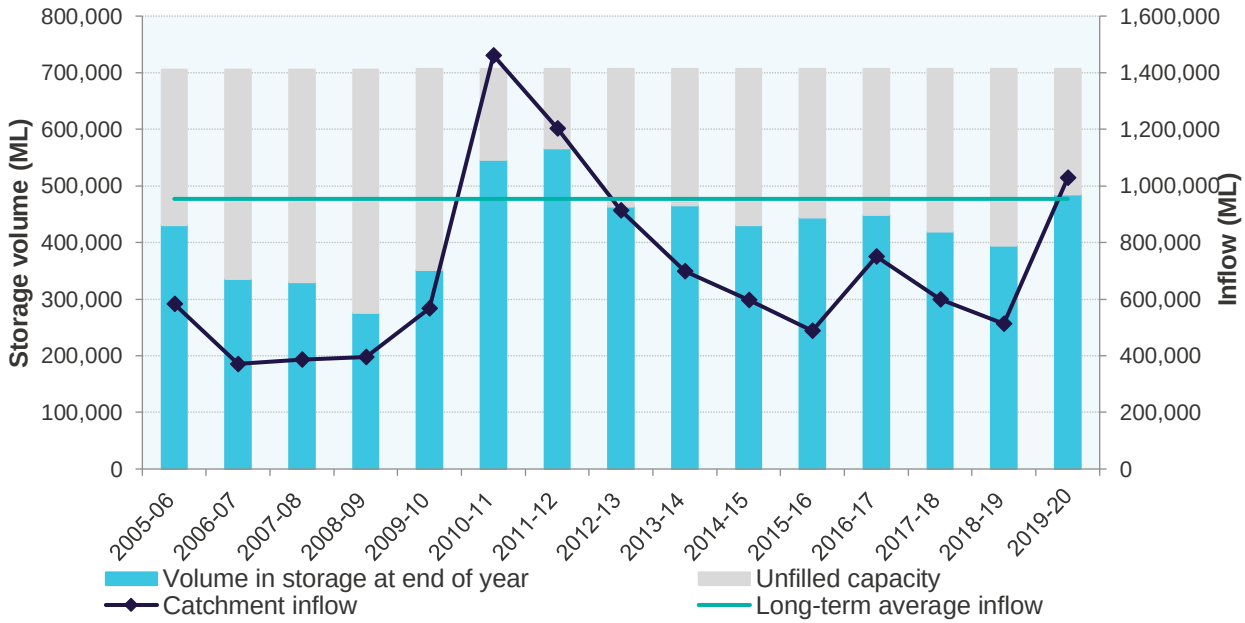
In 2019–20, rainfall:

- in an area in the north-east near Whittlesea was 80% to 100% of the long-term average
- in most of the basin was 100% to 125% of the long-term average
- in the south-east corner near Cockatoo and the north-east corner bordering the Goulburn basin was 125% to 150% of the long-term average.

Catchment inflows to the basin in 2019–20 were 108% of the long-term average of 954,200 ML, greater than in 2018–19 when inflows were 54% of the long-term average.

Major storages in the basin were at 56% of capacity on 1 July 2019 and higher (at 69% of capacity) on 30 June 2020.

Figure 6-33 Storage volumes and catchment inflows, Yarra basin



In 2019–20, ten of the Yarra basin's unregulated streams began the year with restrictions on licensed diversions. Most of these restrictions were lifted by August 2019, except for two streams — Dixons and Pauls creeks — that remained on diversion bans for the entirety of 2019–20. Between December 2019 and February 2020, there was a peak of 18 streams with bans or restrictions on licensed diversions. Most of these restrictions were lifted by the end of March 2020.

There were no restrictions on urban water use in the Yarra basin in 2019–20, 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 2019–20 by the Minister for Water. The total volume delivered to 30 June 2020 was 118,324 ML, representing 6.52% of Melbourne's storage capacity. This is more than the 21,966 ML (or 1.21%) delivered in 2018–19. The 2019–20 water order was for 125,000 ML, with 6,868 ML delivered in advance in June 2019.

In 2019–20, 435,992 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was more than the 424,029 ML diverted in the previous year.

6.17.2.1 Water for the environment

Environmental watering sites 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 2019–20, 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 2019–20, a total of 4,000 ML of environmental water was delivered in the Yarra basin: 69 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 2019–20 are shown in Table 6-107.

Table 6-107 Water balance, Yarra basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	125,851	136,129
Volume in storage at end of year	1	129,874	125,851
Change in storage		**4,023**	**(10,278)**
Inflows			
Catchment inflow	2	1,028,892	512,504
Rainfall on major storages	1	11,853	8,955
Inflow of desalinated water	3	118,324	21,966
Transfers from Thomson	4	36,045	198,850
Transfers from Goulburn (Silver and Wallaby creeks)	4	808	356
Transfers from Goulburn via North-South Pipeline		11	0
Treated wastewater discharged back to river	5	8,471	6,185
Total inflows		**1,204,404**	**748,816**
Outflows			
Diversions			
Urban diversions	4	537,407	434,203
Licensed diversions from unregulated streams		5,202	6,835
Environmental water diversions	6	69	59
Small catchment dams	7	11,638	4,899
Total diversions		*554,316*	*445,995*
Losses			
Evaporation from major storages	1	11,077	11,387
Net evaporation from small catchment dams	7	1,371	2,976
In-stream infiltration to groundwater, flows to floodplain and evaporation	8	-	-
Total losses		*12,448*	*14,363*
Water passed at outlet of basin			
River outflows to Port Phillip Bay		633,617	298,736
Total water passed at outlet of basin		*633,617*	*298,736*
Total outflows		**1,200,381**	**759,094**

6.17.3.1 Notes to the water balance

1. Storage

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	8,210	1,822	1,882	14,029	22,179
O'Shannassy Reservoir	3,123	324	99	102	2,283	2,604
Upper Yarra Reservoir	200,579	95,568	5,347	4,164	(17,689)	79,062
Yan Yean Reservoir	30,266	21,749	4,585	4,929	4,624	26,029
Subtotal	*256,147*	*125,851*	*11,853*	*11,077*	*3,247*	*129,874*
Off-stream storages						
Cardinia Reservoir	286,911	171,061	12,685	10,312	34,717	208,151
Greenvale Reservoir	26,839	19,802	1,155	1,706	2,449	21,700
Silvan Reservoir	40,445	34,227	3,884	2,911	351	35,551
Sugarloaf Reservoir	96,253	43,652	3,628	4,283	47,132	90,129
Subtotal	*450,448*	*268,742*	*21,352*	*19,212*	*84,649*	*355,531*
Total 2019–20	**706,595**	**394,593**	**33,205**	**30,289**	**87,896**	**485,405**
Total 2018–19	706,595	419,723	21,691	25,534	(21,287)	394,593

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 2018–19, the catchment inflow volume has been corrected from the previous accounts. An error was made with the urban diversion volume, which in turn caused an error in the catchment inflow amount.

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 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.

The volume of urban diversions reported in the *Victorian Water Accounts 2018–19* has been amended: it was not correct.

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	Volume 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	1,288	335	10%	135	0	0	200	0	953
Brushy Creek	3,949	92	2%	92	0	0	0	3,857	0
Craigieburn	778	26	3%	26	0	0	0	752	0
Healesville	526	120	0%	0	0	0	120	406	0
Kinglake	5	4	80%	0	4	0	0	0	1
Lilydale	2,470	58	2%	58	0	0	0	2,412	0
Monbulk	28	0	0%	0	0	0	0	28	0
Upper Yarra	875	0	0%	0	0	0	0	875	0
Wallan	1,340	954	69%	220	704	0	30	141	245
Whittlesea	346	210	53%	126	57	0	27	0	136
Total 2019–20	**11,605**	**1,799**	**12%**	**657**	**765**	**0**	**377**	**8,471**	**1,335**
Total 2018–19	11,072	3,722	14%	538	971	0	2,212	6,185	1,166

6. Environmental water diversions

This volume represents the amount that was diverted by the VEWH to Banyule 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)	17,961	7,214	1,167	8,381
Registered/licensed commercial and irrigation	9,451	4,424	204	4,628
Total 2019–20	**27,412**	**11,639**	**1,371**	**13,010**
Total 2018–19	27,412	4,899	2,976	7,875

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 6.1.6.3).

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 (395,856 ML) was within the volume available for the year (479,121 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 which 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 2020	Annual entitlement volume (ML) 30 June 2019
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)	39,408	39,505
Licensed small catchment dams – on-waterway	1,708	1,708
Licensed small catchment dams – off-waterway	7,743	7,769
Total	**465,914**	**466,037**

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 is 12,134 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				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Yarra River - Melbourne Water	-	400,000	0	400,000	382,230
Yarra River Environment Entitlement (1)	13,137	17,000	0	30,137	4,000
Take and use licences – unregulated surface water	-	39,505	(12)	39,493	5,202
Licensed small catchment dams	-	9,479	12	9,491	4,424
Total 2019–20	**13,137**	**465,984**	**0**	**479,121**	**395,856**
Total 2018–19	12,655	466,005	0	478,660	238,113

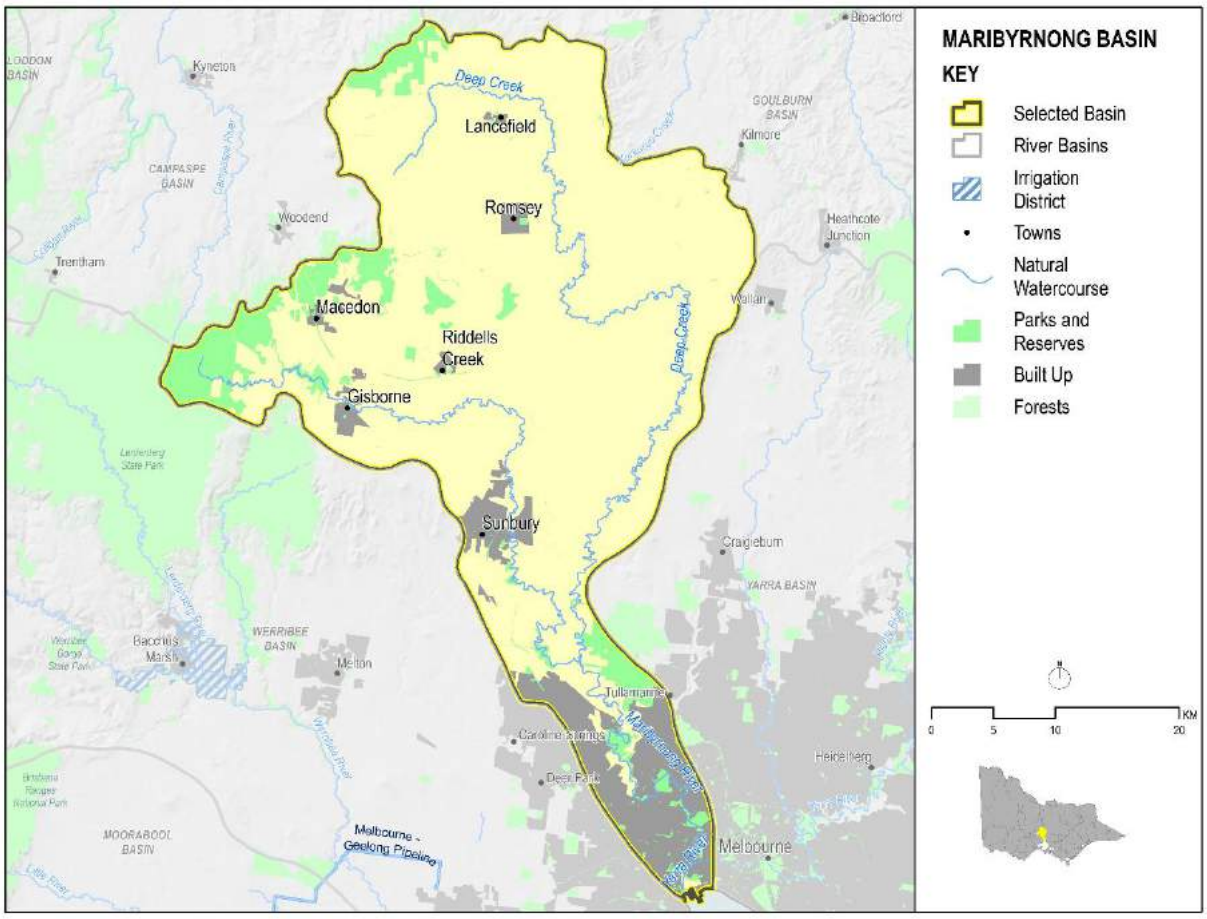
Note

(1) Water taken under the Yarra environmental entitlement includes 69 ML of diversions to wetlands and 3,931 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 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

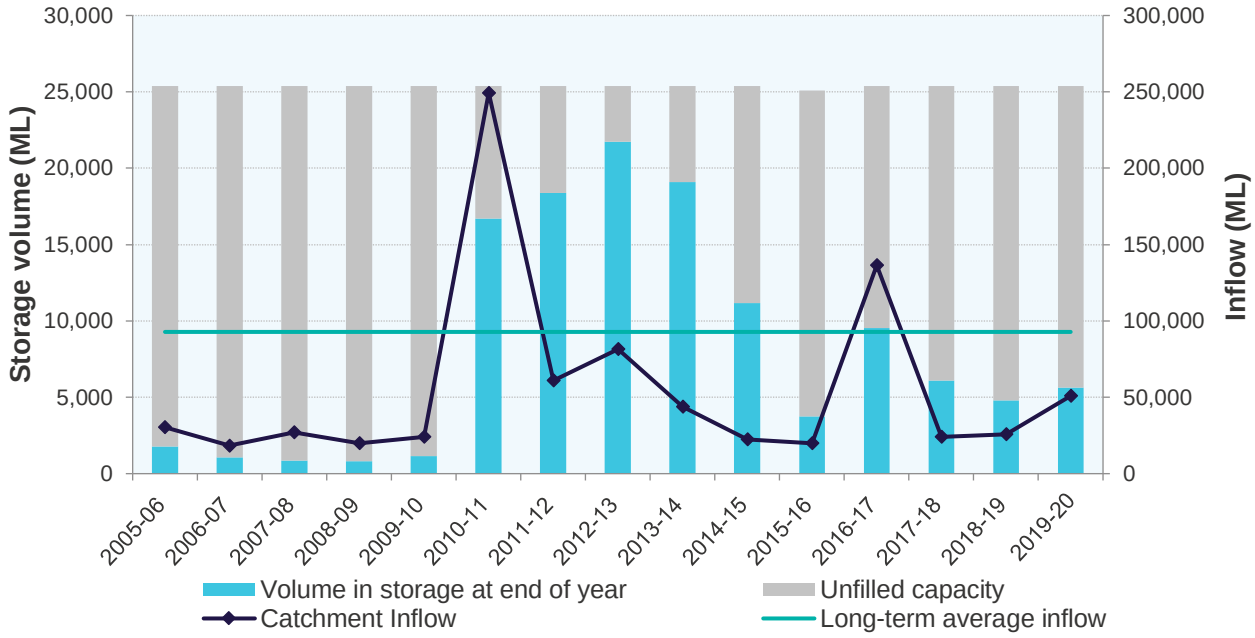
6.18.2 2019–20 water resources overview

In 2019–20, rainfall across the basin was 100% to 125% of the long-term average.

Catchment inflows to the basin in 2019–20 were 55% of the long-term average annual volume of 92,800 ML, greater than in 2018–19 when inflows were 28% of the long-term average.

Rosslynne Reservoir was at 19% of capacity on 1 July 2019 and higher (at 22% of capacity) on 30 June 2020.

Figure 6-35 Storage volumes and catchment inflows, Maribyrnong basin



A licensed diversion ban was in place on the Maribyrnong River for surface water users with winterfill licences for most of the year, except in July and August 2019 and June 2020. Diversions for all-year licences were banned on the Maribyrnong from November 2019 to February 2020 and on Deep, Turitable and Willimigongon creeks from January until May 2020. The rest of the streams were unrestricted for the entirety of 2019–20.

There were no restrictions on urban water use in the Maribyrnong basin in 2019–20, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2019–20, 5,191 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 4,636 ML diverted in the previous year.

6.18.2.1 Water for the environment

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

- Australian grayling and the Jacksons Creek platypus population
- the upper Maribyrnong catchment that 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 2019–20, 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 2019–20.

In 2019–20, 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 2019–20 are shown in Table 6-114.

Table 6-114 Water balance, Maribyrnong basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	4,776	6,102
Volume in storage at end of year	1	5,641	4,776
Change in storage		**865**	**(1,325)**
Inflows			
Catchment inflow	2	50,658	26,319
Rainfall on major storages	1	788	591
Treated wastewater discharged back to river	3	2,555	2,413
Total inflows		**54,001**	**29,322**
Outflows			
Diversions			
Urban diversions		1,966	2,038
Licensed diversions from regulated streams		85	564
Licensed diversions from unregulated streams		226	201
Small catchment dams	4	2,914	1,833
Total diversions		*5,191*	*4,636*
Losses			
Evaporation from major storages	1	1,100	2,877
Net evaporation from small catchment dams	4	1,533	1,523
In-stream infiltration to groundwater, flows to floodplain and evaporation		2,090	2,765
Total losses		*4,723*	*7,165*
Water passed at outlet of basin			
River outflows to the Yarra River		43,222	18,847
Total water passed at outlet of basin		*43,222*	*18,847*
Total outflows		**53,136**	**30,647**

6.18.3.1 Notes to the water balance

1. Storage

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.

The 2018–19 rainfall and evaporation volumes for Rosslynne Reservoir have been corrected from the previous accounts.

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	4,776	1,560	2,178	1,483	5,641
Total 2019–20	**25,368**	**4,776**	**1,560**	**2,178**	**1,483**	**5,641**
Total 2018–19	25,368	6,102	1,169	2,877	382	4,776

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 2018–19 catchment inflow volume has been corrected from the previous accounts. An error was made with the storage volumes, 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 6-116 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	Volume 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	649	72	9%	41	15	0	16	577	0
Riddells Creek	174	102	59%	9	93	0	0	72	0
Romsey	273	267	98%	17	250	0	0	0	6
Sunbury	2,478	572	23%	307	259	0	6	1,906	0
Total 2019–20	**3,574**	**1,013**	**28%**	**374**	**617**	**0**	**22**	**2,555**	**6**
Total 2018–19	4,259	1,846	27%	492	671	0	683	2,413	0

5. 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	2,460	1,415	3,875
Registered/licensed commercial and irrigation	1,790	455	118	572
Total 2019–20	**12,052**	**2,915**	**1,533**	**4,448**
Total 2018–19	12,052	1,833	1,523	3,356

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 (2,764 ML) was within the volume available for the year (13,944 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 2020	Annual entitlement volume (ML) 30 June 2019
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	1,925

Licensed small catchment dams – on-waterway	130	130
Licensed small catchment dams – off-waterway	1,659	1,659
Total	**14,396**	**14,426**

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 at 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 at 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				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Gisborne – Barringo Creek	-	585	0	585	0
Lancefield	-	315	0	315	124
Macedon and Mount Macedon	-	873	0	873	128
Maribyrnong – Melbourne Water (1)	-	1,124	0	1,124	85
Maribyrnong – Southern Rural Water (2)	-	214	0	214	33
Maribyrnong – Western Water (3)	-	6,100	0	6,100	1,324
Riddells Creek	-	300	0	300	28
Romsey (4)	258	460	0	718	362
Take and use licences – unregulated surface water	-	1,925	0	1,925	226
Licensed small catchment dams	-	1,790	0	1,790	454
Total 2019–20	**258**	**13,686**	**0**	**13,944**	**2,764**
Total 2018–19	98	14,371	0	14,469	3,070

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.

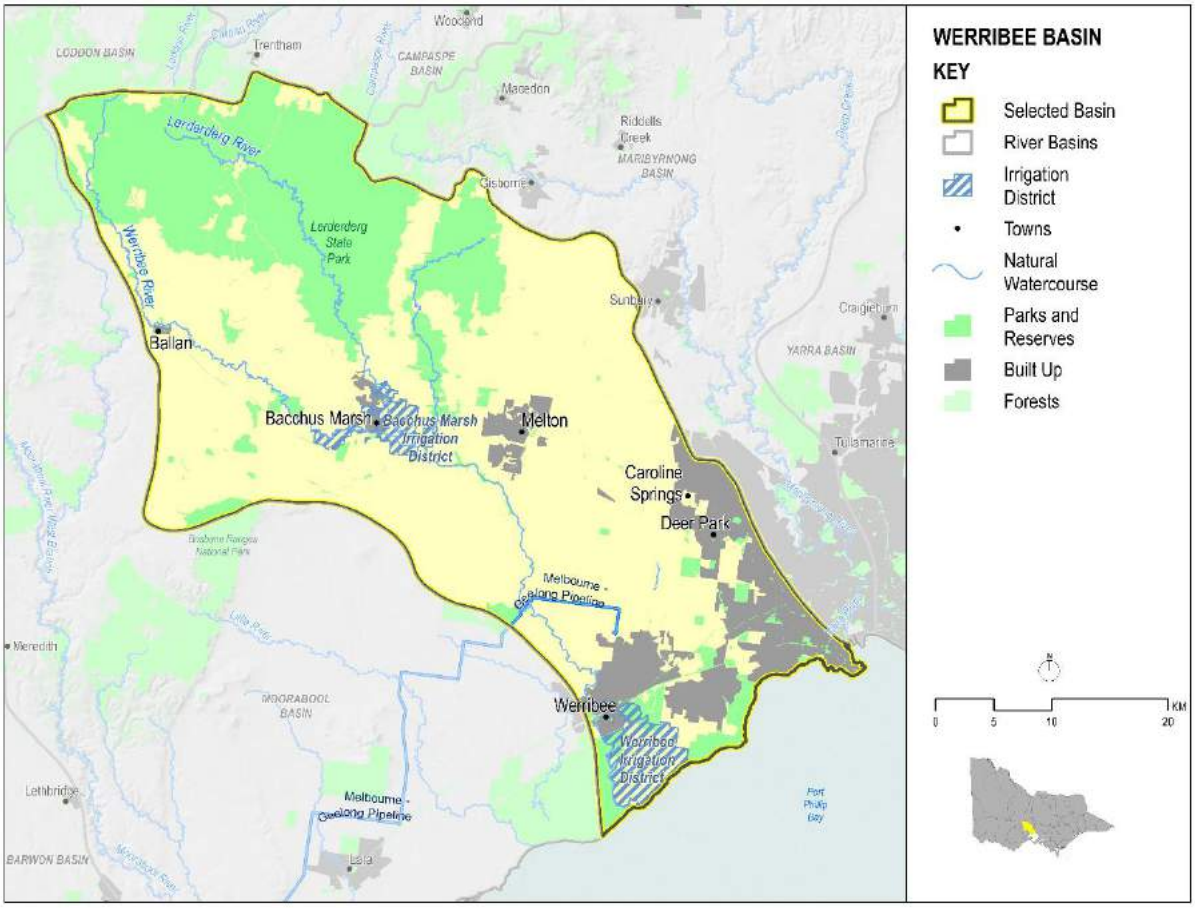
(3) The water available to Western Water is determined by an inflow and storage capacity share in the system. In any year, available inflows will vary; entitlement holders may have water available from the previous year in their storage share, but the maximum annual amount that can be taken is shown here.

(4) Western Water can use unused allocation of up to 280 ML from a previous year under a drought reserve arrangement. 258 ML was added to the drought reserve for this entitlement from 2018–19.

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 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 2019–20 water resources overview

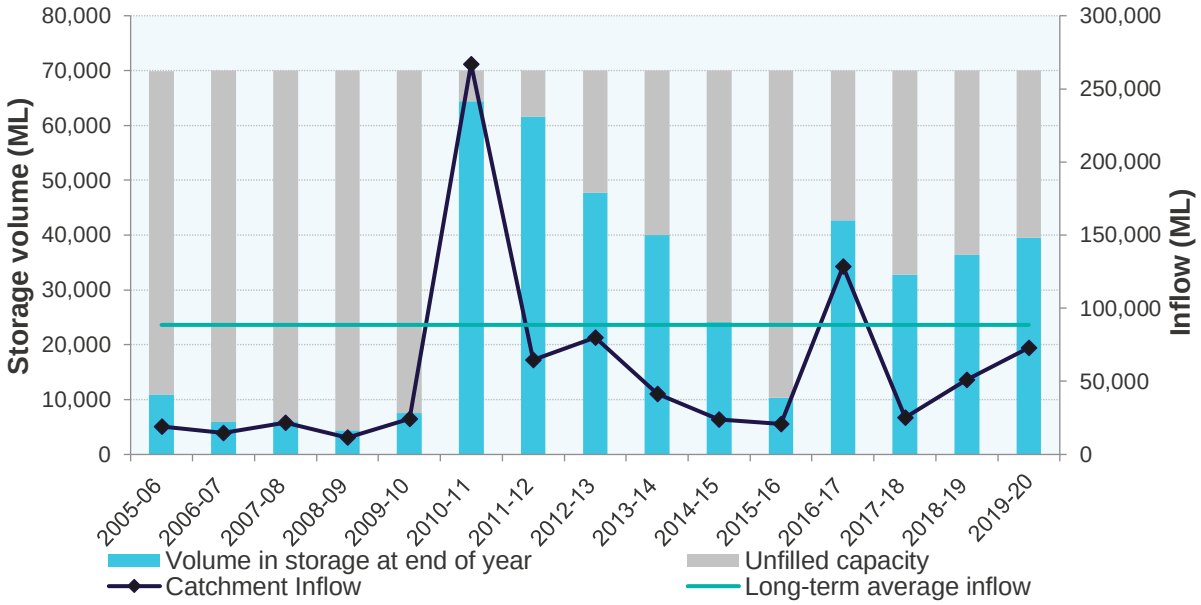
In 2019–20, rainfall:

- in the northern corner of the basin — over the Lerderderg State Park) — was 80% to 100% of the long-term average
- in the rest of the basin was 100% to 125% of the long-term average.

Catchment inflows to the basin in 2019–20 were 82% of the long-term average of 88,600 ML, greater than in 2018–19 when inflows were 58% of the long-term average.

Major storages in the basin were at 52% of capacity on 1 July 2019 and higher (at 57% of capacity) on 30 June 2020.

Figure 6-37 Storage volumes and catchment inflows, Werribee basin



In 2019–20, the first seasonal determination for high-reliability water shares was announced in July 2019 at 45%, which was increased to 100% by August 2019. Unlike the previous year, low-reliability water shares received an determination in 2019–20: they started at 20% in August, increased to 80% by February 2020 and received a final allocation of 100% in April 2020.

In 2019–20, a total ban was placed on licensed diversions from the Lerderderg River in January 2020, which remained in place until the end of May 2020.

There were no restrictions on urban water use in the Werribee basin in 2019–20, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2019–20, 15,988 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was more than the 14,594 ML diverted in the previous year.

6.19.2.1 Water for the environment

Environmental watering sites 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 2019–20, water for the environment in the Werribee basin comprised:

- the Werribee River Environmental Entitlement 2011 comprising 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 2019–20, a total of 1,174 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 2019–20 are shown in Table 6-121.

Table 6-121 Water balance, Werribee basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	36,429	32,721
Volume in storage at end of year	1	39,592	36,429
Change in storage		**3,164**	**3,708**
Inflows			
Catchment inflow	2	73,090	51,068
Rainfall on major storages	1	4,902	4,061
Transfers from other basins		0	0
Return flow from irrigation		109	246
Treated wastewater discharged back to river	3	1,548	0
Total inflows		**79,649**	**55,375**
Outflows			
Diversions			
Urban diversions		2,553	2,549
Irrigation district diversions		11,629	10,819
Licensed diversions from regulated streams		106	177
Licensed diversions from unregulated streams		0	0
Small catchment dams	4	1,700	1,048
Total diversions		*15,988*	*14,594*
Losses			
Evaporation from major storages	1	10,332	12,312
Net evaporation from small catchment dams	4	946	757
In-stream infiltration to groundwater, flows to floodplain and evaporation		1,771	902
Total losses		*13,049*	*13,971*
Water passed at outlet of basin			
River outflows to Port Phillip Bay		47,448	23,101
Total water passed at outlet of basin		*47,448*	*23,101*
Total outflows		**76,485**	**51,667**

6.19.3.1 Notes to the water balance

1. Storage

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. The 2018–19 rainfall and evaporation volumes for Melton, Merrimu and Pykes Creek reservoirs have been corrected from the previous accounts.

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	674	87	58	29	732
Melton Reservoir	14,364	6,352	1,118	2,530	5,227	10,167
Merrimu Reservoir (total)	32,516	10,961	2,369	5,221	2,468	10,577
Pykes Creek Reservoir	22,119	18,441	1,328	2,523	870	18,116
Total 2019–20	**70,013**	**36,429**	**4,902**	**10,332**	**8,594**	**39,592**
Total 2018–19	70,013	32,721	4,061	12,312	11,959	36,429

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 2018–19 catchment inflow volume has been corrected from the previous accounts. An error was made with the storage volumes, 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 6-123 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	Volume 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 process		
Altona	5,751	2,152	37%	2,138	0	0	14	0	3,599
Ballan	218	131	60%	2	129	0	0	87	0
Melton	4,196	2,735	62%	580	2,042	0	113	1,461	0
Parwan (Bacchus Marsh)	577	520	90%	24	496	0	0	0	57
Sunshine Golf Course Sewer Mining Project	32	32	100%	32	0	0	0	0	0
Western Treatment Plant	189,601	22,157	12%	4,552	13,944	3,611	50	0	167,444
Total 2019–20	**200,375**	**27,727**	**14%**	**7,328**	**16,611**	**3,611**	**177**	**1,548**	**171,100**
Total 2018–19	179,884	38,970	21%	9,771	23,707	5,091	401	0	140,914

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	1,545	900	2,445
Registered/licensed commercial and irrigation	936	155	46	201
Total 2019–20	**9,969**	**1,701**	**946**	**2,646**
Total 2018–19	9,969	1,048	757	1,805

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 a net increase of 3,763 ML in the total entitlement volume from the previous year:**
  - **this increase resulted from the allocation of the unallocated 10% inflow and 20% storage share in Lake Merrimu to Western Water under its *Bulk Entitlement (Werribee system – Western Water) Conversion Order 2004* in April 2020.**
- ✓ **The total volume diverted (15,508 ML) was within the volume available for the year (42,884 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 2020	Annual entitlement volume (ML) 30 June 2019
Bulk Entitlement (Werribee system – Irrigation) Conversion Order 1997		
High-reliability water shares	15,473	15,475
Low-reliability water shares	7,256	7,256
Bulk Entitlement (Myrniong) Conversion Order 2004	58	58
Operating provision	4,253	4,251
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 (1)	13,749	9,986
Werribee River Environment Entitlement 2011 (2)	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**	**39,251**

Notes

(1) *Bulk Entitlement (Werribee system – Western Water) Conversion Order 2004* was amended in April 2020 to reflect the allocation of the unallocated 10% inflow and 20% storage share in Lake Merrimu. This increased the entitlement volume to 13,749 ML.

(2) 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				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Werribee system – Irrigation – SRW					
Water shares (1)	5,919	16,773	0	22,693	9,481
Myrniong	1	57	0	58	42
Operating provision (2)	-	2,975	-	2,975	2,975
Net diversion: Werribee system – Irrigation – SRW (3)				*25,725*	*12,498*
Ballan	-	451	0	451	0
Blackwood and Barry's Reef	-	140	0	140	57
Werribee system – Western Water (4)	-	13,749	0	13,749	2,454
Werribee River Environment Entitlement 2011 (5)	791	394	0	1,185	344
Take and use licences – unregulated surface water	-	697	0	697	0
Licensed small catchment dams	-	936	0	936	155
Total 2019–20	**6,712**	**36,172**	**0**	**42,884**	**15,508**
Total 2018–19	9,180	22,300	0	31,480	14,186

Notes

(1) Water use reported includes water taken by primary entitlement holders and includes 830 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 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 (830 ML).

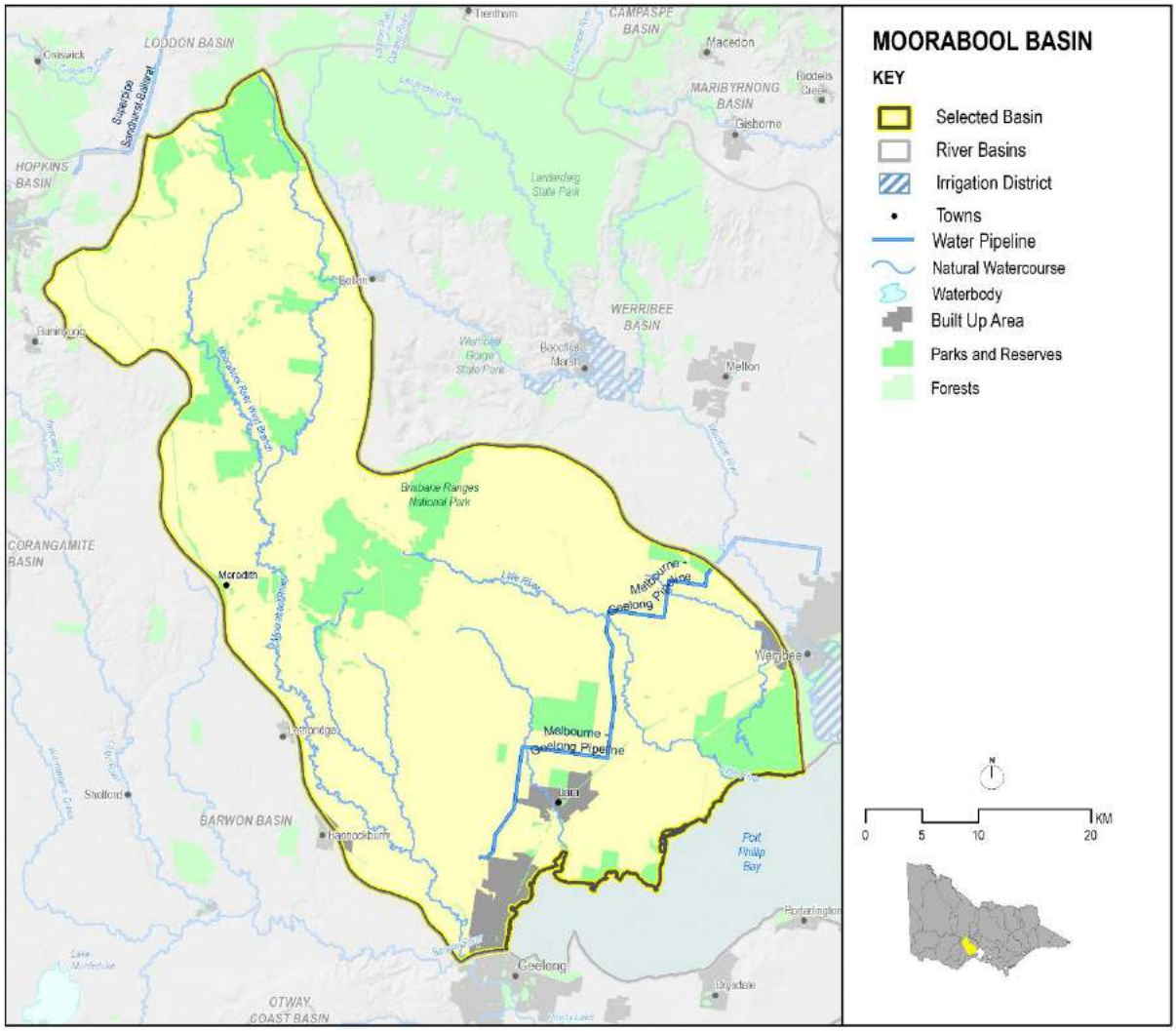
(4) The water available to Western Water is determined by an inflow and storage capacity share in the system. In any year, available inflows will vary; entitlement holders may have water available from the previous year in their storage share, but the maximum annual amount that can be taken is shown 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 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 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 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

6.20.2 2019–20 water resources overview

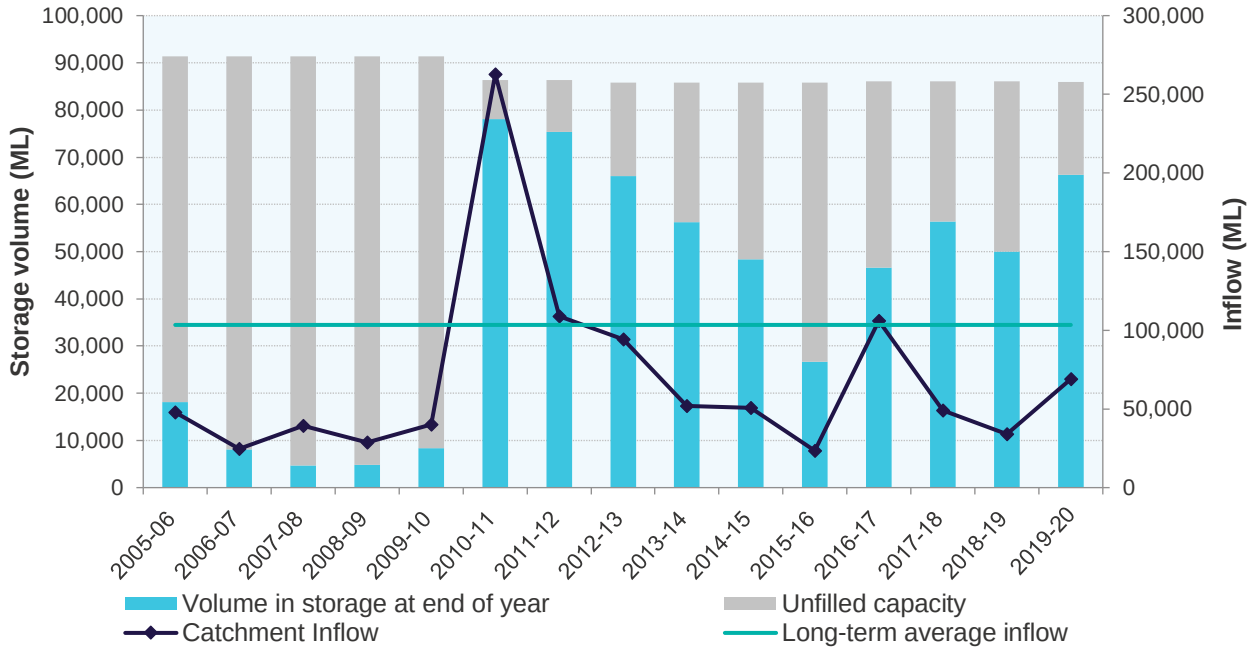
In 2019–20, rainfall:

- in the north-western corner and the south of the basin was 80% to 100% of the long-term average
- in the centre and north-east of the basin was 100% to 125% of the long-term average.

Catchment inflows to the basin in 2019–20 were 67% of the long-term average annual volume of 103,400 ML, greater than in 2018–19 when inflows were 33% of the long-term average.

Major storages in the basin were at 59% of capacity on 1 July 2019 and higher (at 77% of capacity) on 30 June 2020.

Figure 6-39 Storage volumes and catchment inflows, Moorabool basin



In 2019–20, licensed diversions from the Moorabool River were banned from December 2019 to January 2020, unrestricted in February and banned again from March until the end of May 2020. Little River had a total ban on licensed diversions in place from January until the end of May 2020.

There were no restrictions on urban water use in the Moorabool basin in 2019–20, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2019–20, 22,130 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was more than the 17,900 ML diverted in the previous year.

6.20.2.1 Water for the environment

Environmental watering sites 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 2019–20, water for the environment in the Moorabool basin comprised:

- the Moorabool River Environmental Entitlement 2010, comprising 11.9% of inflows held by the VEWH
- 3,506 ML of treated groundwater discharged from the Fyansford quarry to the lower Moorabool River
- 1,000 ML of water traded temporarily to the VEWH
- 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 2019–20, a total of 3,652 ML of environmental water was delivered in-stream in the Moorabool basin. Adding to the environmental benefit in the system; 3,506 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 2019–20 are shown in Table 6-128.

Table 6-128 Water balance, Moorabool basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	45,169	51,355
Volume in storage at end of year	1	59,057	45,169
Change in storage		**13,888**	**(6,186)**
Inflows			
Catchment inflow	2	69,075	33,905
Rainfall on major storages	1	6,182	3,929
Inflow from groundwater	3	3,506	3,457
Treated wastewater discharged back to river	4	0	0
Total inflows		**78,763**	**41,291**
Outflows			
Diversions			
Urban diversions		10,366	11,999
Transfers to Barwon basin (White Swan Reservoir)	5	5,885	2,421
Licensed diversions from unregulated streams		671	833
Small catchment dams	6	5,208	2,647
Total diversions		*22,130*	*17,900*
Losses			
Evaporation from major storages	1	5,481	5,577
Net evaporation from small catchment dams	6	1,929	1,433
In-stream infiltration to groundwater, flows to floodplain and evaporation		13,224	6,944
Total losses		*20,634*	*13,955*
Water passed at outlet of basin			
River outflows to Port Phillip Bay (Little River) and other small coastal streams		5,235	8,338
River outflows to the Barwon River (Moorabool River)		16,876	7,285
Total water passed at outlet of basin		*22,111*	*15,623*
Total outflows		**64,875**	**47,477**

6.20.3.1 Notes to the water balance

1. Storage

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	3,276	747	1,008	1,033	4,048
Korweinguboora Reservoir	2,327	357	524	522	855	1,215
Lal Lal Reservoir	59,549	38,889	3,727	2,368	9,977	50,225
Moorabool Reservoir	6,192	2,355	1,022	1,369	1,422	3,430
Wilsons Reservoir	1,010	292	162	214	(101)	139
Subtotal	*76,438*	*45,169*	*6,182*	*5,481*	*13,187*	*59,057*
Off-stream storage						
Upper Stony Creek Reservoir	9,494	4,797	n/a	n/a	2,361	7,158
Subtotal	*9,494*	*4,797*	*n/a*	*n/a*	*2,361*	*7,158*
Total 2019–20	**85,932**	**49,966**	**6,182**	**5,481**	**15,548**	**66,215**
Total 2018–19	86,027	56,329	3,929	5,577	(4,716)	49,966

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 2018–19 catchment inflow volume has been corrected from the previous accounts. An inflow from groundwater was erroneously excluded, which in turn caused an error in the catchment inflow amount.

3. Inflow from groundwater

3,506 ML of treated groundwater was discharged from the Fyansford quarry to the lower Moorabool River, providing an environmental benefit in the system. This volume was erroneously excluded from the *Victorian Water Accounts 2018–19* and the 2018–19 volume has been corrected for the oversight.

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 2019–20 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	Volume 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	27	27	100%	0	27	0	0	0	0
Northern WRP	1,173	1,173	89%	1,048	0	0	125	0	0
Total 2019–20	**1,200**	**1,200**	**90%**	**1,048**	**27**	**0**	**125**	**0**	**0**
Total 2018–19	1,366	1,366	91%	1,201	39	0	126	0	0

5. Transfers to Barwon basin (White Swan Reservoir)

The 5,885 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)	13,105	3,209	1,500	4,709
Registered/licensed commercial and irrigation	7,221	1,999	429	2,428
Total 2019–20	**20,326**	**5,208**	**1,929**	**7,137**
Total 2018–19	20,326	2,647	1,433	4,081

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 no net increase in the total entitlement volume from the previous year.**
✓ **The total volume diverted (22,573 ML) was within the volume available for the year (56,644 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 2020	Annual entitlement volume (ML) 30 June 2019
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	2,105
Licensed small catchment dams – on-waterway	1,431	1,469
Licensed small catchment dams – off-waterway	5,790	5,790
Total	**49,963**	**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				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Lal Lal – Barwon (1)	-	5,925	(1000)	5,925	2,854
Lal Lal – Central Highlands (1)	-	12,575	0	12,575	5,262
Moorabool River Environment Entitlement (2)	1,786	4,857	1,000	7,643	3,652
Meredith	-	600	0	600	0
She Oaks	-	2,000	0	2,000	0
Upper East Moorabool system	-	9,000	0	9,000	2,250
Upper West Moorabool system	-	10,500	0	10,500	5,885
Take and use licences – unregulated surface water	-	2,138	25	2,163	671
Licensed small catchment dams	-	7,264	(25)	7,239	1,999
Total 2019–20	**1,786**	**54,859**	**0**	**56,644**	**22,573**
Total 2018–19	2,662	50,087	500	53,249	18,215

Notes

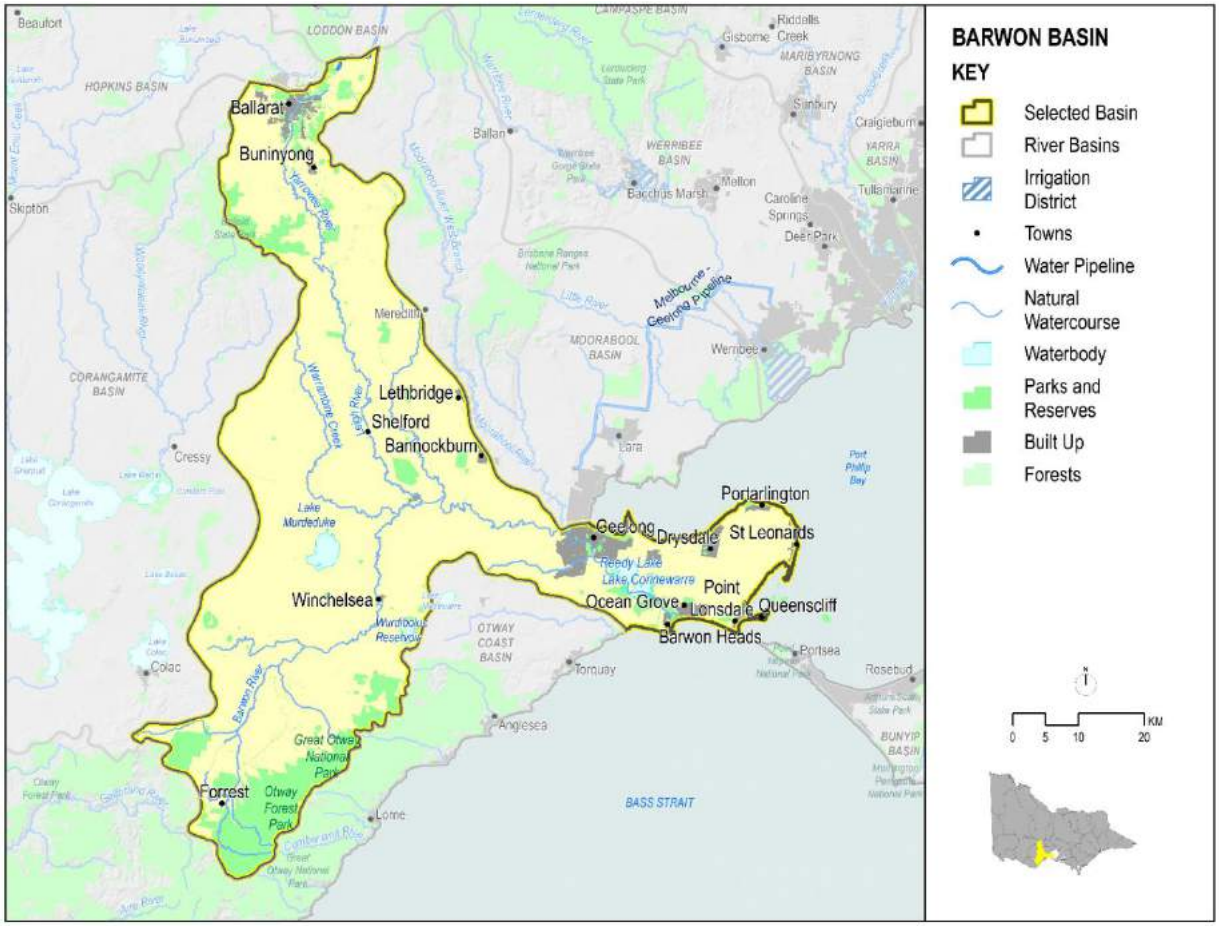
(1) The water available to entitlement holders is determined by an inflow and storage capacity share in the system. In any year, available inflows will vary; entitlement holders may have water available from the previous year in their storage share, but the maximum annual amount that can be taken is 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 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 2019–20 water resources overview

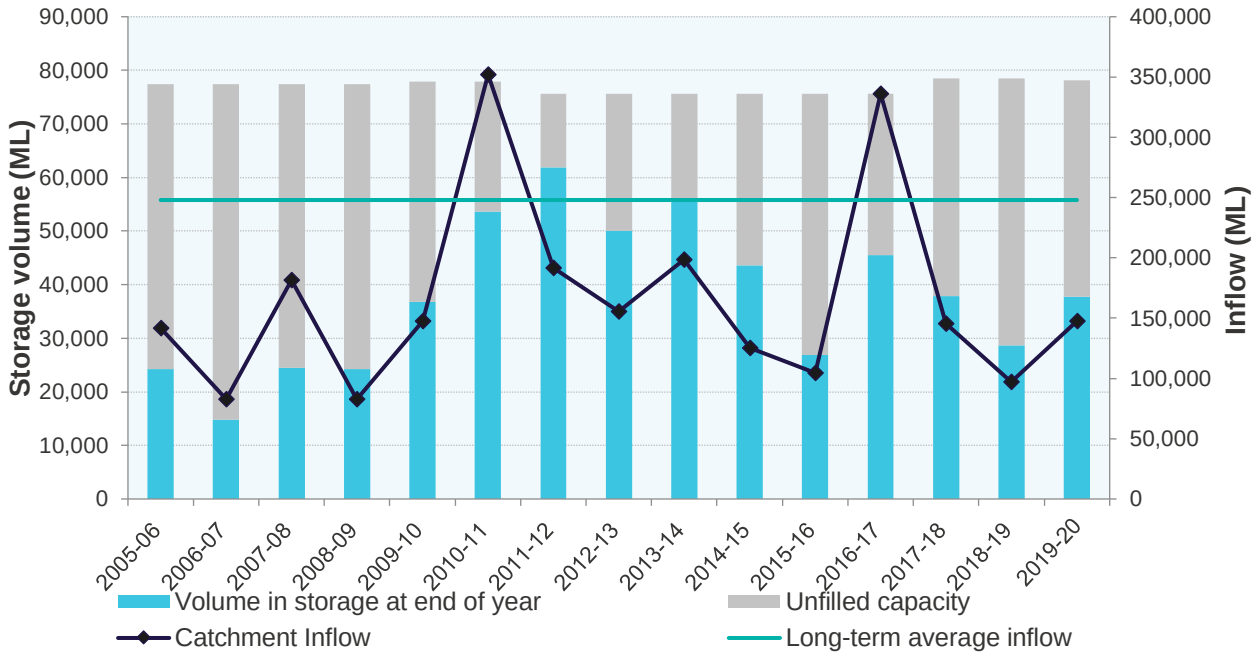
In 2019–20, rainfall:

- in the north — from Lethbridge to Ballarat — and the far eastern corner — over Point Lonsdale — was 100% to 125% of the long-term average
- in the rest of the basin was 80% to 100% of the long-term average.

Catchment inflows to the basin in 2019–20 were 59% of the long-term average of 248,000 ML, greater than in 2018–19 when inflows were 39% of the long-term average.

Major storages in the basin were at 40% of capacity on 1 July 2019 and higher (at 43% of capacity) on 30 June 2020.

Figure 6-41 Storage volumes and catchment inflows, Barwon basin



The Barwon River remained unrestricted from July to December 2019. Total bans on licensed diversions were put in place for the month of January 2020 only at the Inverleigh and Ricketts Marsh sections of the Barwon River. The Inverleigh section was on a stage 3 roster from March to May 2020.

There were no restrictions on urban water use in the Barwon basin in 2019–20, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2019–20, 45,800 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was greater than the 39,387 ML diverted in the previous year.

6.21.2.1 Water for the environment

Environmental watering sites 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 2019–20, 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 2019–20, a total of 908 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 2019–20 are shown in Table 6-135.

Table 6-135 Water balance, Barwon basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	15,407	18,345
Volume in storage at end of year	1	16,233	15,407
Change in storage		**826**	**(2,938)**
Inflows			
Catchment inflow	2	147,415	97,286
Rainfall on major storages	1	3,021	2,739
Inflows from the Moorabool River		16,876	7,285
Transfers from the Corangamite basin via Woady Yaloak Channel		0	0
Transfers from Moorabool basin to White Swan Reservoir	3	5,885	2,421
Transfers from Campaspe basin to White Swan Reservoir	3	253	931
Treated wastewater discharged back to river	4	10,376	9,471
Total inflows		**183,826**	**120,133**
Outflows			
Diversions			
Urban diversions		38,697	34,123
Licensed diversions from unregulated streams		1,087	1,140
Small catchment dams	5	6,016	4,123
Total diversions		*45,800*	*39,387*
Losses			
Evaporation from major storages	1	2,597	2,686
Net evaporation from small catchment dams	5	3,208	2,839
In-stream infiltration to groundwater, flows to floodplain and evaporation		13,224	10,325
Total losses		*19,029*	*15,851*
Water passed at outlet of basin			
River outflows to the ocean		118,171	67,833
Total water passed at outlet of basin		*118,171*	*67,833*
Total outflows		**183,000**	**123,071**

6.21.2.2 Notes to the water balance

1. Storage

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	1,423	145	193	(637)	738
West Barwon Reservoir	22,064	5,756	1,754	1,527	(1,028)	4,954
White Swan Reservoir (1)	14,107	8,228	1,123	877	2,067	10,541
Subtotal	*38,073*	*15,407*	*3,021*	*2,597*	*402*	*16,233*
Off-stream storage						
Wurdee Boluc Reservoir (2)	40,032	13,306	n/a	n/a	8,247	21,553
Subtotal	*40,032*	*13,306*	*n/a*	*n/a*	*8,247*	*21,553*
Total 2019–20	**78,105**	**28,713**	**3,021**	**2,597**	**8,649**	**37,786**
Total 2018–19	78,504	37,867	2,739	2,686	(9,207)	28,713

Notes
(1) White Swan Reservoir is treated as an on-stream storage for the purpose of the water balance.
(2) 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. Transfers of water

The 5,885 ML transfer represents water transferred to White Swan Reservoir from the Moorabool basin and 253 ML transferred to White Swan Reservoir from the Campaspe 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.

Table 6-137 Volume and use of recycled water, Barwon basin

Wastewater treatment plant	Volume 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		
Ballarat North	2,957	369	5%	4	0	147	218	2,588	0
Ballarat South	7,899	111	0%	0	0	0	111	7,788	0
Bannockburn	101	101	47%	47	0	0	54	0	0
Birregurra	15	15	40%	6	0	0	9	0	0
Black Rock	25,668	2,734	8%	1,351	755	0	628	0	22,934
Portarlington	457	456	85%	24	366	0	66	0	1
Winchelsea	58	57	10%	6	0	0	51	0	1
Total 2019–20	**37,155**	**3,843**	**7%**	**1,438**	**1,121**	**147**	**1,137**	**10,376**	**22,936**
Total 2018–19	33,842	4,919	8%	1,340	1,337	147	2,096	9,471	19,451

5. 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)	24,060	4,279	2,720	6,999
Registered/licensed commercial and irrigation	9,849	1,738	488	2,225
Total 2019–20	**33,909**	**6,017**	**3,208**	**9,224**
Total 2018–19	33,909	4,123	2,839	6,963

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 (42,429 ML) was within the volume available for the year (70,671 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 2020	Annual entitlement volume (ML) 30 June 2019
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	4,622	4,627
Licensed small catchment dams – on-waterway	921	921
Licensed small catchment dams – off-waterway	8,928	8,928
Total	**69,204**	**69,209**

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 varying, 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				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Upper Barwon system (1)	-	42,466	0	42,466	31,064
Yarrowee-White Swan system	-	12,267	0	12,267	7,633
Barwon River Environmental Entitlement (2)	-	-	-	-	-
Upper Barwon River Environmental Entitlement (3)	732	712	0	1,444	908
Take and use licences – unregulated surface water	-	4,647	90	4,737	1,087
Licensed small catchment dams	-	9,847	(90)	9,757	1,737
Total 2019–20	**732**	**69,938**	**0**	**70,671**	**42,429**
Total 2018–19	1,000	70,039	0	71,039	37,440

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.

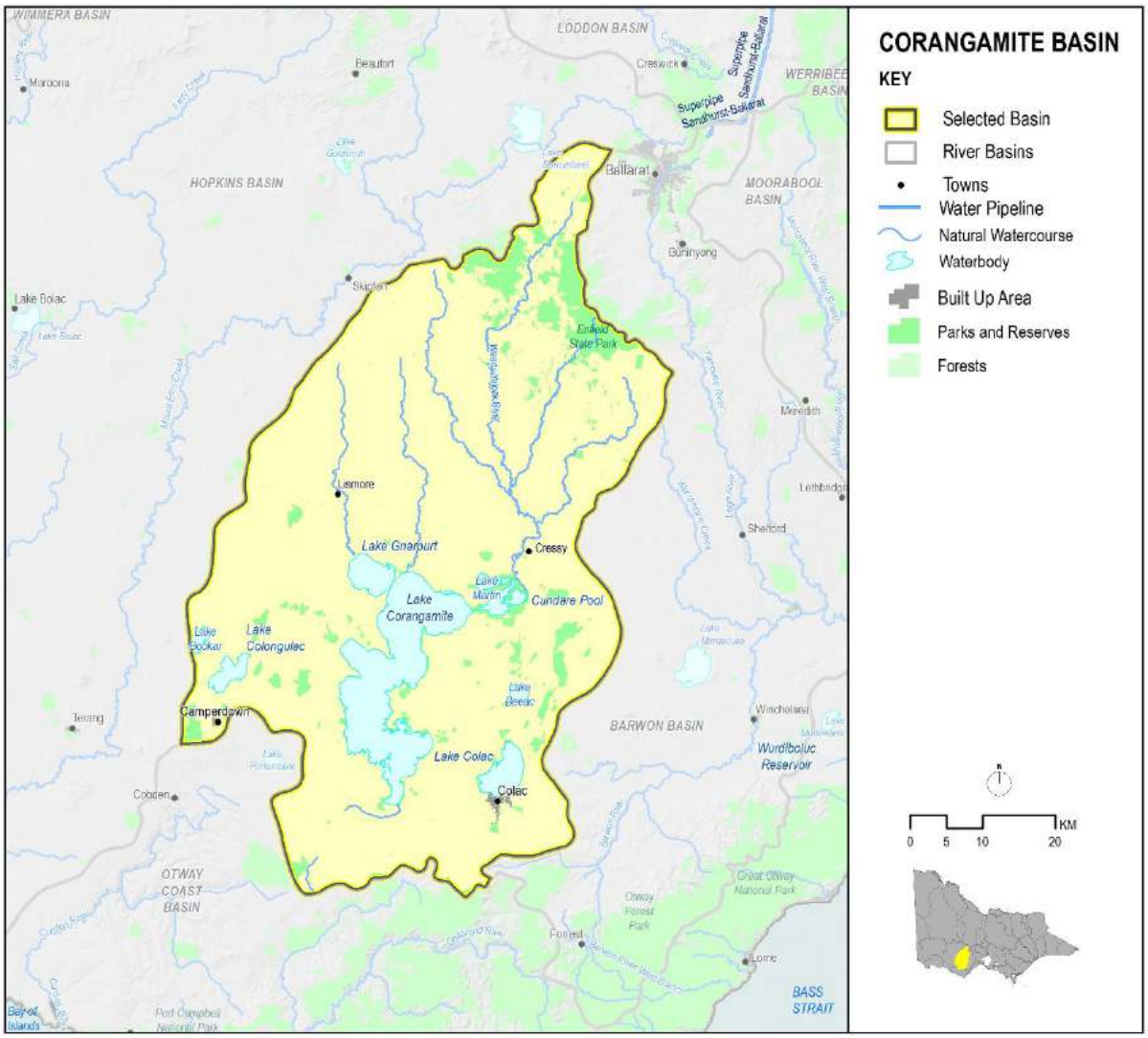
(2) Use of this entitlement depends on suitable river heights, as specified in the entitlement. Volumes delivered are not measured.

(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 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

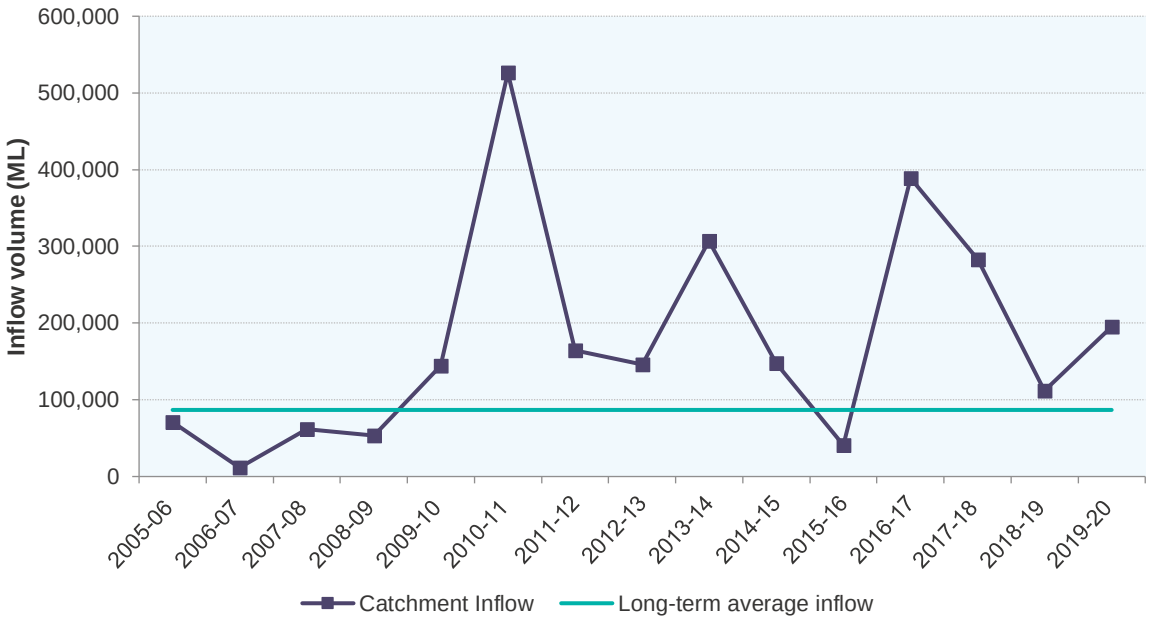
6.22.2 2019–20 water resources overview

In 2019–20, rainfall:

- in the north-western corner and the southern half of the basin was 80% to 100% of the long-term average
- in the rest of the north was 100% to 125% of the long-term average.

Catchment inflows to the basin in 2019–20 were 225% of the long-term average of 86,800 ML, greater than in 2018–19 when inflows were 128% of the long-term average. The amount of water flowing from the Corangamite basin into the Ramsar-listed Western District Lakes represented 99% of the total inflows in 2019–20.

Figure 6-43 Catchment inflows, Corangamite basin



In 2019–20, all licensed diversions from Lake Tooliorook were unrestricted for the entire year.

There were no restrictions on urban water use in the Corangamite basin in 2019–20, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2019–20, 3,075 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was more than the 1,944 ML diverted in the previous year.

6.22.2.1 Water for the environment

Environmental watering sites 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 2019–20, 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 2019–20 are shown in Table 6-142.

Table 6-142 Water balance, Corangamite basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	-	-
Volume in storage at end of year	1	-	-
Change in storage		**-**	**-**
Inflows			
Catchment inflow	2	194,972	111,426
Rainfall on major storages	1	-	-
Treated wastewater discharged back to river	3	2,097	2,004
Total inflows		**197,069**	**113,429**

Outflows			
Diversions			
Urban diversions		0	0
Licensed diversions from unregulated streams		68	60
Small catchment dams	4	3,007	1,884
Total diversions		***3,075***	***1,944***
Losses			
Evaporation from major storages	1	-	-
Net evaporation from small catchment dams	4	1,945	1,353
In-stream infiltration to groundwater, flows to floodplain and evaporation	5	-	-
Total losses		***1,945***	***1,353***
Water passed at outlet of basin			
River outflows to the Corangamite Lakes		192,049	110,132
River outflows to Barwon Basin via Woady Yaloak Channel		0	0
Total water passed at outlet of basin		***192,049***	***110,132***
Total outflows		**197,069**	**113,429**

6.22.3.1 Notes to the water balance

1. Storage

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	Volume 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	36	36	100%	0	36	0	0	0	0
Camperdown Municipal	449	448	100%	10	438	0	0	0	1
Colac	2,172	75	0%	0	0	0	75	2,097	0
Total 2019–20	**2,657**	**559**	**18%**	**10**	**474**	**0**	**75**	**2,097**	**1**
Total 2018–19	2,533	529	17%	15	426	0	88	2,004	0

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)	9,847	2,093	1,710	3,802
Registered/licensed commercial and irrigation	3,869	915	235	1,150
Total 2019–20	**13,715**	**3,008**	**1,945**	**4,952**
Total 2018–19	13,715	1,884	1,353	3,238

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 6.1.6.3).

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

- ✓ **Entitlement volume increased by 17 ML from the previous year:**
  - **this comprised 17 ML of small catchment dam licence volume issued during 2019–20.**
- ✓ **The total volume diverted (983 ML) was within the volume available for the year (4,761 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 2020	Annual entitlement volume (ML) 30 June 2019
Take and use licences – unregulated surface water	875	874
Licensed small catchment dams – on-waterway	243	243
Licensed small catchment dams – off-waterway	3,625	3,608
Total	**4,743**	**4,725**

Table 6-146 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

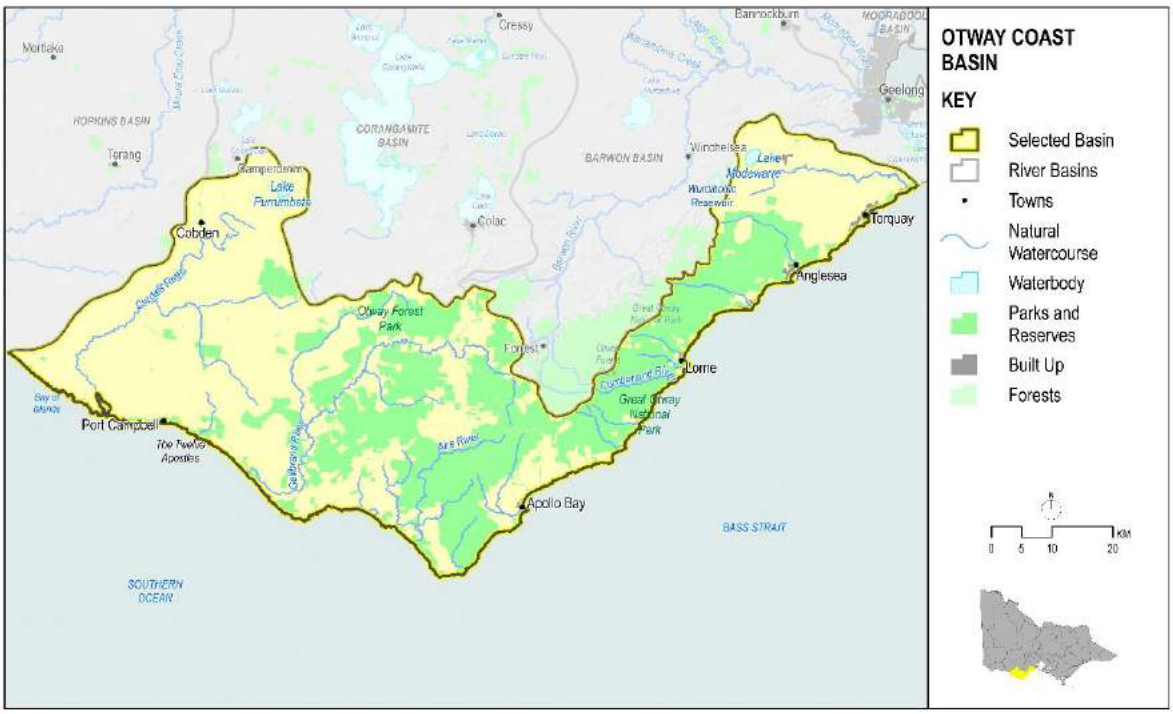
Table 6-146 Available water and take, Corangamite basin

Water entitlement	Available water				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Take and use licences – unregulated surface water	-	892	0	892	68
Licensed small catchment dams	-	3,869	0	3,869	915
Total 2019–20	**-**	**4,761**	**0**	**4,761**	**983**
Total 2018–19	-	4,725	0	4,725	655

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 Otway Coast basin



6.23.1 Management arrangements

Management of water in the Otway Coast basin is undertaken by various parties, as shown by 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 2019–20 water resources overview

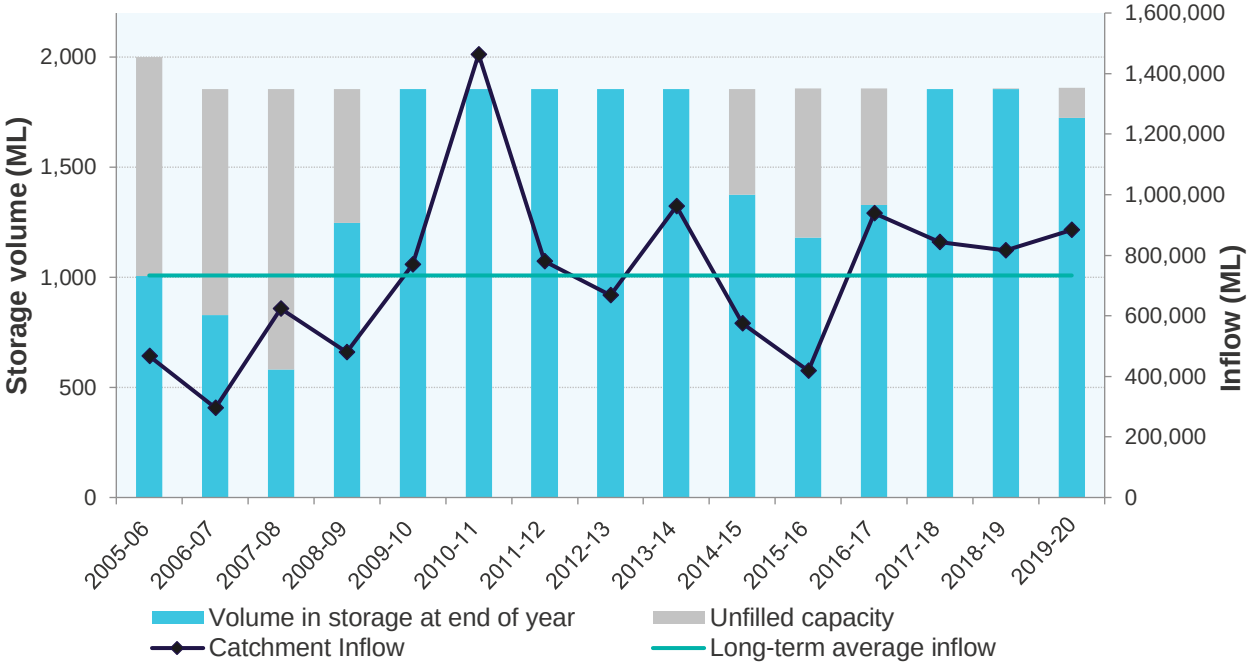
In 2019–20, rainfall in the basin was 80% to 100% of the long-term average.

Catchment inflows to the basin in 2019–20 were 121% of the long-term average of 733,300 ML, greater than in 2018–19 when inflows were 111% of the long-term average.

The amount of water flowing into Bass Strait represented 97% of the catchment inflows in the basin in 2019–20.

West Gellibrand Reservoir was at 100% of capacity on 1 July 2019 and lower (at 93% of capacity) on 30 June 2020.

Figure 6-45 Storage volumes and catchment inflows, Otway Coast basin



In 2019–20, licensed diversions from the Curdies River were banned for the month of March 2020 and from the Carlisle River for the month of April 2020. Both rivers were unrestricted for the rest of the year.

There were no restrictions on urban water use in the Otway Coast basin in 2019–20, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2019–20, 21,108 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 22,620 ML diverted in the previous year.

6.23.2.1 Water for the environment

Environmental watering sites 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 2019–20, 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 2019–20 are shown in Table 6-148.

Table 6-148 Water balance, Otway Coast basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	1,855	1,856
Volume in storage at end of year	1	1,723	1,855
Change in storage		**(132)**	**(1)**
Inflows			
Catchment inflow	2	884,419	816,710
Rainfall on major storages	1	336	342
Treated wastewater discharged back to river	3	68	72
Total inflows		**884,823**	**817,124**
Outflows			
Diversions			
Urban diversions		12,448	13,531
Licensed diversions from unregulated streams		144	175
Small catchment dams	4	8,516	8,914
Total diversions		*21,108*	*22,620*
Losses			
Evaporation from major storages	1	386	326
Net evaporation from small catchment dams	4	3,297	3,760
In-stream infiltration to groundwater, flows to floodplain and evaporation	5	-	-
Total losses		*3,683*	*4,086*
Water passed at outlet of basin			
River outflows to the ocean		860,164	790,420
Total water passed at outlet of basin		*860,164*	*790,420*
Total outflows		**884,955**	**817,125**

6.23.3.1 Notes to the water balance

1. Storage

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	1,855	336	386	(83)	1,723
Total 2019–20	**1,860**	**1,855**	**336**	**386**	**(83)**	**1,723**
Total 2018–19	1,856	1,856	342	326	(17)	1,855

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	Volume 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	0	0	0%	0	0	0	0	0	0
Anglesea	386	41	8%	30	0	0	11	0	345
Apollo Bay	483	14	0%	0	0	0	14	0	469
Cobden	136	85	63%	0	85	0	0	51	0
Lorne	294	15	0%	0	0	0	15	0	279
Peterborough	4	4	100%	0	4	0	0	0	0
Port Campbell	54	54	100%	0	54	0	0	0	0
Simpson	17	0	0%	0	0	0	0	17	0
Timboon	67	67	100%	0	67	0	0	0	0
Total 2019–20	**1,441**	**280**	**17%**	**30**	**210**	**0**	**40**	**68**	**1,093**
Total 2018–19	1,425	372	23%	82	249	0	41	72	981

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)	13,676	4,472	2,482	6,954
Registered/licensed commercial and irrigation	10,014	4,044	815	4,859
Total 2019–20	**23,691**	**8,516**	**3,297**	**11,813**
Total 2018–19	23,691	8,914	3,760	12,674

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 6.1.6.3).

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 no net increase in the total entitlement volume from the previous year.**
✓ **The total volume diverted (16,636 ML) was within the volume available for the year (34,159 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 – Otway Coast	Annual entitlement volume (ML) 30 June 2020	Annual entitlement volume (ML) 30 June 2019
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	4,467
Licensed small catchment dams – on-waterway	1,965	1,965
Licensed small catchment dams – off-waterway	8,050	8,050
Total	**34,105**	**34,149**

Table 6-153 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

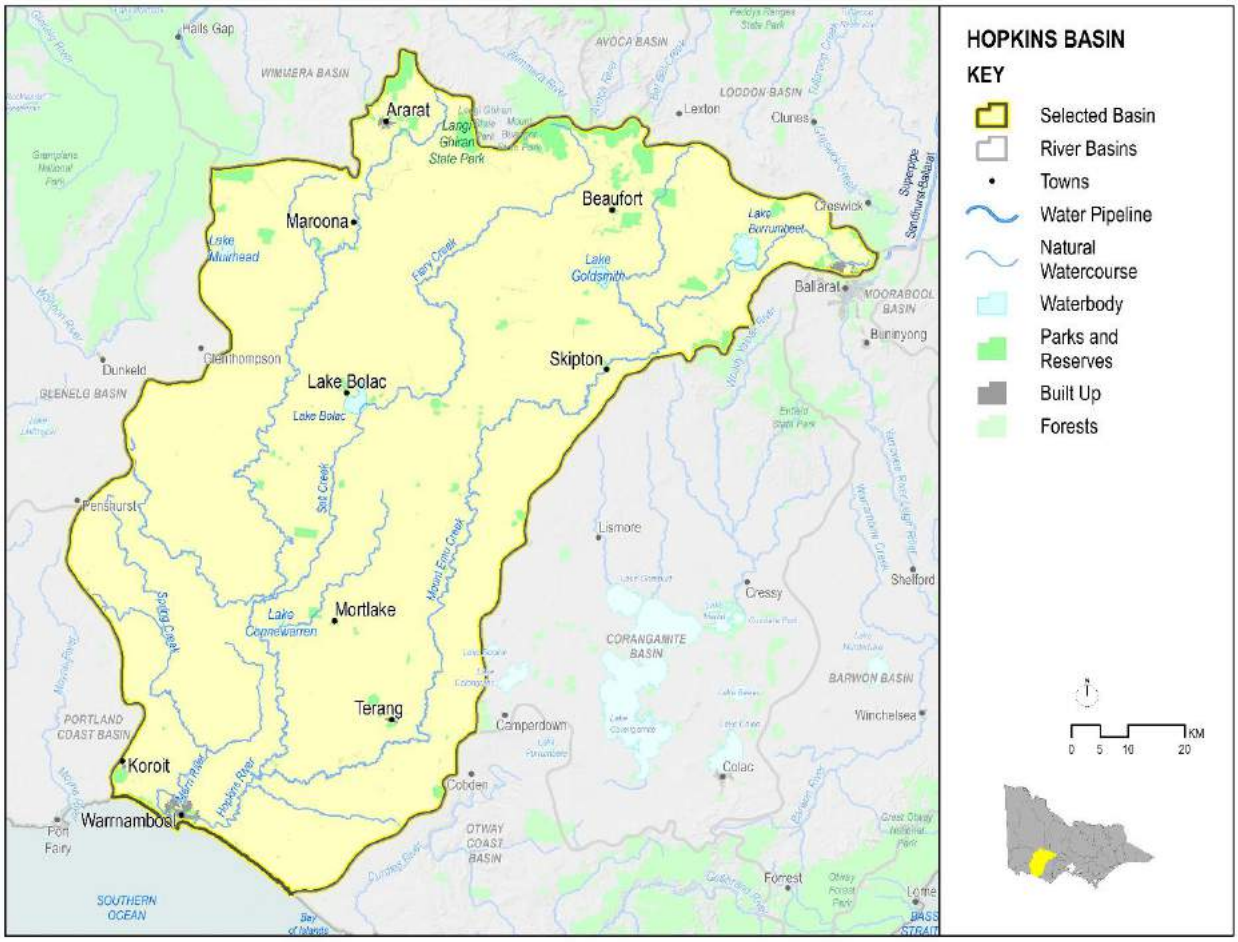
Table 6-153 Available water and take, Otway Coast basin

Water entitlement	Available water				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Aireys Inlet	-	317	0	317	0
Apollo Bay	-	800	0	800	428
Colac	-	5,400	0	5,400	3,547
Gellibrand	-	60	0	60	20
Lorne	-	510	0	510	426
Otway system	-	12,580	0	12,580	8,028
Take and use licences – unregulated surface water	-	4,477	0	4,477	144
Licensed small catchment dams	-	10,014	0	10,014	4,044
Total 2019–20	**-**	**34,159**	**0**	**34,159**	**16,636**
Total 2018–19	-	34,393	0	34,393	17,992

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 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

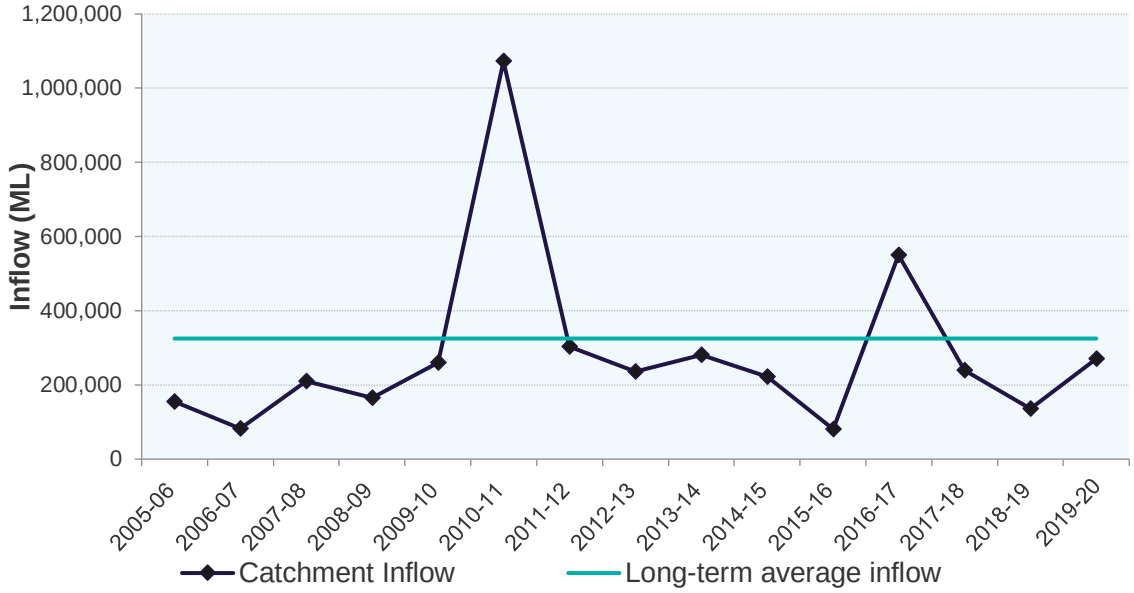
6.24.2 2019–20 water resources overview

In 2019–20, rainfall:

- in most of the basin was 80% to 100% of the long-term average
- in two areas in the centre of the basin near Mortlake was 100% to 125%.

Catchment inflows to the basin in 2019–20 were 83% of the long-term average annual volume of 325,100 ML, greater than in 2018–19 when inflows were 42% of the long-term average.

Figure 6-47 Catchment inflows, Hopkins basin



Similar to the previous year, Brucknell Creek, the Hopkins and Merri rivers and Mount Emu Creek all began 2019–20 on a stage 1 roster. Brucknell Creek and the Hopkins River were on a stage 1 roster for the whole year. A stage 2 roster was applied to the Merri River from December 2019 to the end of March 2020, when the stage 1 roster then applied until the end of the year. Stage 3 and 4 rosters were in place in Mount Emu Creek from December 2019 to February 2020 when a total ban on licensed diversions was put in place for the month of March 2020. Licensed diversions were put on a stage 2 roster for April and a stage 1 roster for May and June 2020.

There were no restrictions on urban water use in the Hopkins basin in 2019–20, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2019–20, 7,628 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was more than the 5,722 ML diverted in the previous year.

6.24.2.1 Water for the environment

Environmental watering sites 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 2019–20, 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 2019–20 are shown in Table 6-155.

Table 6-155 Water balance, Hopkins basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	-	-
Volume in storage at end of year	1	-	-
Change in storage		**-**	**-**
Inflows			
Catchment inflow	2	269,866	135,766
Rainfall on major storages	1	-	-
Treated wastewater discharged back to river	3	64	0
Total inflows		**269,930**	**135,766**
Outflows			
Diversions			
Urban diversions		167	221
Licensed diversions from unregulated streams		2,032	2,401
Small catchment dams	4	5,429	3,099
Total diversions		*7,628*	*5,722*
Losses			
Evaporation from major storages	1	-	-
Net evaporation from small catchment dams	4	4,172	2,825
In-stream infiltration to groundwater, flows to floodplain and evaporation	5	-	-
Total losses		*4,172*	*2,825*
Water passed at outlet of basin			
River outflows to the ocean		258,130	127,219
Total water passed at outlet of basin		*258,130*	*127,219*
Total outflows		**269,930**	**135,766**

6.24.3.1 Notes to the water balance

1. Storage

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	Volume produced (ML)	Volume recycled (ML)	Percent recycled	Type of end use (ML)				Volume discharged to the environment	Volume discharged to ocean/other (ML)
				Urban and industrial	Agriculture	Beneficial allocation	Within plant process		
Ararat [1]	612	612	99%	118	488	0	6	0	0
Beaufort	63	63	100%	0	63	0	0	0	0
Cardigan Village	70	57	81%	0	57	0	0	12	1
Mortlake	149	97	65%	6	91	0	0	52	0
Snake Valley	12	12	100%	0	12	0	0	0	0
Skipton [2]	0	0	0%	0	0	0	0	0	0
Terang	143	143	100%	0	143	0	0	0	0
Warrnambool	5,499	54	0%	6	0	0	48	0	5,445
Willaura	22	7	32%	7	0	0	0	0	15
Total 2019–20	**6,570**	**1,045**	**15%**	**137**	**854**	**0**	**54**	**64**	**5,461**
Total 2018–19	6,643	1,007	14%	151	790	0	65	0	5,637

Notes

(1) At the Ararat treatment plant, 192 ML of the 'Volume produced' was created in the previous year and carried over.

(2) The Skipton wastewater treatment plant was 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 6-157 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	4,264	3,779	8,043
Registered/licensed commercial and irrigation	8,146	1,165	393	1,558
Total 2019–20	**36,088**	**5,429**	**4,172**	**9,601**
Total 2018–19	36,088	3,099	2,825	5,924

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 6.1.6.3).

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 (3,364 ML) was within the volume available for the year (18,046 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 – Hopkins	Annual entitlement volume (ML) 30 June 2020	Annual entitlement volume (ML) 30 June 2019
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	2,314	2,219
Licensed small catchment dams – off-waterway	5,832	5,927
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.

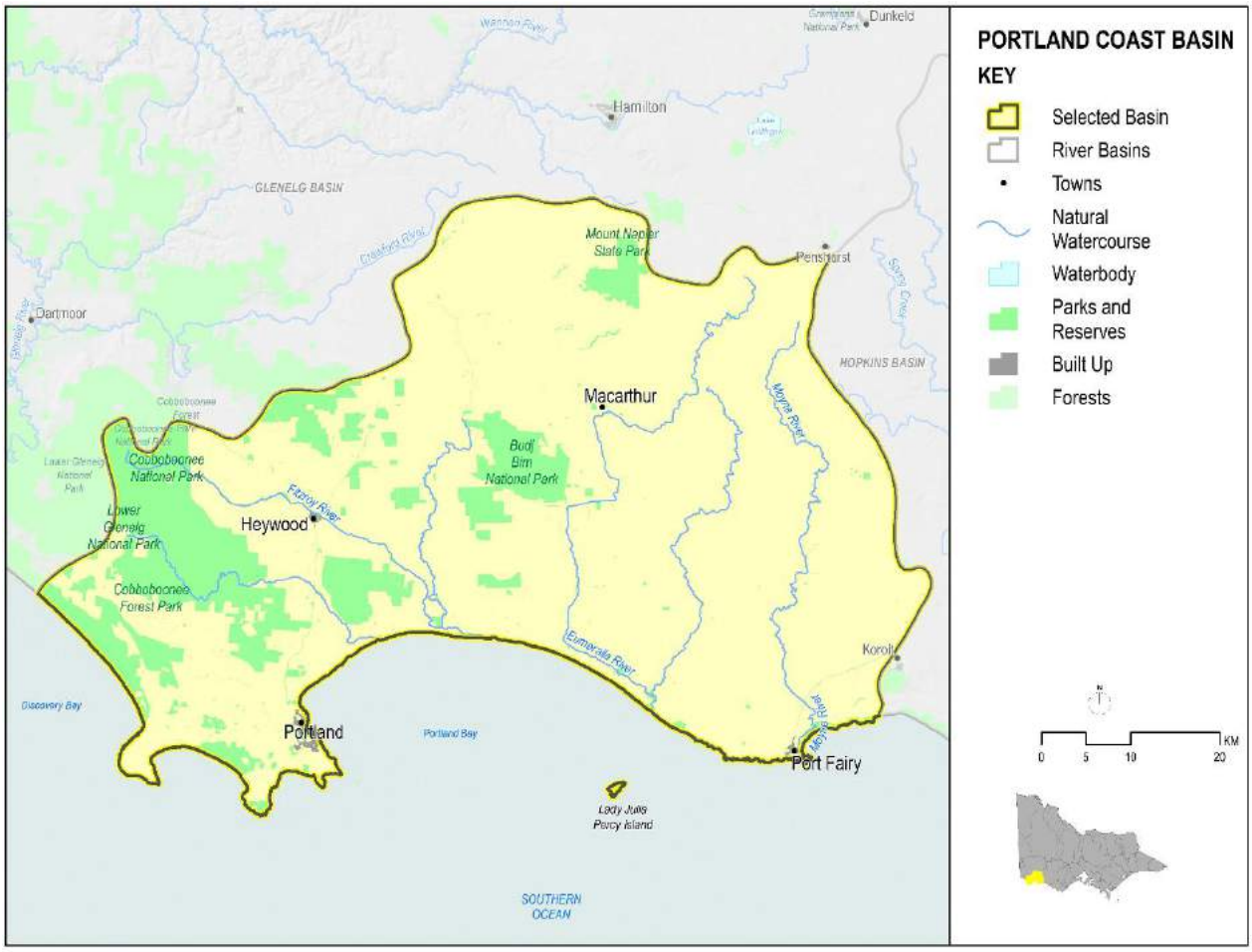
Table 6-159 Available water and take, Hopkins basin

Water entitlement	Available water				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Beaufort	-	419	0	419	167
Skipton	-	210	0	210	0
Take and use licences – unregulated surface water	-	9,176	0	9,176	2,032
Licensed small catchment dams	-	8,241	0	8,241	1,165
Total 2019–20	**-**	**18,046**	**0**	**18,046**	**3,364**
Total 2018–19	-	17,999	0	17,999	3,258

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 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

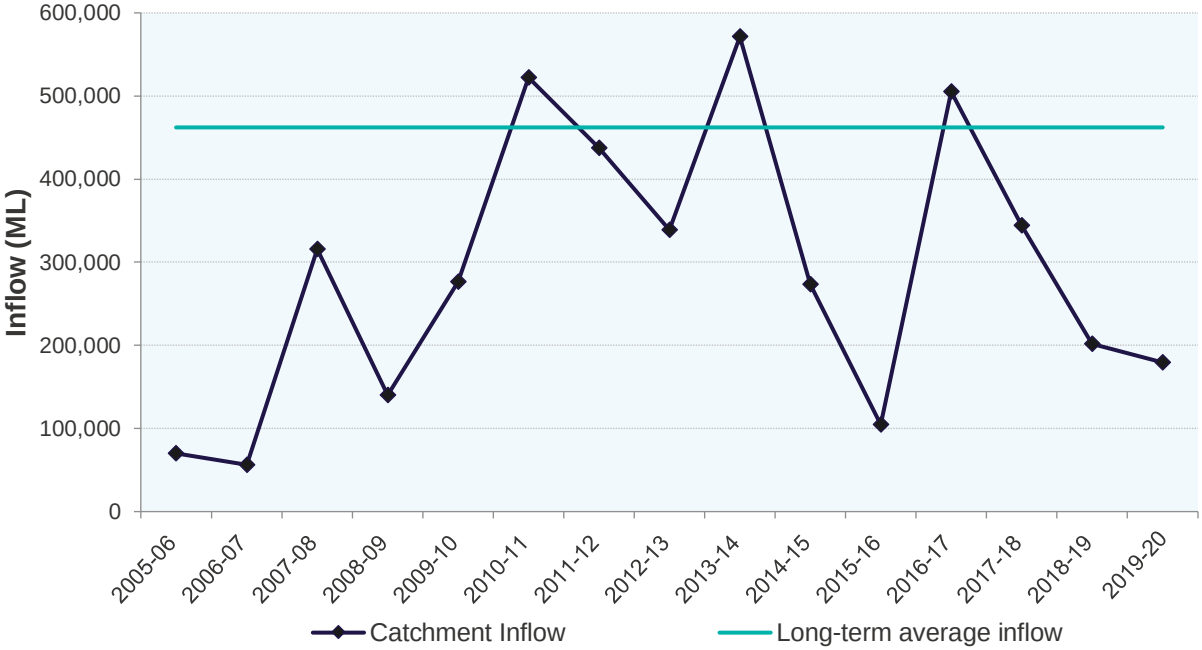
Authority	Management responsibilities
Southern Rural Water	Manages licensed diversions
Wannon Water	Supplies groundwater to Koroit, Port Fairy, Heywood and Portland
Glenelg Hopkins Catchment Management Authority	Responsible for waterway and catchment management in the whole Portland Coast basin

6.25.2 2019–20 water resources overview

In 2019–20, rainfall in the basin was 80% to 100% of the long-term average.

Catchment inflows to the basin in 2019–20 were 39% of the long-term average annual volume of 462,200 ML, less than in 2018–19 when inflows were 44% of the long-term average.

Figure 6-49 Catchment inflows, Portland Coast basin



In 2019–20, a ban on licensed diversions was implemented for the Fitzroy, Eumeralla and Moyne rivers from December 2019 and the Surrey River from January 2020. These bans were in place until the end of April 2020, and the four rivers were unrestricted for May to June 2020. Licensed diversions were unrestricted from Darlots Creek for the whole of 2019–20.

There were no restrictions on urban water use in the Portland Coast basin in 2019–20, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2019–20, 1,322 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was more than the 1,217 ML diverted in the previous year.

6.25.2.1 Water for the environment

Environmental watering sites 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 2019–20, 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, Darlot 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 2019–20 are shown in Table 6-161.

Table 6-161 Water balance, Portland Coast basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	-	-
Volume in storage at end of year	1	-	-
Change in storage		**-**	**-**

Inflows			
Catchment inflow	2	179,570	202,080
Rainfall on major storages	1	-	-
Treated wastewater discharged back to river	3	168	220
Total inflows		**179,738**	**202,300**
Outflows			
Diversions			
Licensed diversions from unregulated streams		0	0
Small catchment dams	4	1,322	1,217
Total diversions		*1,322*	*1,217*
Losses			
Evaporation from major storages	1	-	-
Net evaporation from small catchment dams	4	860	1,019
In-stream infiltration to groundwater, flows to floodplain and evaporation	5	-	-
Total losses		*860*	*1,019*
Water passed at outlet of basin			
River outflows to the ocean		177,556	200,063
Total water passed at outlet of basin		*177,556*	*200,063*
Total outflows		**179,738**	**202,300**

6.25.3.1 Notes to the water balance

1. Storage

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	Volume 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		
Heywood	255	86	34%	0	86	0	0	168	1
Port Fairy Domestic	628	0	0%	0	0	0	0	0	628
Port Fairy Industrial	176	0	0%	0	0	0	0	0	176
Portland	1,647	0	0%	0	0	0	0	0	1,647
Total 2019–20	**2,706**	**86**	**3%**	**0**	**86**	**0**	**0**	**168**	**2,452**
Total 2018–19	2,634	125	5%	0	125	0	0	220	2,289

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)	6,594	1,232	833	2,065
Registered/licensed commercial and irrigation	497	90	27	117
Total 2019–20	**7,090**	**1,322**	**860**	**2,182**
Total 2018–19	7,090	1,217	1,019	2,237

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 6.1.6.3).

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 (90 ML) was within the volume available for the year (1,507 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 2020	Annual entitlement volume (ML) 30 June 2019
Take and use licences – unregulated surface water	1,003	1,011
Licensed small catchment dams – on-waterway	67	67
Licensed small catchment dams – off-waterway	429	429
Total	**1,499**	**1,507**

Table 6-165 shows the amount available to be taken by entitlement holders and the amount they have taken during the water year.

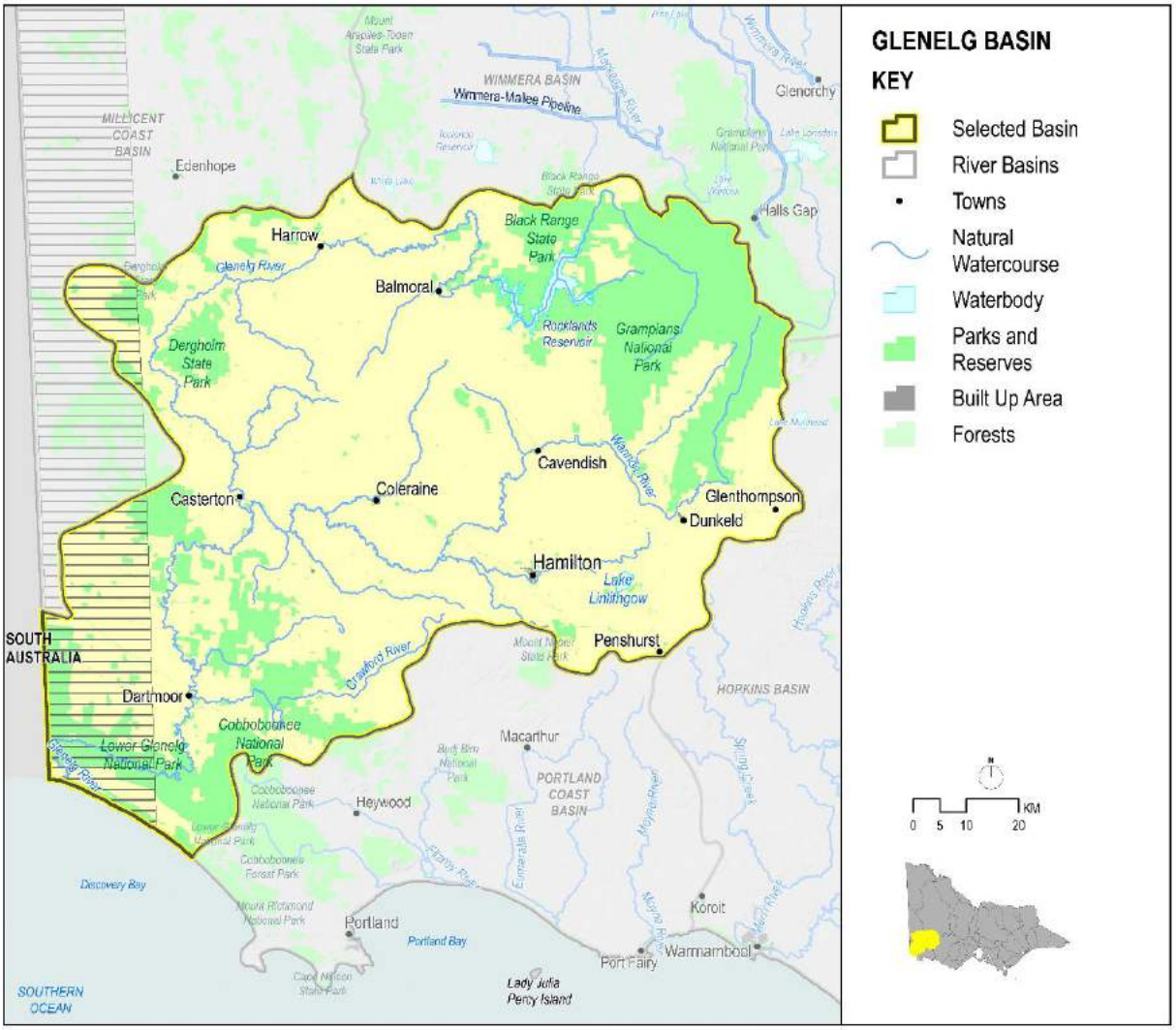
Table 6-165 Available water and take, Portland Coast basin

Water entitlement	Available water				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Take and use licences – unregulated surface water	-	1,011	0	1,011	0
Licensed small catchment dams	-	497	0	497	90
Total 2019–20	**-**	**1,507**	**0**	**1,507**	**90**
Total 2018–19	-	1,507	0	1,507	81

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 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 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 2019–20 water resources overview

In 2019–20, rainfall:

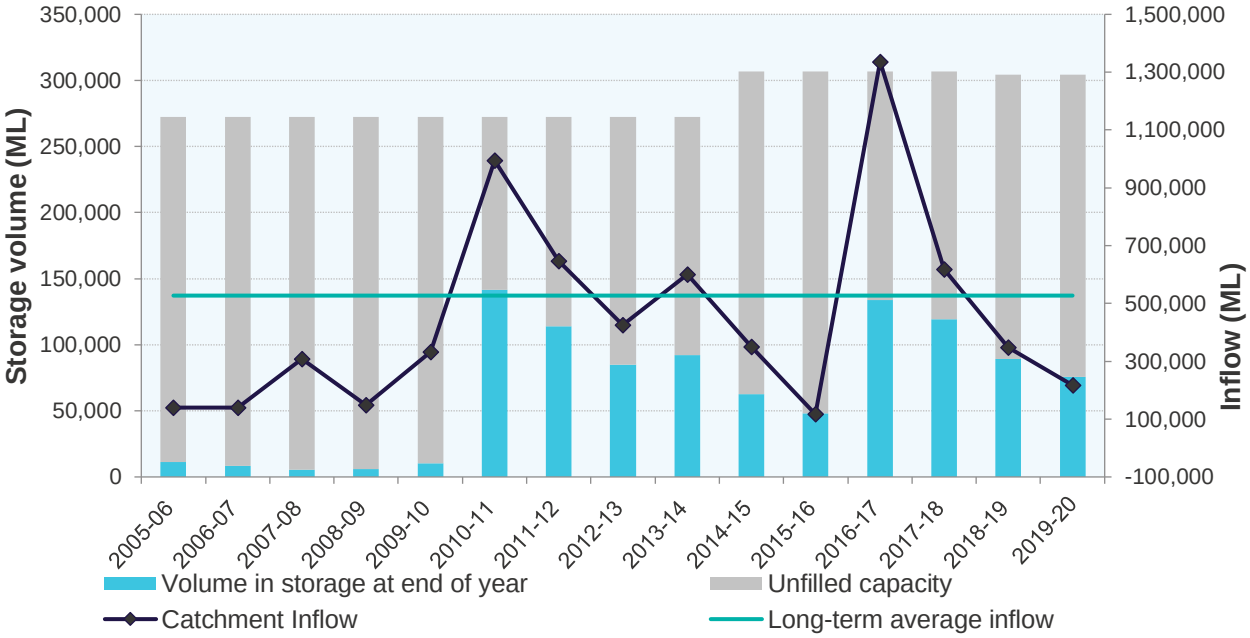
- in most of the basin was 80% to 100% of the long-term average

- in an area near the border with South Australia south-west of Casterton was 100% to 125% of the long-term average.

Catchment inflows to the basin in 2019–20 were 41% of the long-term average of 527,300 ML, greater than in 2018–19 when inflows were 66% of the long-term average.

Major storages in the basin were at 29% of capacity on 1 July 2019 and lower (at 25% of capacity) on 30 June 2020.

Figure 6-51 Storage volumes and catchment inflows, Glenelg basin



In 2019–20, a ban on all licensed diversions was implemented on the Crawford and Wannon rivers from December 2019. It was lifted on the Wannon River by the end of March 2020 and on the Crawford River by the end of April 2020. The Glenelg and Grange Burn rivers were unrestricted for the entirety of 2019–20.

There were no restrictions on urban water use in the Glenelg basin in 2019–20, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2019–20, 16,490 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 20,287 ML diverted in the previous year.

6.26.2.1 Water for the environment

- Environmental watering sites in the Glenelg basin that depend on water for the environment include:
- the lower Glenelg River, which is a heritage river and which rely 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 2019–20, 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 2019–20, a total of 12,292 ML of environmental water was used in the Glenelg basin. This was all delivered in-stream for the Glenelg River. This volume includes 1,970 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 2019–20 are shown in Table 6-167.

Table 6-167 Water balance, Glenelg basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	89,238	119,162
Volume in storage at end of year	1	75,646	89,238
Change in storage		**(13,592)**	**(29,924)**
Inflows			
Catchment inflow	2	217,010	347,250
Rainfall on major storages	1	11,495	12,051
Treated wastewater discharged back to river	3	0	144
Total inflows		**228,505**	**359,445**
Outflows			
Diversions			
Urban diversions		1,813	1,619
Transfers to the Wimmera basin		9,236	12,606
Licensed diversions from unregulated streams		124	124
Small catchment dams	4	5,317	5,938
Total diversions		*16,490*	*20,287*
Losses			
Evaporation from major storages	1	27,781	22,805
Net evaporation from small catchment dams	4	4,770	5,934
In-stream infiltration to groundwater, flows to floodplain and evaporation		34,066	48,751
Total losses		*66,617*	*77,490*
Water passed at outlet of basin			
River outflows to the ocean		158,990	291,592
Total water passed at outlet of basin		*158,990*	*291,592*
Total outflows		**242,097**	**389,369**

6.26.3.1 Notes to the water balance

1. Storage

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	1,802	n/a	n/a	10	1,812
Moora Moora Reservoir	6,300	2,720	2,080	3,717	1,597	2,680
Rocklands Reservoir	296,000	84,716	9,415	24,064	1,087	71,154
Total 2019–20	**304,220**	**89,238**	**11,495**	**27,781**	**2,694**	**75,646**
Total 2018–19	304,220	119,162	12,051	22,805	(19,170)	89,238

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. 100% of their wastewater was recycled in 2019–20.

Table 6-169 Volume and use of recycled water, Glenelg basin

Wastewater treatment plant	Volume 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	77	77	100%	0	77	0	0	0	0
Coleraine	39	39	100%	0	39	0	0	0	0
Dunkeld	12	12	100%	12	0	0	0	0	0
Hamilton	570	570	100%	38	532	0	0	0	0
Total 2019–20	**698**	**698**	**100%**	**50**	**648**	**0**	**0**	**0**	**0**
Total 2018–19	924	780	84%	33	747	0	0	143	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)	32,525	4,905	4,608	9,512
Registered/licensed commercial and irrigation	3,084	413	162	575
Total 2019–20	**35,610**	**5,318**	**4,770**	**10,087**
Total 2018–19	35,610	5,938	5,934	11,872

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 (2,350 ML) was within the volume available for the year (8,612 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 2020	Annual entitlement volume (ML) 30 June 2019
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	970	974
Licensed small catchment dams – on-waterway	66	66
Licensed small catchment dams – off-waterway	3,019	3,019
Total	**8,608**	**8,612**

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				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Coleraine, Casterton, Sandford	-	855	0	855	85
Dunkeld system	-	170	0	170	18
Glenthompson	-	94	0	94	12
Hamilton	-	3,435	0	3,435	1,698
Take and use licences – unregulated surface water	-	974	0	974	124
Licensed small catchment dams	-	3,084	0	3,084	413
Total 2019–20	**-**	**8,612**	**0**	**8,612**	**2,350**
Total 2018–19	-	8,616	0	8,616	2,214

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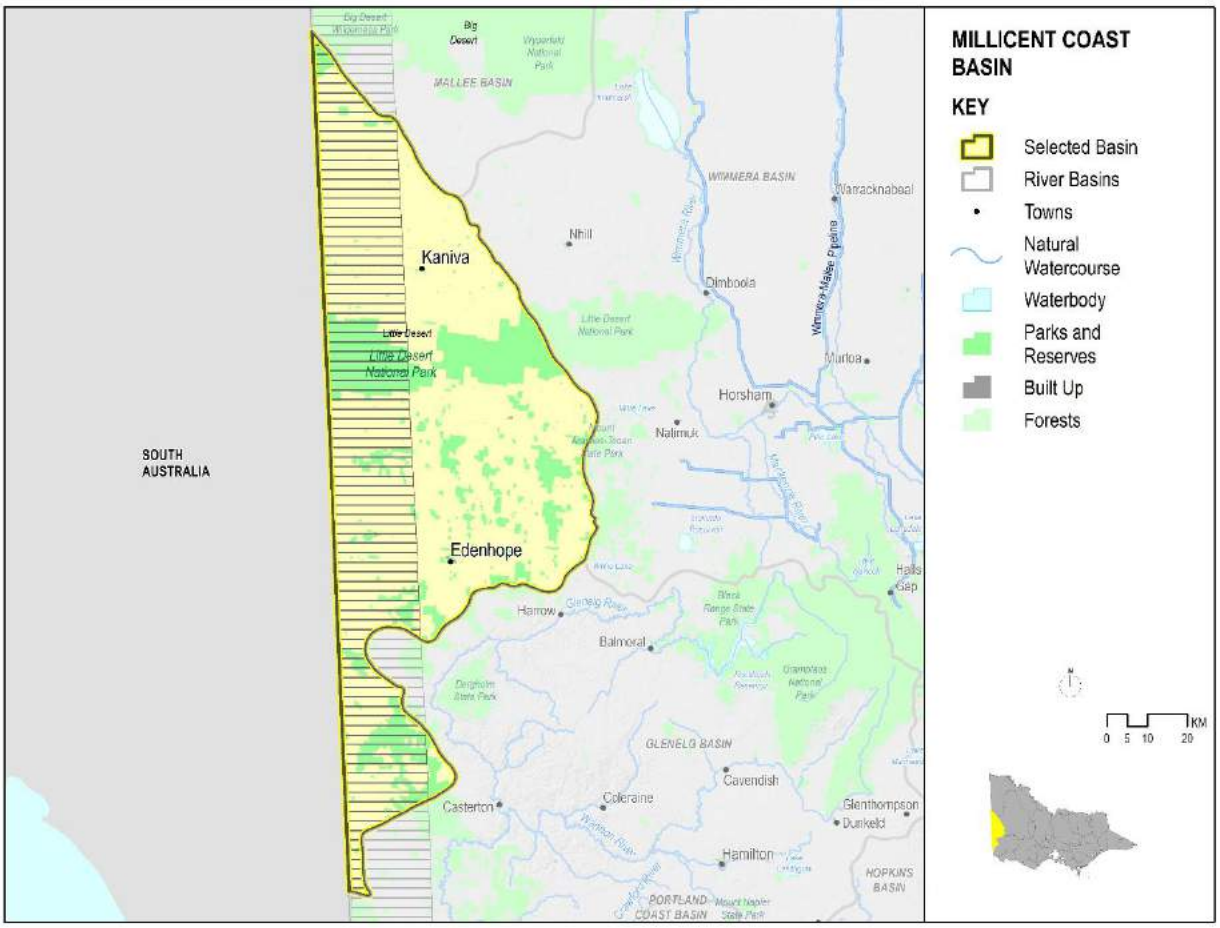
6.27 Millicent Coast basin

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 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 2019–20 water resources overview

In 2019–20, rainfall:

- in most of the basin was 80% to 100% of the long-term average
- in a small area at the southern end of the basin was 100% to 125% of the long-term average.

Groundwater taken from the West Wimmera GMA is the main source of water supply in the Millicent Coast basin. Chapter 7.6.1 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 2019–20, 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 2019–20, 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

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	Volume 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)	2	2	100%	2	0	0	0	0	0
Kaniva North (2)	0	0	0%	0	0	0	0	0	0
Kaniva South (2)	0	0	0%	0	0	0	0	0	0
Serviceton (2)	0	0	0%	0	0	0	0	0	0
Total 2019–20	**2**	**2**	**100%**	**2**	**0**	**0**	**0**	**0**	**0**
Total 2018–19	71	10	13%	10	0	0	0	0	61

Notes

(1) At the Edenhope treatment plant, the 2 ML 'Volume produced' was created in the previous year and carried over.

(2) Wastewater treatment plants at Kaniva North, Kaniva South and Serviceton were operational but did not output any recycled water 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	191	437	628
Registered/licensed commercial and irrigation	5,071	55	33	88
Total 2019–20	**9,727**	**247**	**469**	**716**
Total 2018–19	9,727	367	648	1,015

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 (59 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 2020	Annual entitlement volume (ML) 30 June 2019
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.

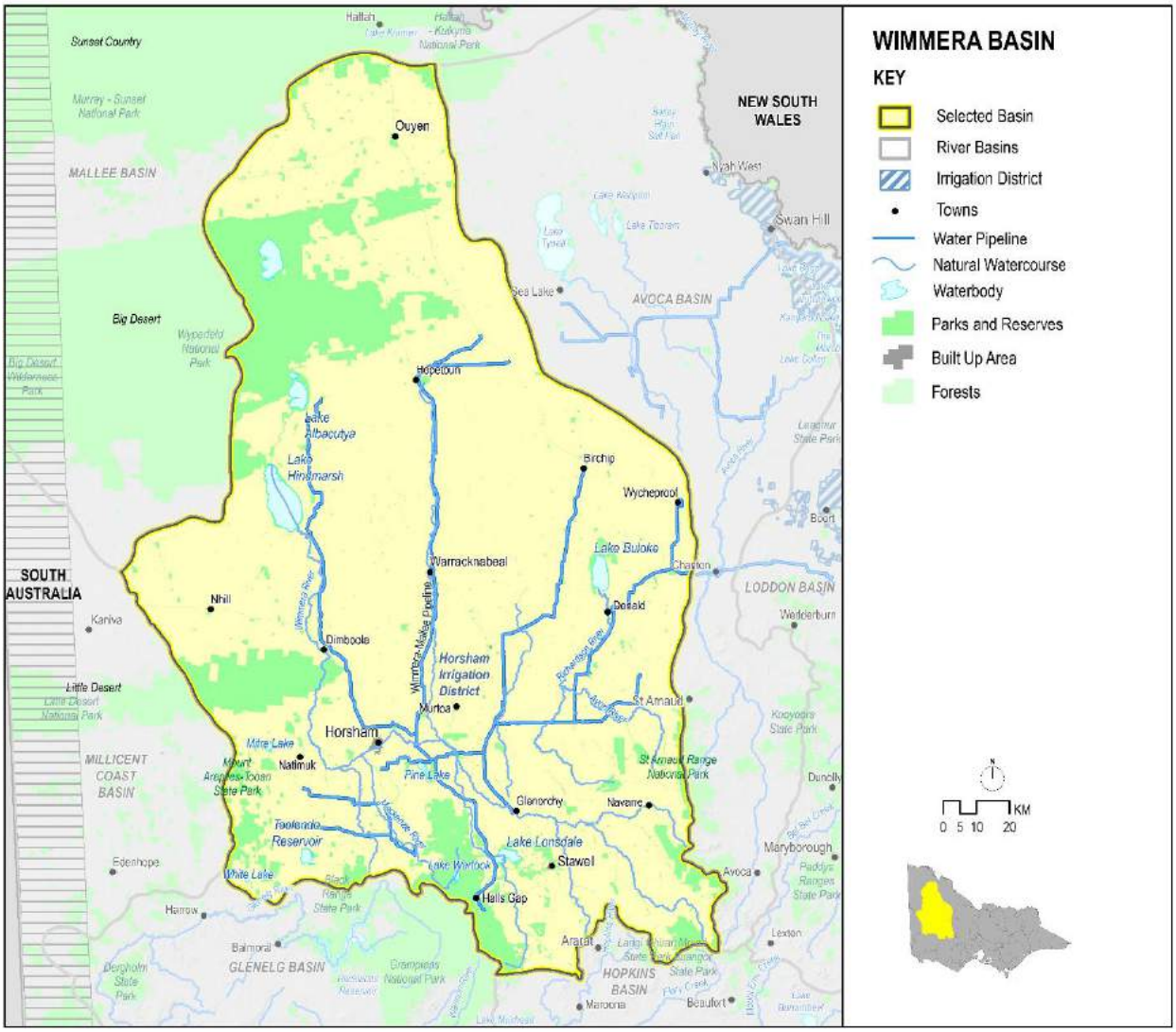
Table 6-177 Available water and take, Millicent Coast basin

Water entitlement	Available water				Water taken
	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	55
Total 2019–20	**-**	**5,075**	**0**	**5,075**	**59**
Total 2018–19	-	5,075	0	5,075	163

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 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 2019–20 water resources overview

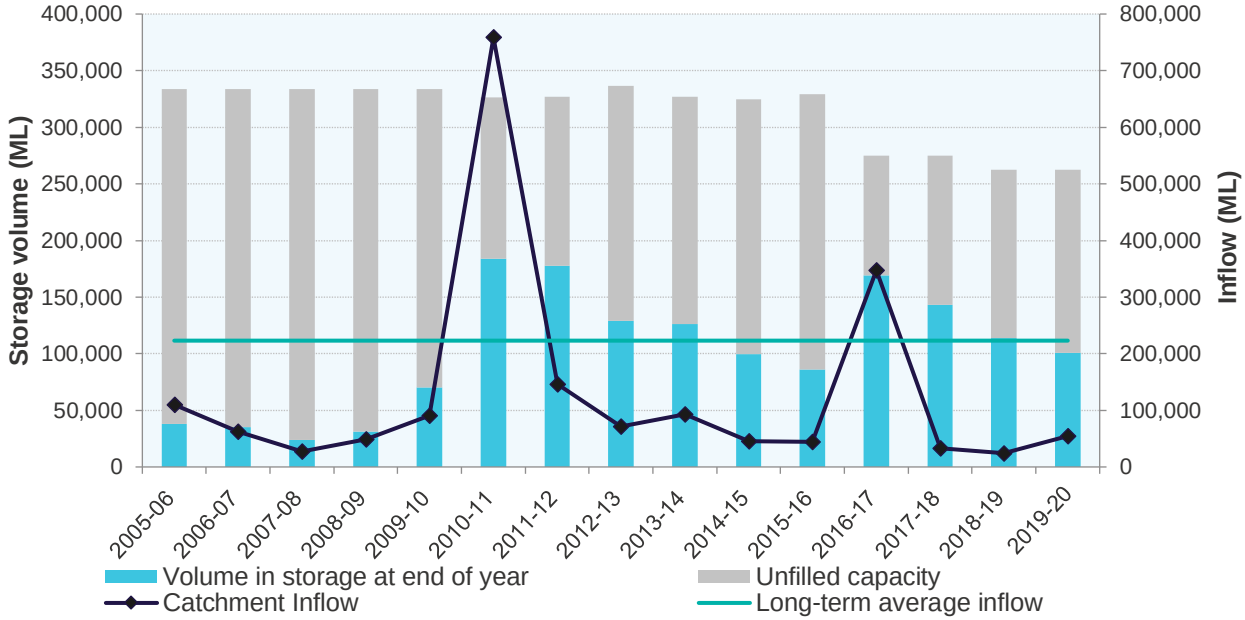
In 2019–20, rainfall:

- in most of the basin was 80% to 100% of the long-term average
- in a small area in the south-east — from St. Arnaud to Stawell — was 60% to 80% of the long-term average.

Catchment inflows to the basin in 2019–20 were 25% of the long-term average of 223,100 ML, greater than in 2018–19 when inflows were 11% of the long-term average.

Major storages in the basin were at 43% of capacity on 1 July 2019 and lower (at 38% of capacity) on 30 June 2020.

Figure 6-54 Storage volumes and catchment inflows, Wimmera basin



Seasonal allocations for the Wimmera-Glenelg system were lower in 2019–20 than in the previous year. The Wimmera Mallee Pipeline Product began the year with a 0% opening seasonal allocation in July 2019, which then reached 40% in February 2018 and ended slightly higher with 42% in March.

Licensed diversions from the Wimmera and Avon rivers were restricted in July 2019, but trigger rules were satisfied in August and diversions were then unrestricted for the remainder of the year.

There were no restrictions on urban water use in the Wimmera basin in 2019–20, with all towns in the basin remaining on permanent water-saving rules throughout the year.

In 2019–20, 22,342 ML of water was diverted for consumptive uses: town, domestic and stock, irrigation and commercial supply. This was less than the 23,242 ML diverted in the previous year.

6.28.2.1 Water for the environment

Environmental watering sites 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 2019–20, 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 12,354 ML of environmental water was used in the Wimmera basin in 2019–20; 94 ML of this was diverted off-stream, 690 ML was passing flows and the remainder was delivered in-stream.

6.28.3 Water balance

The total volumes of water available and supplied from water resources in the Wimmera basin in 2019–20 are shown in Table 6-179.

Table 6-179 Water balance, Wimmera basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	113,638	143,242
Volume in storage at end of year	1	100,919	113,638
Change in storage		**(12,719)**	**(29,604)**
Inflows			
Catchment inflow	2	54,700	24,306
Rainfall on major storages	1	17,375	18,811
Transfer from Glenelg basin		9,236	12,606
Treated wastewater discharged back to river	3	0	0
Total inflows		**81,311**	**55,723**
Outflows			
Diversions			
Urban diversions and domestic and stock use		17,198	18,317
Diversions for irrigation		0	0
Licensed diversions from unregulated streams		670	422
Environmental water diversions		94	147
Supply to designated recreational lakes		2,264	2,369
Small catchment dams	4	2,116	1,986
Total diversions		*22,342*	*23,242*
Losses			
Evaporation from major storages		39,905	39,028
Net evaporation from small catchment dams	4	2,709	2,661
In-stream infiltration to groundwater, flows to floodplain and evaporation		14,886	11,858
Total losses		*57,500*	*53,547*
Water passed at outlet of basin			
River outflows to Lake Buloke		966	4
River outflows to Lake Hindmarsh (measured at Tarranyurk)		13,222	8,534
Total water passed at outlet of basin		*14,188*	*8,538*
Total outflows		**94,030**	**85,327**

6.28.3.1 Notes to the water balance

1. Storage

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	12,896	1,704	4,310	3,296	13,586
Green Lake [1]	5,350	2,384	n/a	n/a	(16)	2,368
Lake Bellfield	78,560	53,868	2,659	3,909	(4,182)	48,436
Lake Lonsdale	53,300	9,923	4,873	13,426	5,404	6,774
Taylors Lake	27,060	9,450	1,070	4,168	4,448	10,800
Toolondo Reservoir	50,530	13,640	2,408	7,057	(861)	8,130
Wartook Reservoir	29,300	11,477	4,661	7,035	1,722	10,825
Total 2019–20	**262,560**	**113,638**	**17,375**	**39,905**	**9,811**	**100,919**
Total 2018–19	262,560	143,242	18,811	39,028	(9,387)	113,638

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	Volume 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]	39	74	190%	0	74	0	0	0	(35)
Dimboola	77	4	5%	0	4	0	0	0	73
Donald	104	83	80%	0	83	0	0	0	21
Halls Gap	114	49	43%	32	17	0	0	0	65
Hopetoun [2]	0	0	0%	0	0	0	0	0	0
Horsham	1,034	889	86%	145	744	0	0	0	145
Jeparit [2]	0	0	0%	0	0	0	0	0	0
Minyip [2]	0	0	0%	0	0	0	0	0	0
Murtoa	22	22	100%	0	22	0	0	0	0
Natimuk [2]	0	0	0%	0	0	0	0	0	0
Nhill	88	54	61%	0	54	0	0	0	34
Ouyen [2]	0	0	0%	0	0	0	0	0	0
Rainbow [2]	0	0	0%	0	0	0	0	0	0
Rupanyup	12	1	8%	0	1	0	0	0	11
Stawell [3]	452	452	100%	187	265	0	0	0	0
Warracknabeal [4]	144	144	100%	130	14	0	0	0	0
Wycheproof	24	24	100%	0	24	0	0	0	0
Total 2019–20	**2,110**	**1,796**	**85%**	**494**	**1,302**	**0**	**0**	**0**	**314**
Total 2018–19	2,447	1,848	75%	541	1,306	0	0	0	599

Notes
(1) In Birchip, effluent was carried over from the previous year and recycled in 2019–20.
(2) Wastewater treatment plants at Hopetoun, Jeparit, Minyip, Natimuk, Ouyen and Rainbow were operational but did not output any recycled water this year.
(3) At the Stawell treatment plant, 124 ML of the 'Volume produced' was created in the previous year and carried over.
(4) At the Warracknabeal treatment plant, 74 ML of the 'Volume produced' was created in the previous year and carried over.

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	1,561	2,416	3,977
Registered/licensed commercial and irrigation	7,436	554	293	848
Total 2019–20	**36,971**	**2,115**	**2,709**	**4,824**
Total 2018–19	36,971	1,986	2,661	4,647

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 (42,660 ML) was within the volume available for the year (177,477 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

	Annual entitlement volume (ML) 30 June 2020	Annual entitlement volume (ML) 30 June 2019
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]	2,078	2,179
Licensed small catchment dams – off-waterway	7,436	7,436
Total	**136,089**	**136,190**

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 purposes.

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				Water taken
	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	198
Willaura system – Wannon Water	-	58	0	58	37
Diversion: Willaura, Elmhurst and Buangor systems – GWMWater				466	235
Wimmera and Glenelg Rivers – GWMWater					
GWMWater Wimmera Mallee Pipeline Product	80,366	18,779	(2,600)	96,545	15,326
Supply by agreement – CEWH [1]	1,562	0	0	1,562	1,562
Glenelg compensation flow	1,705	33	0	1,738	632
Recreation	210	0	2,600	2,810	2,264
Pipeline loss allowance	8,437	2,605	0	11,042	696
Wimmera and Glenelg Rivers – Coliban Water	220	126	0	346	264
Wimmera and Glenelg Rivers – Wannon Water	6,110	890	0	7,000	45
Wimmera and Glenelg Rivers Environmental Entitlement [2]	29,317	17,035	0	46,352	20,413
Diversion: Wimmera and Glenelg Rivers [3]				167,395	41,201
Take and use licences – unregulated surface water	-	2,121	0	2,121	670
Licensed small catchment dams	-	7,436	0	7,436	555
Total 2019–20	**127,926**	**49,551**	**0**	**177,477**	**42,660**
Total 2018–19	149,408	59,351	0	208,759	51,472

Notes

(1) The supply by agreement – CEWH entitlement is 1,562 ML of environmental in-stream use. The in-stream use amount is not included in the water balance in Table 6-179, as it is not an actual diversion from the waterway.

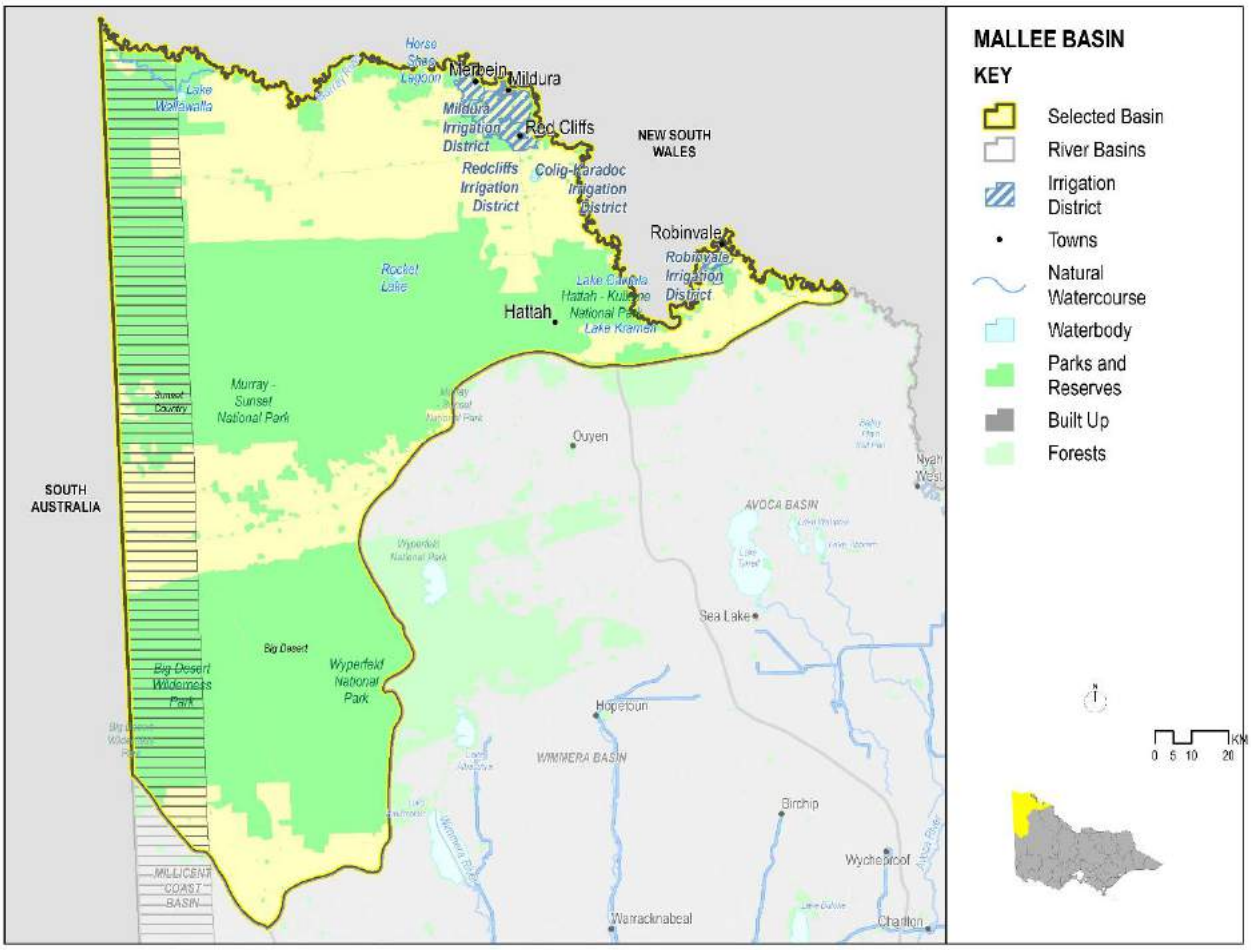
(2) Use against this environmental entitlement included 20,331 ML of water delivered in-stream — 10,009 ML in the Wimmera basin and 10,322 ML in the Glenelg basin — and 82 ML of water delivered off-stream to the Wimmera Mallee wetlands and Ranch Billabong. The 20,331 ML delivered in-stream in the Wimmera 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 2,660 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 (20,331 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 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 2019–20 water resources overview

In 2019–20, rainfall:

- in the north of the basin — along the border with New South Wales and South Australia and down to Hattah — was 60% to 80% of the long-term average
- in the rest of the basin was 80% to 100% of the long-term average.

Almost all surface water used in the Mallee basin is sourced from other basins.

There were four towns with restrictions on urban water use in the Mallee basin in 2019–20. Supplied from the Murray system, Mildura, Irymple, Red Cliffs and Merbein were on stage 1 restrictions from November 2019 to the

end of May 2020. These restrictions were then lifted and permanent water-saving rules applied for June. All other towns in the basin were on permanent water-saving rules throughout the year.

6.29.2.1 Water for the environment

In 2019–20, water for the environment in 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

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 2020	Annual entitlement volume (ML) 30 June 2019
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				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Licensed small catchment dams (1)	-	10	0	10	-
Total 2019–20	**-**	**10**	**0**	**10**	**-**
Total 2018–19	-	10	0	10	-

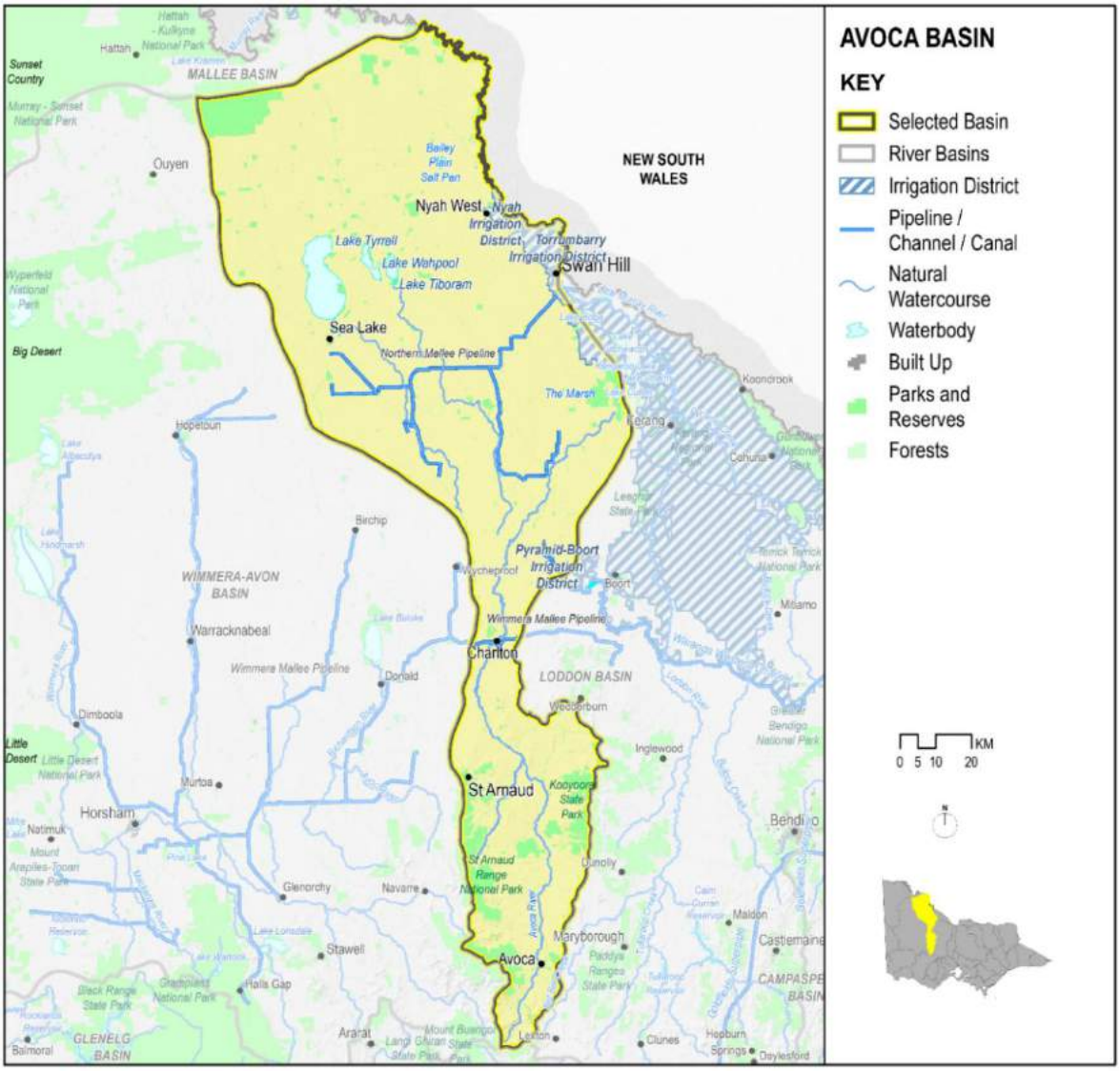
Note

(1) The volume of water taken from small catchment dams in the Mallee has not been estimated, due to lack of information for the basin.

6.30 Avoca basin

The Avoca basin (Figure 6-56) 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 6-56 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 2019–20 water resources overview

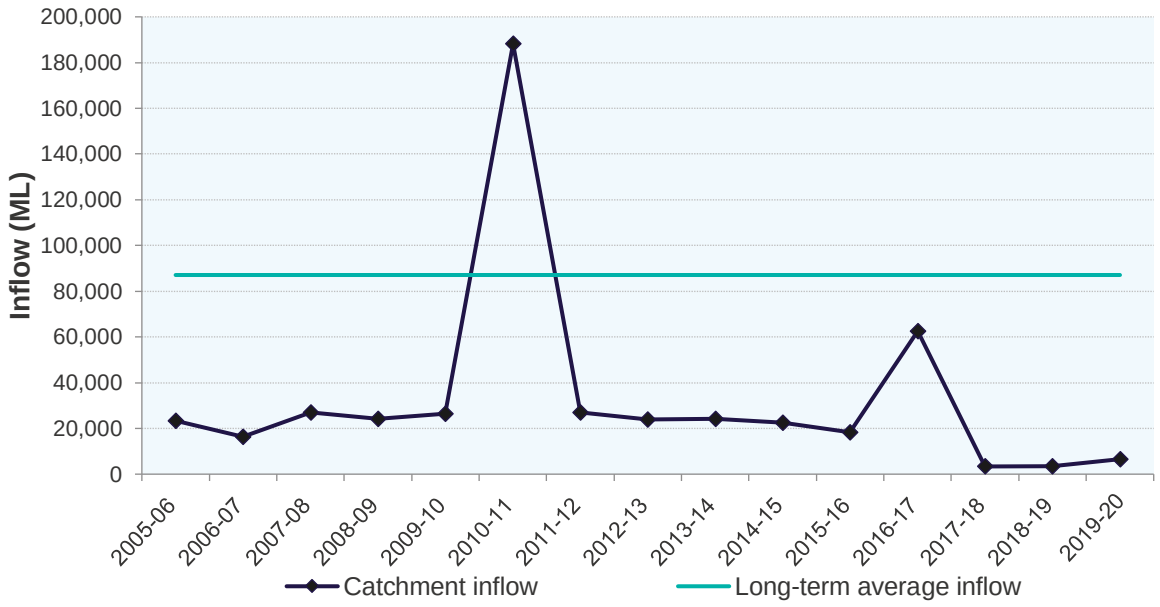
In 2019–20, rainfall:

- in the north-east and an area south of St. Arnaud was 60% to 80% of the long-term average

- in most of the basin was 80% to 100% of the long-term average
- in a small area in the centre of the basin north of Charlton was 100% to 125% of the long-term average.

Catchment inflows to the basin in 2019–20 were 7% of the long-term average annual volume of 87,100 ML. Similar to the previous year, only a small volume of water (19 ML) outflowed to the terminal lakes in the basin.

Figure 6-57 Storage volumes and catchment inflows, Avoca basin



All irrigation diversions from the Avoca River were unrestricted for the entirety of 2019–20. Licensed diversions for domestic and stock use were also not banned.

There was one town with restrictions on urban water use in the Avoca basin in 2019–20. Supplied from the Murray system, Swan Hill was on stage 1 restrictions from November 2019 to the end of May 2020. These restrictions were then lifted and permanent water-saving rules applied for June. All other towns in the basin were on permanent water-saving rules throughout the year.

In 2019–20, 976 ML of water was diverted for consumptive uses: town, domestic and stock and farm dam extractions. This was similar to the 989 ML reported in the previous year.

6.30.2.1 Water for the environment

Environmental watering sites 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 2019–20 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 2019–20 are shown in Table 6-189.

Table 6-189 Water balance, Avoca basin

Water account component	Note	2019–20 (ML)	2018–19 (ML)
Major on-stream storage			
Volume in storage at start of year	1	-	-
Volume in storage at end of year	1	-	-
Change in storage		-	-
Inflows			
Catchment inflow	2	6,431	3,397

Rainfall on major storages		-	-
Treated wastewater discharged back to river	3	0	0
Total inflows		**6,431**	**3,397**
Outflows			
Diversions			
Urban diversions		32	30
Licensed diversions from unregulated streams		92	48
Small catchment dams	4	852	911
Total diversions		*976*	*989*
Losses			
Evaporation from major storages		-	-
Net evaporation from small catchment dams	4	1,056	1,193
In-stream infiltration to groundwater, flows to floodplain and evaporation		4,380	1,214
Total losses		*5,436*	*2,406*
Water passed at outlet of basin			
Avoca River flow at Sandhill Lake Road (outflow to terminal lakes)		19	2
Avoca River overflow from the terminal lakes to the Kerang Lakes		0	0
Total water passed at outlet of basin		*19*	*2*
Total outflows		**6,431**	**3,397**

6.30.3.1 Notes to the water balance

1. Storage

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 2019–20, 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	Volume 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		
Avoca	28	28	100%	0	28	0	0	0	0
Charlton (1)	0	0	0%	0	0	0	0	0	0
Sea Lake (1)	0	0	0%	0	0	0	0	0	0
St Arnaud	97	93	96%	35	58	0	0	0	4
Total 2019–20	**125**	**121**	**97%**	**35**	**86**	**0**	**0**	**0**	**4**
Total 2018–19	260	151	58%	40	111	0	0	0	109

Note

(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)	9,483	457	839	1,297
Registered/licensed commercial and irrigation	5,183	394	217	611
Total 2019–20	**14,667**	**852**	**1,056**	**1,908**
Total 2018–19	14,667	911	1,193	2,104

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 (518 ML) was within the volume available for the year (8,028 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 2020	Annual entitlement volume (ML) 30 June 2019
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	2,289	2,566
Licensed small catchment dams – on-waterway	5,183	5,183
Total	**7,751**	**8,028**

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				Water taken
	Opening carryover	Allocation issued	Net trade in / (out)	Total available water	
Amphitheatre	-	25	0	25	13
Avoca	-	233	0	233	19
Redbank	-	20	0	20	0
Take and use licences – unregulated surface water	-	2,566	0	2,566	92
Licensed small catchment dams	-	5,183	0	5,183	394
Total 2019–20	**-**	**8,028**	**0**	**8,028**	**518**
Total 2018–19	-	8,150	0	8,150	493

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.

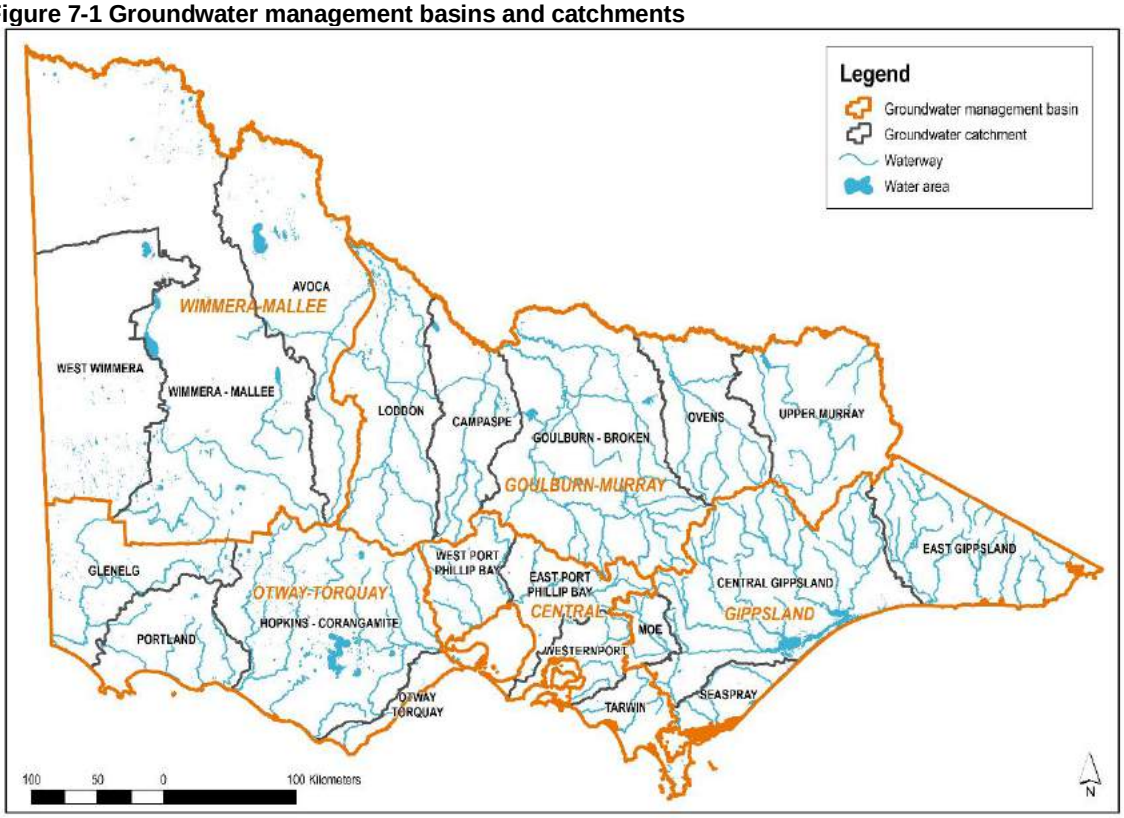
There are five groundwater management basins in Victoria. These are partly based on an understanding of the groundwater geological basins but are also aligned with water corporations' administrative boundaries.

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 is managed through licensing. The total volume of groundwater that can be licensed and taken in a GMU is determined 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. These are developed in consultation with local stakeholders including water users, environmental representatives, traditional owners and relevant government agencies.

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 2019–20 is presented in this chapter for each of the 20 groundwater catchments. There are three parts to each groundwater catchment sub-chapter:

- **management arrangements**, which summarises management arrangements and GMUs in the groundwater catchment
- **2019–20 groundwater resources overview**, which provides a snapshot of the resource condition in the groundwater catchment in 2019–20 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 2019–20.

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 the associated 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. 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 at 30 June of each water year.
- **Carryover**, which represents any water carried over from 2018–19 that could be taken in 2019–20. Carryover is only available if the Minister of Water has made a declaration under section 62A of the *Water Act 1989.*
- **Licensed volume allocated**[3], 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 2019–20, take and use licence holders in the Deutgam WSPA were restricted to 25% of their licence volume (that is, for every 100 ML in their licence, they could use or trade 25 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 2019–20. 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 overall 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 used during the water year under the licensed entitlement.

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 grants private rights to take water for domestic and stock purposes from surface and groundwater under certain circumstances without a licence.

Estimated domestic and stock use is calculated based on an assumed usage per 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 use for domestic and stock purposes is taken under 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:

- Upper Ovens WSPA: there is no PCV
- Shepparton Irrigation Region GMA: there is no PCV
- West Goulburn GMA: there is no PCV
- South West Limestone GMA: there is no PCV
- Stratford GMA: current compliance assessment criteria are not applicable: coal mine licences physically in the area are not assigned to the Stratford GMA.

[3] Under the *Water Act 1989* licences may be restricted. Licences do not receive an allocation.

7.2 Groundwater management unit compliance reporting for 2019–20

A summary of licensed groundwater use against available water and the PCV for 2019–20 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 2019–20, this was true for all GMUs where compliance is assessed: as noted above, compliance was not assessed in five GMUs.

✓ **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

GMU	Entitlement volume		Water available and taken under licences 2019–20					Compliance		
	PCV (a)	Licensed entitlement (ML) (b)	Carryover (c)	Water allocated (d)	Net trade (e)	Total water available (f) =(c)+(d)+(e)	Water taken (ML) (g)	% of PCV (h) =(g)/(a)	% of available water (i) =(g)/(b)	Licence volume available under PCV (ML) (j) =(a)-(b)
Goulburn-Murray Water										
Water supply protection areas										
Katunga	60,577	60,203	0	60,203	0	**60,203**	**37,837**	**62%**	**63%**	**374**
Loddon Highlands [1]	20,697	20,502	2,865	20,287		**23,152**	**6,071**	**29%**	**26%**	**195**
Lower Campaspe Valley [2]	55,875	55,860	11,512	53,862	0	**65,373**	**41,752**	**75%**	**64%**	**15**
Upper Ovens River [3]	n/a	3,605	0	3,329	(168)	**3,161**	**873**	**n/a**	**28%**	**n/a**
Groundwater management areas										
Barnawartha	2,100	375	0	375	0	**375**	**8**	**0%**	**2%**	**1,725**
Broken	3,732	2,993	0	2,898	95	**2,993**	**509**	**14%**	**17%**	**739**
Central Victorian Mineral Springs	6,024	5,082	0	5,114	0	**5,114**	**1,154**	**19%**	**23%**	**942**
Eildon	1,496	605	0	608	0	**608**	**216**	**14%**	**36%**	**892**
Kiewa	3,852	3,115	0	3,115	0	**3,115**	**394**	**10%**	**13%**	**737**
Lower Ovens	25,200	19,877	0	19,875	100	**19,975**	**7,442**	**30%**	**37%**	**5,323**
Mid Goulburn	12,470	12,375	2,297	12,470	(95)	**14,672**	**4,029**	**32%**	**27%**	**95**
Mid Loddon	34,037	33,927	7,715	33,927	0	**41,642**	**20,147**	**59%**	**48%**	**110**
Shepparton Irrigation Region [4] [5]	n/a	184,937	0	185,485	0	**185,485**	**106,719**	**n/a**	**58%**	**n/a**
Strathbogie	1,660	1,446	0	1,446	0	**1,446**	**558**	**34%**	**39%**	**214**
Upper Goulburn	8,568	6,115	0	6,133	14	**6,147**	**968**	**11%**	**16%**	**2,453**
Upper Murray	7,674	3,532	0	3,532	0	**3,532**	**470**	**6%**	**13%**	**4,142**
West Goulburn [6]	n/a	3,071	273	3,071	0	**3,344**	**1,277**	**n/a**	**38%**	**n/a**
Outside management units										
Goulburn-Murray Water	n/a	14,679	0	14,779	(114)	**14,665**	**4,899**	**n/a**	**33%**	**n/a**
GWMWater										
Groundwater management areas										
Murrayville	11,005	9,755	1,865	9,755	0	**11,619**	**5,285**	**48%**	**45%**	**1,250**
West Wimmera [7] [8]	57,409	53,688	11,363	49,580	0	**60,942**	**24,520**	**43%**	**40%**	**3,721**
Outside management units										
GWMWater	n/a	9,612	0	9,612	0	**9,612**	**2,098**	**n/a**	**22%**	**n/a**
Southern Rural Water										
Water supply protection areas										
Condah	7,475	7,470	0	7,470	0	**7,470**	**2,325**	**31%**	**31%**	**5**
Deutgam [9]	5,100	5,082	0	1,271	0	**1,271**	**275**	**5%**	**22%**	**18**
Glenelg	33,262	16,092	0	16,242	(100)	**16,142**	**5,768**	**17%**	**36%**	**17,170**
Koo-Wee-Rup	12,915	12,575	0	12,575	()	**12,575**	**2,912**	**23%**	**23%**	**340**

Sale	21,238	21,203	0	21,103	(20)	**21,083**	**14,092**	**66%**	**67%**	**35**
Warrion	14,086	14,075	0	14,075	0	**14,075**	**2,913**	**21%**	**21%**	**11**
Yarram	25,690	25,688	0	25,688	0	**25,688**	**8,194**	**32%**	**32%**	**2**
Groundwater management areas										
Bungaree	5,334	5,293	0	5,355	0	**5,355**	**2,196**	**41%**	**41%**	**41**
Cardigan	3,967	3,889	0	3,889	0	**3,889**	**732**	**18%**	**19%**	**78**
Colongulac	4,695	4,404	0	4,404	0	**4,404**	**1,138**	**24%**	**26%**	**291**
Corinella	2,550	662	0	662	0	**662**	**40**	**2%**	**6%**	**1,888**
Cut Paw Paw	3,650	523	0	523	0	**523**	**0**	**0%**	**0%**	**3,127**
Denison (10)	18,502	18,499	0	18,499	0	**18,499**	**6,394**	**35%**	**35%**	**3**
Frankston	3,200	2,212	0	2,212	0	**2,212**	**686**	**21%**	**31%**	**988**
Gellibrand (11)	0	0	0	0	0	**0**	**0**	**n/a**	**n/a**	**n/a**
Gerangamete (12)	239	238	0	238	0	**238**	**112**	**47%**	**47%**	**1**
Giffard	5,689	5,689	0	5,689	0	**5,689**	**2,618**	**46%**	**46%**	**1**
Glenormiston	2,698	2,636	0	2,636	0	**2,636**	**1,141**	**42%**	**43%**	**62**
Jan Juc (13)	14,250	14,250	0	14,250	0	**14,250**	**2,254**	**16%**	**16%**	**0**
Lancefield	1,485	1,378	0	1,378	0	**1,378**	**220**	**15%**	**16%**	**108**
Leongatha	6,500	1,803	0	1,803	0	**1,803**	**94**	**1%**	**5%**	**4,697**
Merrimu	451	10	0	10	0	**10**	**0**	**0%**	**0%**	**441**
Moe	8,200	3,882	0	3,885	(30)	**3,855**	**567**	**7%**	**15%**	**4,318**
Moorabbin	2,700	2,624	0	2,624	0	**2,624**	**816**	**30%**	**31%**	**76**
Nepean (8)	6,110	6,110	0	6,110	0	**6,110**	**2,812**	**46%**	**46%**	**1**
Newlingrook	1,977	1,958	0	1,958	0	**1,958**	**15**	**1%**	**1%**	**20**
Orbost	1,217	1,217	0	1,217	0	**1,217**	**241**	**20%**	**20%**	**1**
Paaratte	4,606	3,159	0	3,159	0	**3,159**	**304**	**7%**	**10%**	**1,447**
Portland	7,795	7,794	0	7,794	0	**7,794**	**2,411**	**31%**	**31%**	**1**
Rosedale (7) (14)	22,372	22,322	0	22,322	0	**22,322**	**7,682**	**34%**	**34%**	**50**
South West Limestone (15)	n/a	81,194	23,013	81,315	100	**104,428**	**27,461**	**n/a**	**26%**	**n/a**
Stratford (7) (14)	27,686	37,084	0	37,084	0	**37,084**	**22,198**	**n/a**	**60%**	**n/a**
Tarwin	1,300	58	0	58	0	**58**	**10**	**1%**	**17%**	**1,242**
Wa De Lock (7) (10)	30,795	29,124	0	29,146	0	**29,146**	**6,294**	**20%**	**22%**	**1,671**
Wandin Yallock	3,027	3,025	0	3,025	0	**3,025**	**482**	**16%**	**16%**	**2**
Wy Yung (7)	7,463	7,462	0	7,462	0	**7,462**	**919**	**12%**	**12%**	**1**
Outside management units (10)										
Southern Rural Water	n/a	72,003	0	72,384	50	**72,434**	**12,898**	**n/a**	**18%**	**n/a**
Total 2019–20	**n/a**	**948,037**	**60,902**	**938,966**	**(168)**	**999,699**	**406,438**	**n/a**	**41%**	**61,060**
Total 2018–19	n/a	965,641	63,318	966,341	(291)	1,029,369	466,514	**n/a**	45%	**51,835**

Notes

(1) Extractions from Newlyn trading zone in the Loddon Highlands WSPA were restricted to 75% allocation.

(2) Extractions from Barnadown trading zone in the Lower Campaspe Valley WSPA were restricted to 75% allocation.

(3) The Minister approved the revocation of the PCV on 3 March 2013. A PCV is not required for the Upper Ovens River WSPA because the management plan prevents additional entitlements or an increase in entitlement volume from being issued except by trade.

(4) There is no permissible consumptive volume for the Shepparton Irrigation GMA as there is no limit on the total volume of shallow groundwater entitlement available.

(5) Groundwater use in the Shepparton Irrigation Region GMA is estimated at the end of each season using a method which 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.

(6) There is no PCV for the West Goulburn GMA but there are individual zone caps set: recorded use in the West Goulburn GMA in 2019–20 was 1,277 ML, 42% of the total licensed volume.

(7) The PCV that applies to West Wimmera GMA, Wy Yung GMA, Nepean GMA, Rosedale GMA, Stratford GMA and Wa De Lock GMA is the total of the sum of the PCVs for all zones within each GMA.

(8) Extractions from Neuarpur subzone 1 (a trading zone in the West Wimmera GMA) were restricted to 80% allocation.

(9) Extractions from Deutgam WSPA were restricted to 25% allocation.

(10) The volumes of use in Denison GMA, Wa De Lock GMA and the outside management units include metered extractions for salinity control (Denison GMA 306 ML, Wa De Lock GMA 297 ML and outside management units 871 ML).

(11) The Gellibrand PCV of 0 ML was gazetted at the end of 2018–19.

(12) The PCV for the Gerangamete GMA decreased to 239 ML in 2019–20. The volume reported in the previous year was 20,239 ML. The decrease was due to the non-renewal of Barwon Water's 20,000 ML licence.

(13) The PCV for Jan Juc GMA is Zone 1 all formations 250 ML, Zone 2 Upper Eastern View formation 4,000 ML and Zone 2 Lower Eastern View formation 35,000 ML in any five-year period. The Jan Juc bulk entitlement, which applies to Zone 2 Lower Eastern View formation, is based on a five-year total of 35,000 ML with a maximum annual extraction of 10,000 ML. The total of 14,250 ML includes 4,250 ML and the maximum annual bulk entitlement extraction volume of 10,000 ML.

(14) The use and licensed entitlement volume reported in the Rosedale and Stratford GMAs includes metered extractions from Latrobe Valley coal mines (Rosedale GMA 931 ML use and 9,304 ML entitlement; and Stratford GMA 22,163 ML use and 36,207 ML entitlement). These coal mine licences are in the Rosedale and Stratford physical area but the licence volume and extraction is not assigned to or assessed against the GMAs. For this reason, the licence volume in the Stratford GMA is shown as exceeding the PCV.

(15) 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. Abolition of the Nullawarre and Yangery WSPAs was approved on 24 October 2014 and published in the Victoria Government Gazette on 30 October 2014. 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.

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 sedimentary fractured 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.

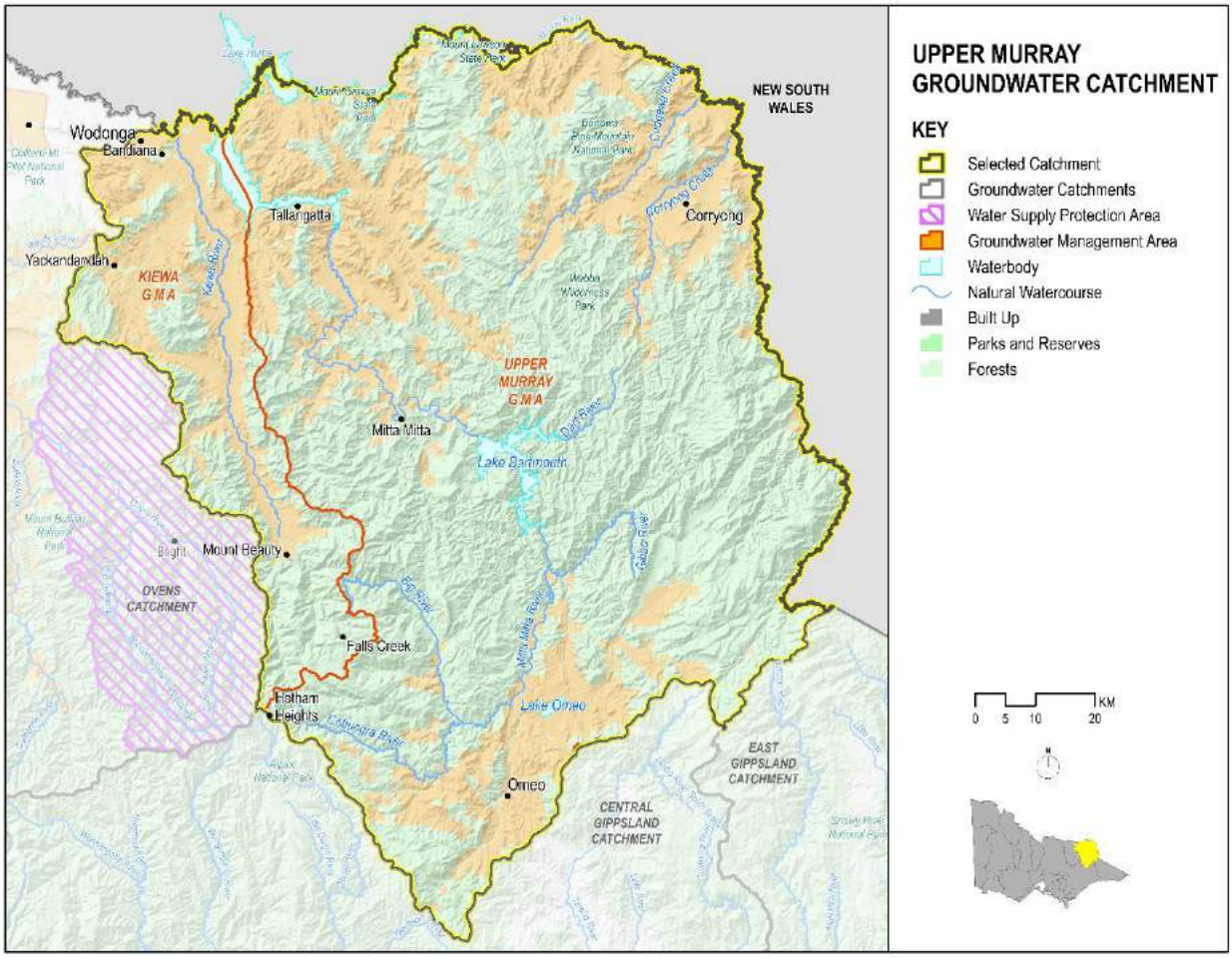
In the north, the plain of the Goulburn–Murray groundwater management basin gradually thickens into several geological layers.

- 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 sedimentary fractured 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 2019–20 groundwater resources overview

Groundwater level trends for 2019–20 are shown in Table 7-2. Across the catchment, trends were categorised as stable to declining from July to December 2019 and mostly stable to rising from January to June 2020.

Table 7-2 Groundwater level trends, Upper Murray groundwater catchment

Groundwater management unit	Groundwater level trend 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Groundwater management area					
Kiewa	Declining	Declining	Rising	**Declining**	**Stable**
Upper Murray	Stable	Declining	Stable	**Stable**	**Stable**

In 2019–20, 1,664 ML of water was extracted for consumptive purposes, which was slightly more than the 1,515 ML extracted in the previous year. Of this volume, 56 ML was for urban use and 794 ML was estimated 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 (865 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.

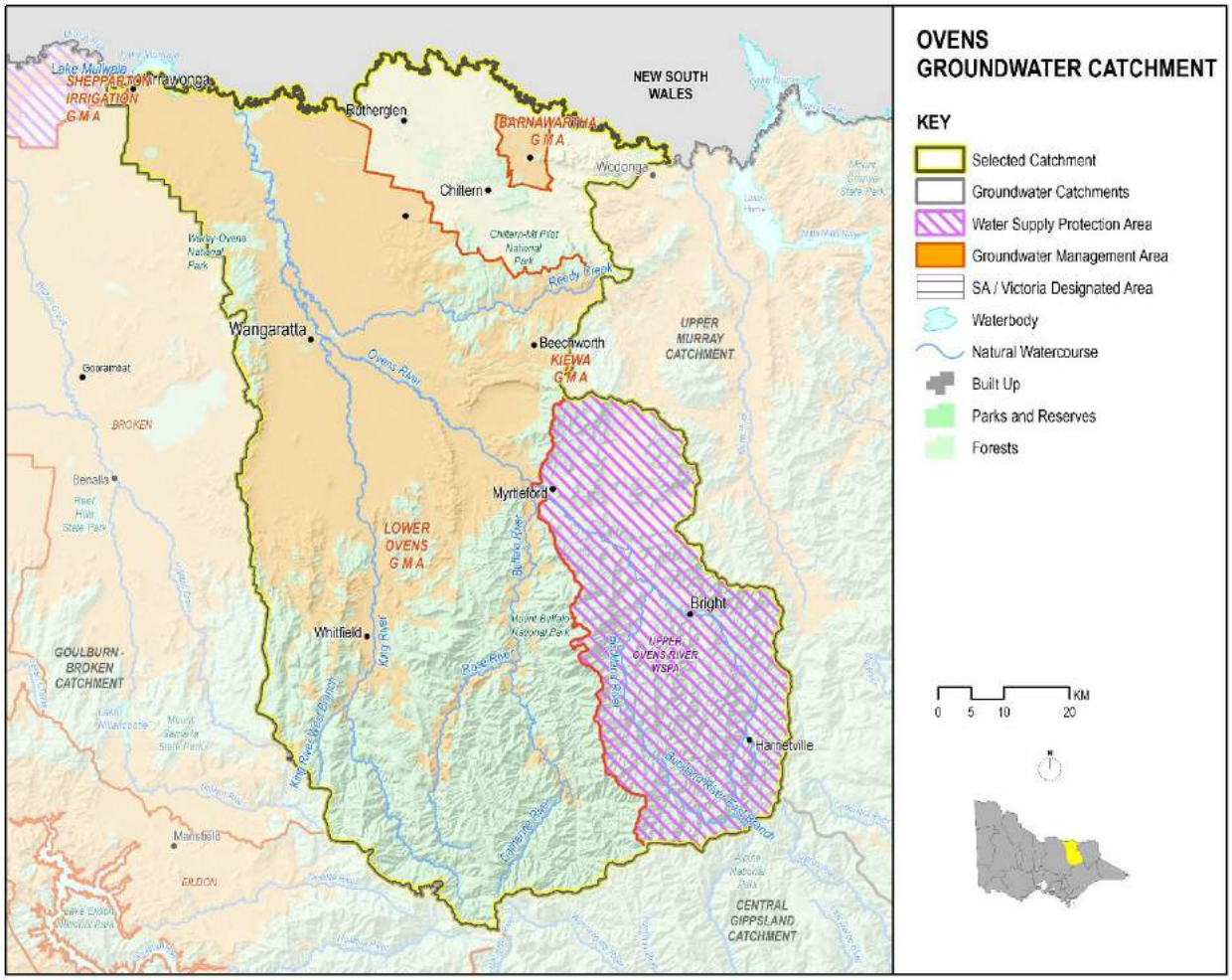
Table 7-3 Licensed groundwater volumes and use, Upper Murray groundwater catchment

GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
Kiewa GMA	Licensed use (non-urban)	3,115	0	3,115	0	3,115	394
	Domestic & stock	-	-	-	-	-	454
Upper Murray GMA	Licensed use (non-urban)	3,412	0	3,412	0	3,412	420
	Dinner Plains urban	120	0	120	0	120	50
	Domestic & stock	-	-	-	-	-	350
Upper Murray total 2019–20		**6,647**	**0**	**6,647**	**0**	**6,647**	**1,669**
Upper Murray total 2018–19		6,649	-	6,653	0	6,653	1,515

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 River WSPA. The area not covered by GMUs is reported as outside management units. The *Upper Ovens River 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 2019–20 groundwater resources overview

Groundwater level trends for 2019–20 are shown in Table 7-4. In 2019–20, Upper Ovens River WSPA groundwater level trends were classified as stable from July 2019 to March 2020, with rising levels towards the end of 2019–20. Lower Ovens and Barnawartha GMA levels were declining for most of the year.

Table 7-4 Groundwater level trends, Ovens groundwater catchment

Groundwater management unit	Groundwater level trend 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Water supply protection area					
Upper Ovens	Stable	Stable	Stable	**Rising**	**Stable**
Groundwater management area					
Barnawartha	Declining	Stable	Declining	**Declining**	**Stable**
Lower Ovens	Declining	Declining	Declining	**Declining**	**Declining**

In 2019–20, 11,898 ML of water was extracted for consumptive purposes, which was less than the 13,266 ML extracted in the previous year. Of this volume, 193 ML was for urban use and 2,472 ML was estimated 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 total volume extracted under licences (9,437 ML) was within the volume available for the year (25,851 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

GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
Barnawartha GMA	Licensed use (non-urban)	82	0	82	0	82	8
	Barnawartha urban	293	0	293	0	293	0
	Domestic & stock	-	-	-	-	-	60
Lower Ovens GMA	Licensed use (non-urban)	19,177	0	19,175	100	19,275	7,237
	Springhurst urban	20	0	20	0	20	0
	Wangaratta urban	680	0	680	0	680	205
	Domestic & stock	-	-	-	-	-	1,962
Upper Ovens WSPA (1)	Licensed use (non-urban)	3,530	0	3,255	(100)	3,155	873
	Bright urban	75	0	74	(68)	6	0
	Domestic & stock	-	-	-	-	-	276
Outside management units	Licensed use (non-urban)	2,315	0	2,415	(100)	2,315	1,114
	Chiltern urban	25	0	25	0	25	0
	Domestic & stock	-	-	-	-	-	216
Ovens total 2019–20		**26,197**	**0**	**26,019**	**(168)**	**25,851**	**11,951**
Ovens total 2018–19		26,308	-	26,379	(291)	26,088	13,266

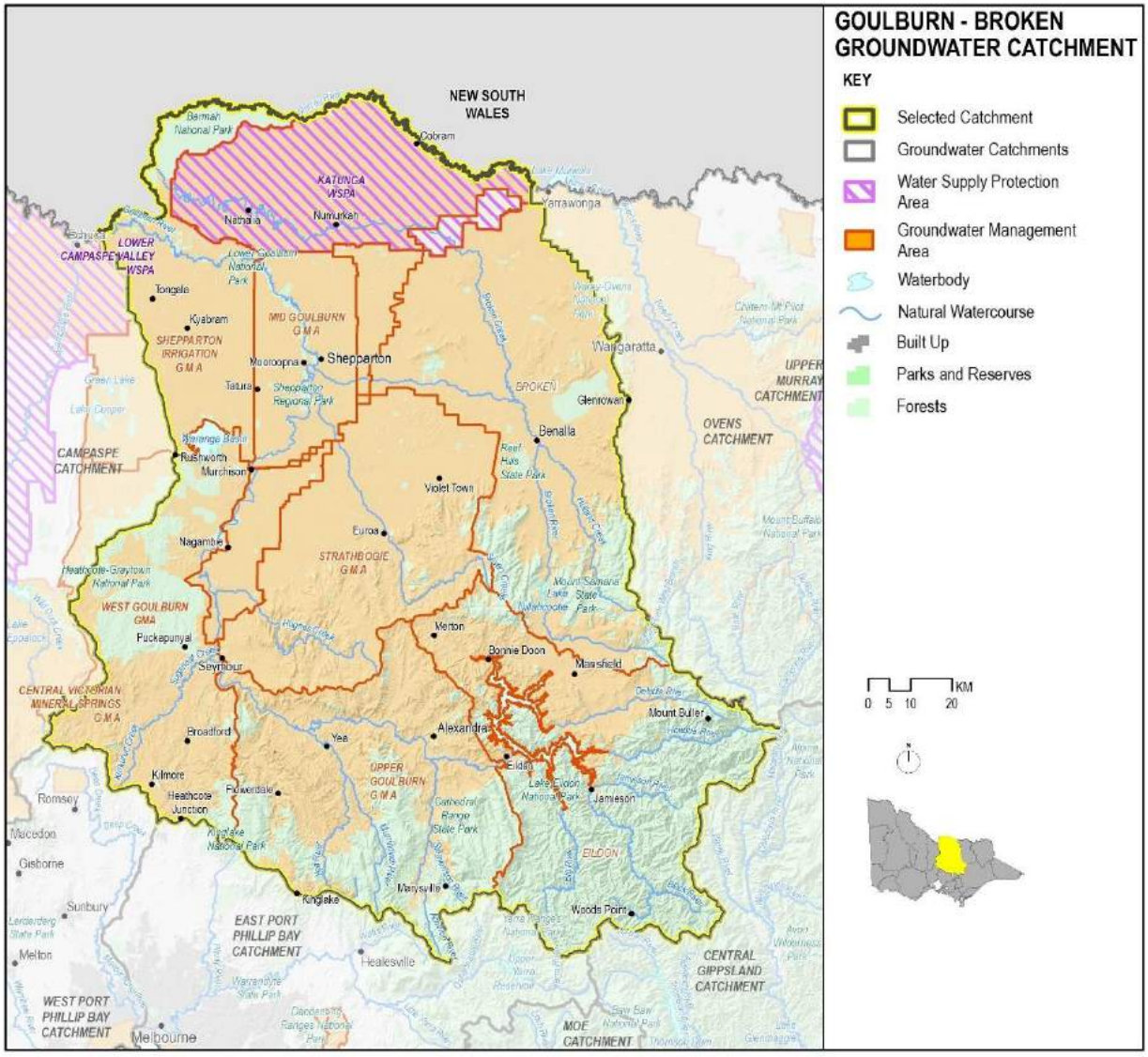
Note

(1) A PCV is not required for the Upper Ovens River WSPA because the management plan prevents additional entitlements or an increase in entitlement volume from being issued, except by trade.

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 2019–20 groundwater resources overview

There were no restrictions on licensed use in Katunga WSPA for the whole of 2019–20.

Groundwater level trends for 2019–20 are presented in Table 7-6. Most GMU groundwater trends in the catchment were declining for the year. Strathbogie GMA was mostly stable, and the Upper Goulburn and West

Goulburn GMAs varied from declining to stable for the year, one ending with a rising trend and the other as stable.

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 2019–20 was above average.

Table 7-6 Groundwater level trends, Goulburn–Broken groundwater catchment

Groundwater management unit	Groundwater level trend 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Water supply protection area					
Katunga	Declining	Declining	Declining	**Declining**	**Declining**
Groundwater management area					
Broken	Declining	Declining	Declining	**Declining**	**Stable**
Mid Goulburn	Declining	Declining	Declining	**Declining**	**Declining**
Shepparton Irrigation Region (1)	Declining	Declining	Declining	**Declining**	**Declining**
Strathbogie	Rising	Stable	Stable	**Stable**	**Stable**
Upper Goulburn	Stable	Declining	Stable	**Rising**	**Declining**
West Goulburn (2)	Stable	Declining	Declining	**Stable**	**Declining**

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 2019–20, 138,011 ML of water was extracted for consumptive purposes, which was slightly less than the 142,276 ML extracted in the previous year. Of this volume, 40 ML was for urban use and 6,950 ML was estimated 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 total volume extracted under licences (142,991 ML) was within the volume available for the year (259,134 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

GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
Broken GMA	Licensed use (non-urban)	2,969	0	2,874	95	2,969	509
	Goorambat urban	24	0	24	0	24	0
	Domestic & stock	-	-	-	-	-	664
Eildon GMA	Licensed use (non-urban)	605	0	608	0	608	216
	Domestic & stock	-	-	-	-	-	596
Katunga WSPA	Licensed use (non-urban)	60,013	0	59,363	730	60,093	37,797
	Katunga urban	110	0	110	0	110	40
	Strathmerton urban	80	0	730	(730)	0	0
	Domestic & stock	-	-	-	-	-	1,552
Mid Goulburn GMA	Licensed use (non-urban)	12,375	2,297	12,470	(95)	14,672	4,029
	Domestic & stock	-	-	-	-	-	254
Shepparton Irrigation Region GMA (1) (2)	Licensed use (non-urban)	168,611	0	169,159	0	169,159	97,298
	Domestic & stock	-	-	-	-	-	1,894
Strathbogie GMA	Licensed use (non-urban)	1,446	0	1,446	0	1,446	558
	Domestic & stock	-	-	-	-	-	448

Upper Goulburn GMA	Licensed use (non-urban)	6,115	0	6,133	14	6,147	968
	Domestic & stock	-	-	-	-	-	1,040
West Goulburn GMA [3]	Licensed use (non-urban)	2,814	247	2,814	0	3,062	1,277
	Domestic & stock	-	-	-	-	-	104
Outside management units	Licensed use (non-urban)	859	0	859	(14)	845	299
	Domestic & stock	-	-	-	-	-	414
Goulburn – Broken total 2019–20		**256,020**	**2,544**	**256,589**		**259,134**	**149,957**
Goulburn – Broken total 2018–19		255,772	2,758	259,505	100	262,363	142,276

Notes

(1) The Shepparton Irrigation Region GMA extends into the Campaspe groundwater catchment, and an additional 16,325 ML of entitlement volume is reported in the Campaspe groundwater catchment account (Table 7-9). The total entitlement volume for the GMA as at 30 June 2020 was 184,937 ML.
Groundwater use in the Shepparton Irrigation Region GMA is estimated at the end of each season using a method which 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.

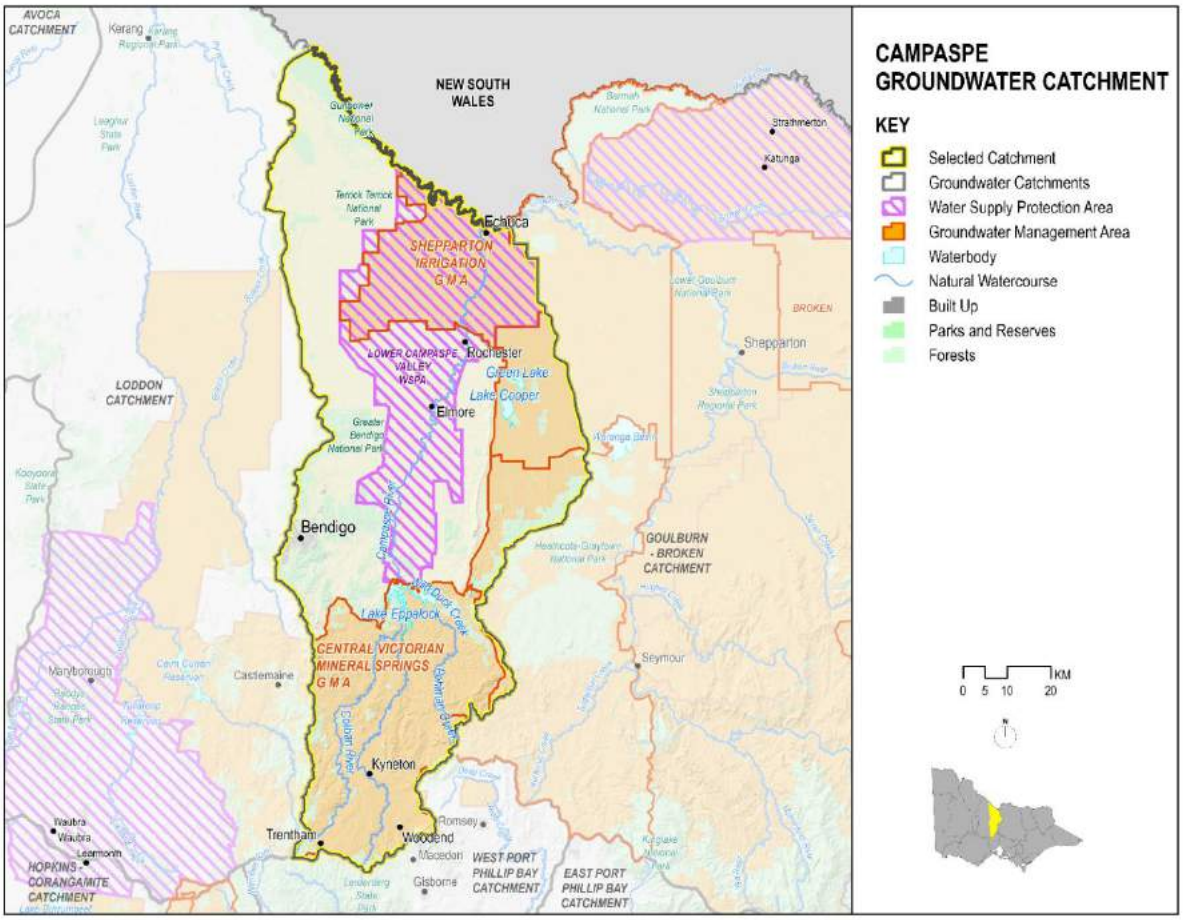
(2) There is no PCV for the Shepparton Irrigation GMA as there is no limit on the total volume of shallow groundwater entitlement available.

(3) There is no PCV for the West Goulburn GMA, however there are individual zone caps set (total recorded use in the West Goulburn GMA in 2019–20 was 1,277 ML, 42% of total licensed volume).

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 2019–20 groundwater resources overview

In the Lower Campaspe Valley WSPA, the allocation for the Barnadown Zone was reduced to 75% for 2019–20.

Groundwater level trends for 2019–20 are shown in Table 7-8. The trends varied from declining to stable across GMUs in the catchment. Like the previous year, levels in the Lower Campaspe Valley WSPA and Shepparton Irrigation Region GMA were declining for all of 2019–20; Central Victorian Mineral Springs GMA and West Goulburn GMA trends were categorised as stable for much of the year.

Table 7-8 Groundwater level trends, Campaspe groundwater catchment

Groundwater management unit	Groundwater level trend 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Water supply protection area					
Lower Campaspe Valley	Declining	Declining	Declining	**Declining**	**Declining**
Groundwater management area					
Central Victorian Mineral Springs [1]	Stable	Stable	Stable	**Stable**	**Stable**

Shepparton Irrigation Region [2]	Declining	Declining	Declining	**Declining**	**Declining**
West Goulburn GMA [3]	Stable	Declining	Declining	**Stable**	**Declining**

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 2019–20, 54,905 ML of water was extracted for consumptive purposes, which was less than the 62,979 ML extracted in the previous year. Of this volume,157 ML was for urban use and 2,906 ML was estimated 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 total volume extracted under licences (53,932 ML) was within the volume available for the year (89,159 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

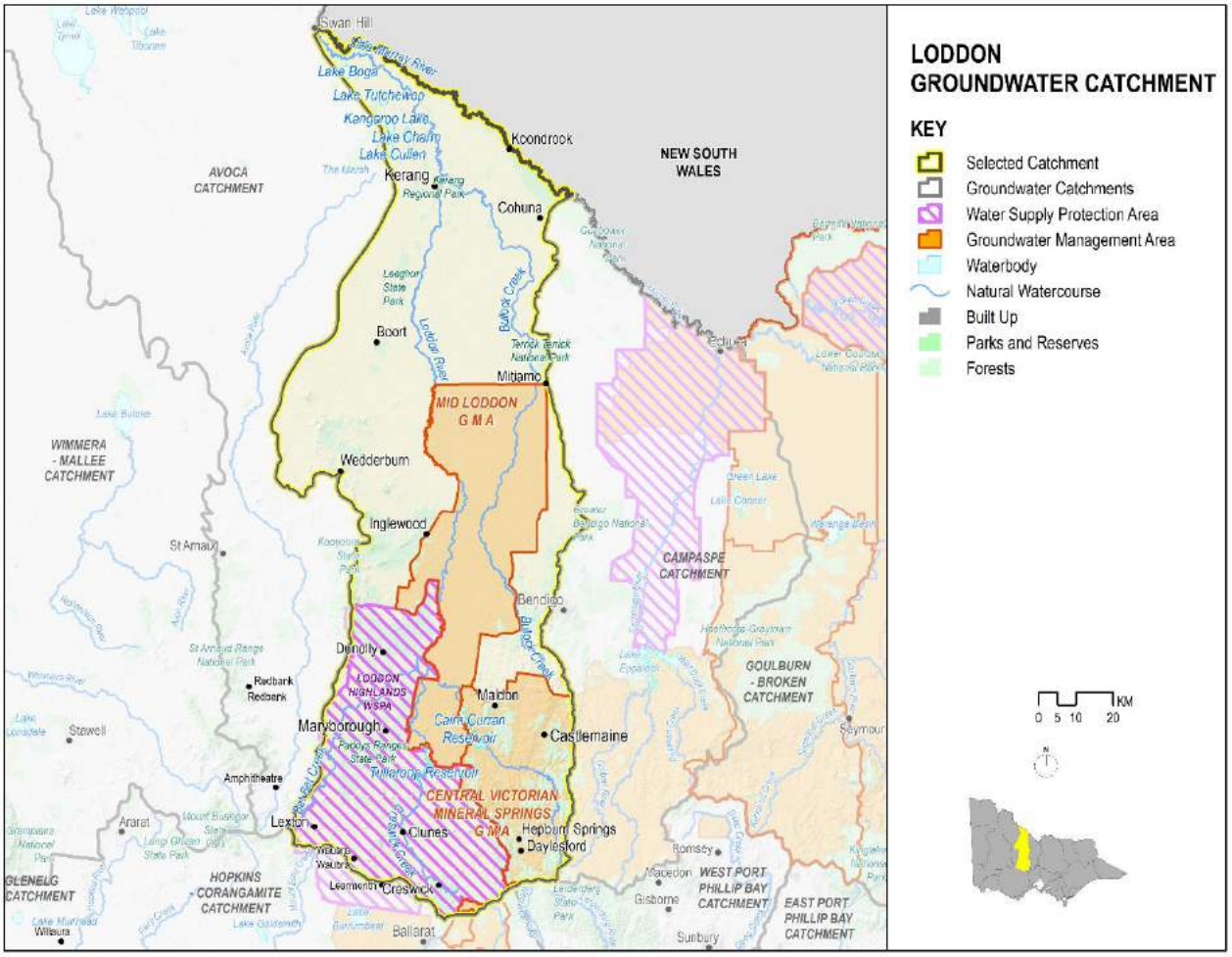
GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
Central Victorian Mineral Springs GMA [1]	Licensed use (non-urban)	2,205	0	2,237	0	2,237	487
	Trentham urban	103	0	103	0	103	47
	Domestic and stock use	-	-	-	-	-	1,402
Lower Campaspe Valley WSPA	Licensed use (non-urban)	55,576	11,441	53,578	0	65,018	41,624
	Elmore urban	284	71	284	0	355	128
	Domestic and stock use	-	-	-	-	-	730
Shepparton Irrigation Region GMA [2] [3]	Licensed use (non-urban)	16,325	0	16,325	0	16,325	9,421
	Domestic and stock use	-	-	-	-	-	198
West Goulburn GMA [4]	Licensed use (non-urban)	257	25	257	0	282	0
	Domestic and stock use	-	-	-	-	-	16
Outside management units	Licensed use (non-urban)	4,838	0	4,838	0	4,838	2,225
	Domestic and stock use	-	-	-	-	-	580
Campaspe total 2019–20		**79,589**	**11,537**	**77,622**	**0**	**89,159**	**56,858**
Campaspe total 2018–19		78,555	13,408	78,607	(100)	91,915	62,979

Notes
(1) The Central Victorian Mineral Springs GMA extends into the Loddon groundwater catchment, and an additional 2,774 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 at 30 June 2020 was 5,082 ML.
(2) The Shepparton Irrigation Region GMA extends into the Goulbourn-Broken groundwater catchment, and an additional 168,611 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 at 30 June 2020 was 184,937 ML.
Groundwater use in the Shepparton Irrigation Region GMA is estimated at the end of each season using a method which 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 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 2019–20 was 1,277 ML, 42% of total licensed volume).

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 six towns in the area.

7.3.5.2 2019–20 groundwater resources overview

In the Loddon Highlands WSPA, licensed diversions from all zones except Newlyn were able to take 100% of their entitlement volume. Licensed diversions from the Newlyn Zone were restricted to 75% of entitlement volume.

Groundwater level trends for 2019–20 are shown in Table 7-10. The groundwater level trend was mostly categorised as declining throughout the catchment except for the Central Victorian Mineral Springs GMA, which was categorised as stable for the whole year.

Table 7-10 Groundwater level trends, Loddon groundwater catchment

Groundwater management unit	Groundwater level trend 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Water supply protection area					
Loddon Highlands	Declining	Declining	Rising	**Declining**	**Declining**
Groundwater management area					
Mid Loddon	Declining	Declining	Declining	**Declining**	**Declining**
Central Victorian Mineral Springs (1)	Stable	Stable	Stable	**Stable**	**Stable**

Note
(1) The Central Victorian Mineral Springs GMA extends into the Campaspe groundwater catchment.

In 2019–20, 30,262 ML of water was extracted for consumptive purposes, which was less than the 42,930 ML extracted in the previous year. Of this volume, 1,157 ML was for urban use and 2,120 ML was estimated 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 (28,096 ML) was within the volume available for the year (74,279 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 2019–20. 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 six towns within the catchment.

Table 7-11 Licensed groundwater volumes and use, Loddon groundwater catchment

GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
Central Victorian Mineral Springs GMA (1)	Licensed use (non-urban)	2,501	0	2,506	0	2,506	575
	Daylesford urban	273	0	268	0	268	45
	Domestic & stock	-	-	-	-	-	802
Loddon Highlands WSPA	Licensed use (non-urban)	18,787	2,608	18,153	(506)	20,256	5,002
	Avoca urban	250	38	250	0	288	164
	Clunes urban	350	53	350	0	403	213
	Forest Hill urban	350	53	263	0	315	150
	Learmonth urban	98	15	98	(5)	108	34
	Lexton urban	30	5	30	0	35	23
	Maryborough urban	570	86	1,076	506	1,667	458
	Waubra urban	65	10	65	0	75	25
	Domestic & stock	-	-	-	-	-	754
Mid Loddon GMA	Licensed use (non-urban)	33,927	7,715	33,927	0	41,642	20,147
	Domestic & stock	-	-	-	-	-	332
Outside management units	Licensed use (non-urban)	6,718	0	6,718	0	6,718	1,261
	Domestic & stock	-	-	-	-	-	238
Loddon total 2019–20		**63,919**	**10,580**	**63,704**	**(5)**	**74,279**	**30,222**
Loddon total 2018–19		63,706	11,880	63,011	(2)	74,888	42,930

Note
(1) The Central Victorian Mineral Springs GMA extends into the Campaspe groundwater catchment, and an additional 2,308 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 at 30 June 2020 was 5,082 ML.

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 which 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.

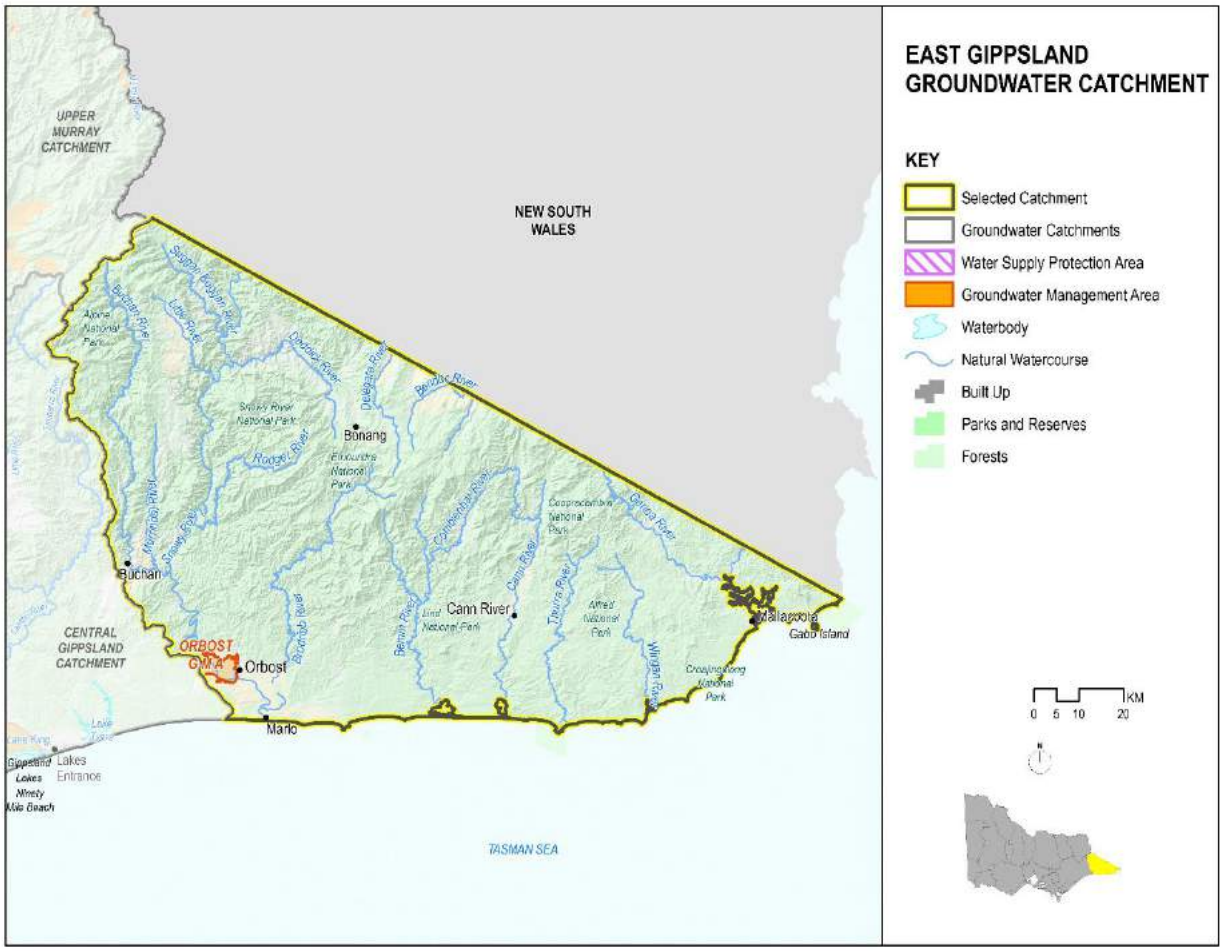
Middle aquifers cover a large part of the Gippsland groundwater management basin from Moe to Bairnsdale. They comprise thick seams of sand aquifers separated by aquitards. The aquitards are generally clay or coal seams in the north-west of the Gippsland groundwater management basin, and limestone in 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 2019–20 groundwater resources overview

The groundwater level trend for 2019–20 is shown in Table 7-12. The Orbost GMA was categorised as declining throughout 2019–20.

Table 7-12 Groundwater level trends, East Gippsland groundwater catchment

Groundwater management unit	Groundwater level trend 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Groundwater management area					
Orbost	Declining	Declining	Declining	**Declining**	**Declining**

In 2019–20, 633 ML of water was extracted for consumptive purposes, which was less than the 942 ML extracted in the previous year. Of this volume, 151 ML was for urban use and 81 ML was estimated 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 (552 ML) was within the volume available for the year (2,318 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.

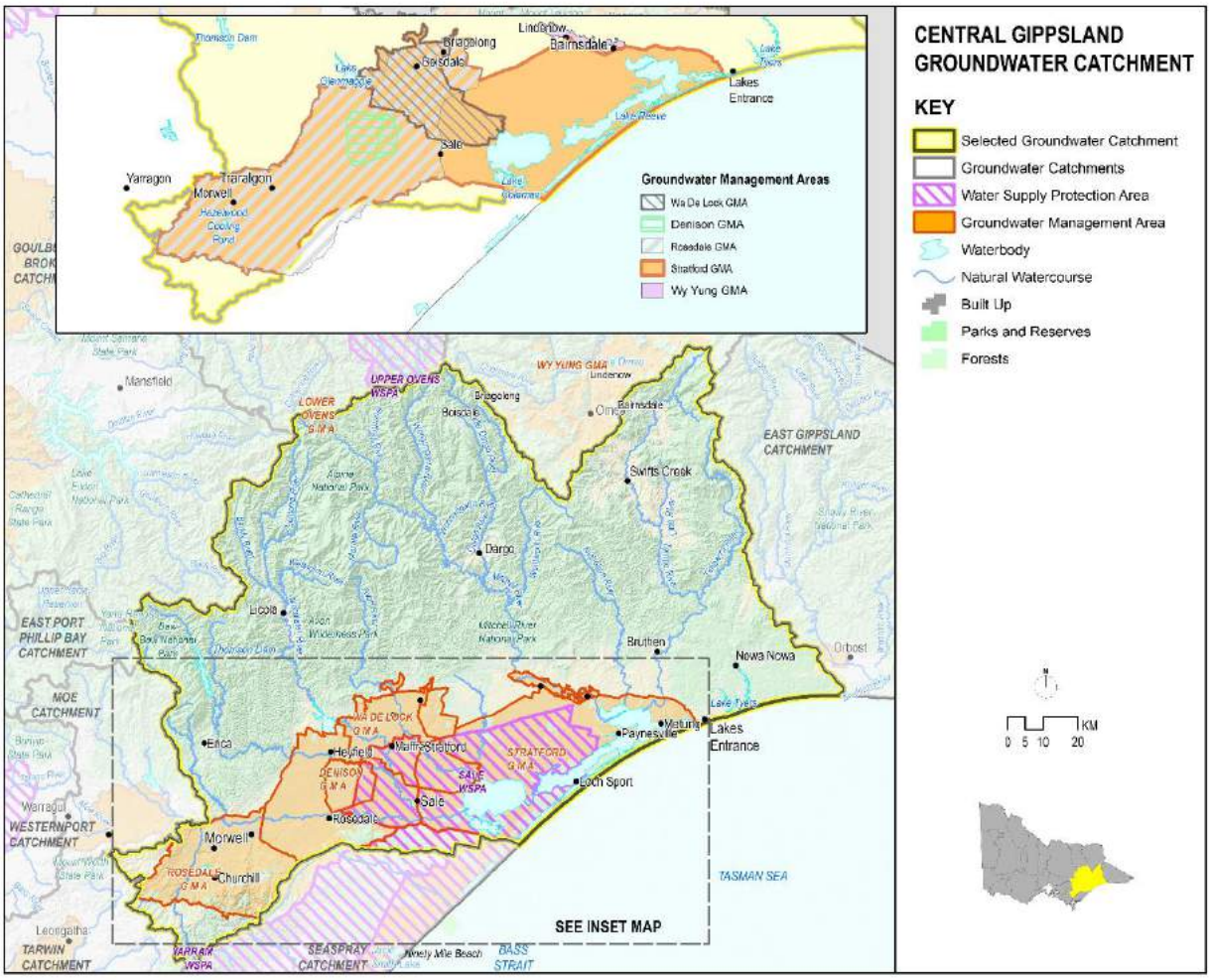
Table 7-13 Licensed groundwater volumes and use, East Gippsland groundwater catchment

GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
Orbost GMA	Licensed use (non-urban)	1,217	0	1,217	0	1,217	241
	Domestic and stock use	-	-	-	-	-	5
Outside management units	Licensed use (non-urban)	708	0	811	70	881	160
	Mallacoota urban	220	0	220	0	220	151
	Domestic and stock use	-	-	-	-	-	78
East Gippsland total 2019–20		**2,145**	**0**	**2,248**	**70**	**2,318**	**634**
East Gippsland total 2018–19		2,061	-	2,132	83	2,215	942

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 2019–20 groundwater resources overview

Groundwater level trends for 2019–20 are shown in Table 7-14. They were mostly all declining for the whole year, with Rosedale being the only to end 2019–20 with a stable trend in the final quarter.

Table 7-14 Groundwater level trends, Central Gippsland groundwater catchment

Groundwater management unit	Groundwater level trend 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Water supply protection area					
Sale	Stable	Declining	Declining	**Declining**	**Stable**
Yarram [1]	Declining	Declining	Declining	**Declining**	**Declining**
Groundwater management area					

Moe [2]	Declining	Declining	Declining	**Declining**	**Declining**
Rosedale [3]	Declining	Declining	Declining-	**Stable**	**Declining**
Stratford [3]	Declining	Declining	Declining	**Declining**	**Declining**
Wa De Lock	Declining	Declining	Declining	**Declining**	**Declining**
Wy Yung	Declining	Declining	Declining	**Declining**	**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 2019–20, 66,733 ML of water was extracted for consumptive purposes, which was less than the 85,806 ML extracted in the previous year. Of this volume, 1,920 ML was for urban use and 1,874 ML was estimated 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.**

✓ **The total volume extracted under licences (64,868 ML) was within the volume available for the year (162,029 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

GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
Denison GMA [1]	Licensed use (non-urban)	18,499	0	18,499	0	18,499	6,394
	Domestic and stock use	-	-	-	-	-	113
Moe GMA [2]	Licensed use (non-urban)	33	0	33	0	33	10
	Domestic and stock use	-	-	-	-	-	0
Rosedale GMA [3]	Licensed use (non-urban)	22,322	0	22,322	0	22,322	7,682
	Domestic and stock use	-	-	-	-	-	159
Sale WSPA	Licensed use (non-urban)	17,723	0	17,913	260	18,173	12,248
	Sale urban	3,480	0	3,190	(280)	2,910	1,844
	Domestic and stock use	-	-	-	-	-	365
Stratford GMA [3] [4] [5] [6]	Licensed use (non-urban)	36,722	0	36,722	0	36,722	22,164
	Domestic and stock use	-	-	-	-	-	24
Wa De Lock GMA [1]	Licensed use (non-urban)	28,928	0	28,950	0	28,950	6,218
	Boisdale urban	37	0	37	0	37	0
	Briagolong urban	160	0	160	0	160	76
	Domestic and stock use	-	-	-	-	-	393
Wy Yung GMA	Licensed use (non-urban)	7,462	0	7,462	0	7,462	919
	Domestic and stock use	-	-	-	-	-	11
Yarram WSPA [7]	Licensed use (non-urban)	6,889	0	6,897	0	6,897	3,575
	Domestic and stock use	-	-	-	-	-	104
Outside management units [1]	Licensed use (non-urban)	19,747	0	19,744	(50)	19,694	3,731
	Lindenow urban	171	0	171	0	171	9
	Domestic and stock use	-	-	-	-	-	**725**
Central Gippsland total 2019–20		**162,172**	**0**	**162,099**	**(70)**	**162,029**	**66,760**
Central Gippsland total 2018–19		162,149	-	164,166	(86)	164,080	85,806

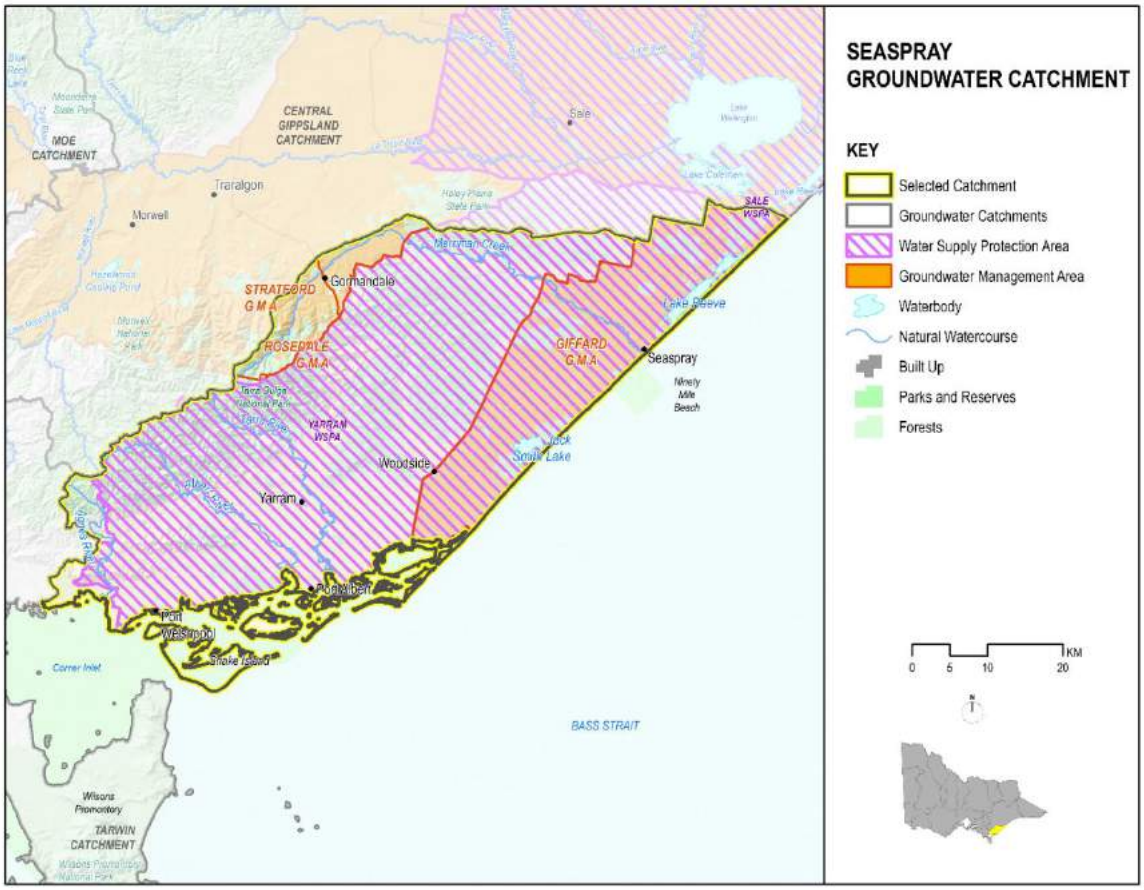
Notes
(1) The volumes of use in the Denison GMA, Wa De Lock GMA and outside management units include metered extractions for salinity control (Denison GMA 306 ML, Wa De Lock GMA 297 ML and outside management units 871 ML).

(2) The Moe GMA extends into the Moe groundwater catchment, and an additional 3,849 ML of entitlement volume is reported in the Moe catchment account (Table 7-19). The total entitlement volume for the Moe GMA as at 30 June 2020 was 3,882 ML.
(3) The use volume reported in the Rosedale and Stratford GMAs includes metered extractions from Latrobe Valley coal mines (Rosedale GMA 931 ML and Stratford GMA 22,163 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 at 30 June 2020 was 37,084 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 at 30 June 2020 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 2019–20 groundwater resources overview

The groundwater level trends were categorised as declining for all GMUs in 2019–20 (Table 7-16).

Table 7-16 Groundwater level trends, Seaspray groundwater catchment

Groundwater management unit	Groundwater level trend 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Water supply protection area					
Yarram (1)	Declining	Declining	Declining	**Declining**	**Declining**
Groundwater management area					
Giffard	Declining	Declining	Declining	**Declining**	**Declining**
Stratford (2)	Declining	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 2019–20, 7,848 ML of water was extracted for consumptive purposes, which was less than the 17,994 ML extracted in the previous year. Of this volume, 6 ML was for urban use and 468 ML was estimated for domestic and stock use.

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.**
Current compliance assessment criteria are not applicable in Stratford GMA: coal mine licences physically in the area are not assigned to the GMA.

✓ **The total volume extracted under licences (7,380 ML) was within the volume available for the year (25,859 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

GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
Giffard GMA	Licensed use (non-urban)	5,689	0	5,689	0	5,689	2,618
	Domestic & stock	-	-	-	-	-	114
Stratford GMA (1) (2)	Licensed use (non-urban)	362	0	362	0	362	34
	Domestic & stock	-	-	-	-	-	0
Yarram WSPA (3)	Licensed use (non-urban)	18,585	0	18,577	0	18,577	4,613
	Yarram urban	214	0	214	0	214	6
	Domestic & stock	-	-	-	-	-	237
Outside management units	Licensed use (non-urban)	1,018	0	1,018	0	1,018	109
	Domestic & stock	-	-	-	-	-	117
Seaspray total 2019–20		**25,867**	**0**	**25,859**	**0**	**25,859**	**7,848**
Seaspray total 2018–19		25,867	-	25,861	3	25,864	17,994

Notes

(1) The Stratford GMA extends into the Central Gippsland groundwater catchment, and an additional 36,722 ML of entitlement volume is reported in the Central Gippsland catchment account (Table 7-15). The total entitlement volume for the Stratford WSPA as at 30 June 2020 was 37,084 ML.

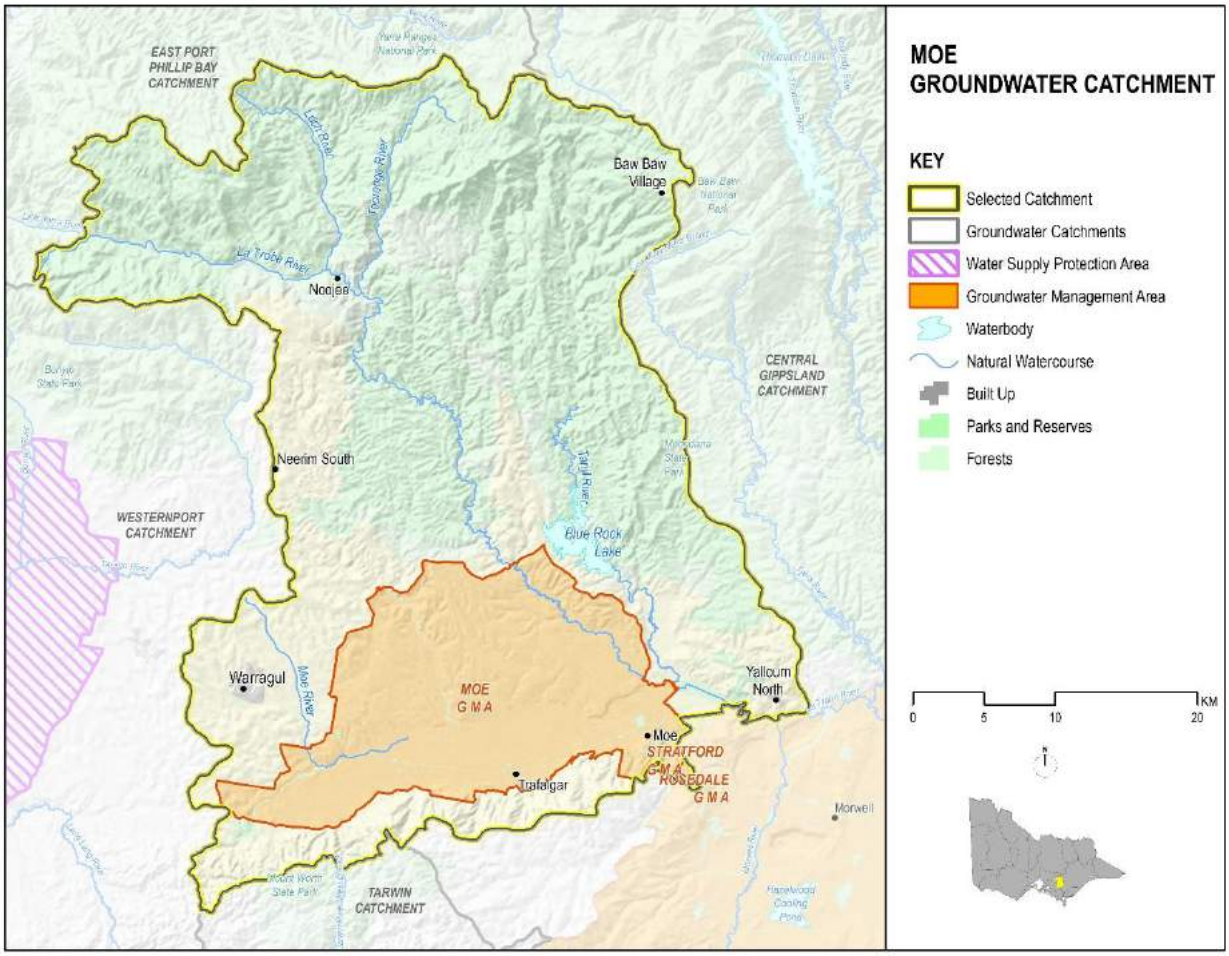
(2) Compliance against the PCV for Stratford GMA is not assessed because current compliance assessment criteria are not applicable in Stratford GMA: coal mine licences physically in the area are not assigned to the GMA.

(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 at 30 June 2020 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 Groundwater resources overview

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 2019–20 groundwater resources overview

Moe GMA's groundwater level trend was categorised as declining throughout 2019–20 (Table 7-18).

Table 7-18 Moe groundwater level trend

Groundwater management unit	Groundwater level trend 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Groundwater management area					
Moe	Declining	Declining	Declining	**Declining**	**Declining**

Note
(1) The Moe GMA extends into the Central Gippsland groundwater catchment.

In 2019–20, 1,153 ML of water was extracted for consumptive purposes, which was less than the 1,358 ML extracted in the previous year. Of this volume, 224 ML was estimated for domestic and stock use. There was no urban use in 2019–20.

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 (930 ML) was within the volume available for the year (5,210 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

GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
Moe GMA (1)	Licensed use (non-urban)	3,749	0	3,752	(30)	3,722	557
	Yarragon urban	100	0	100	0	100	0
	Domestic & stock	-	-	-	-	-	125
Outside management units	Licensed use (non-urban)	1,358	0	1,358	30	1,388	373
	Domestic & stock	-	-	-	-	-	110
Moe total 2019–20		**5,206**	**0**	**5,210**	**0**	**5,210**	**1,164**
Moe total 2018–19		5,210	-	5,210	0	5,210	1,358

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 at 30 June 2020 was 3,882 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.

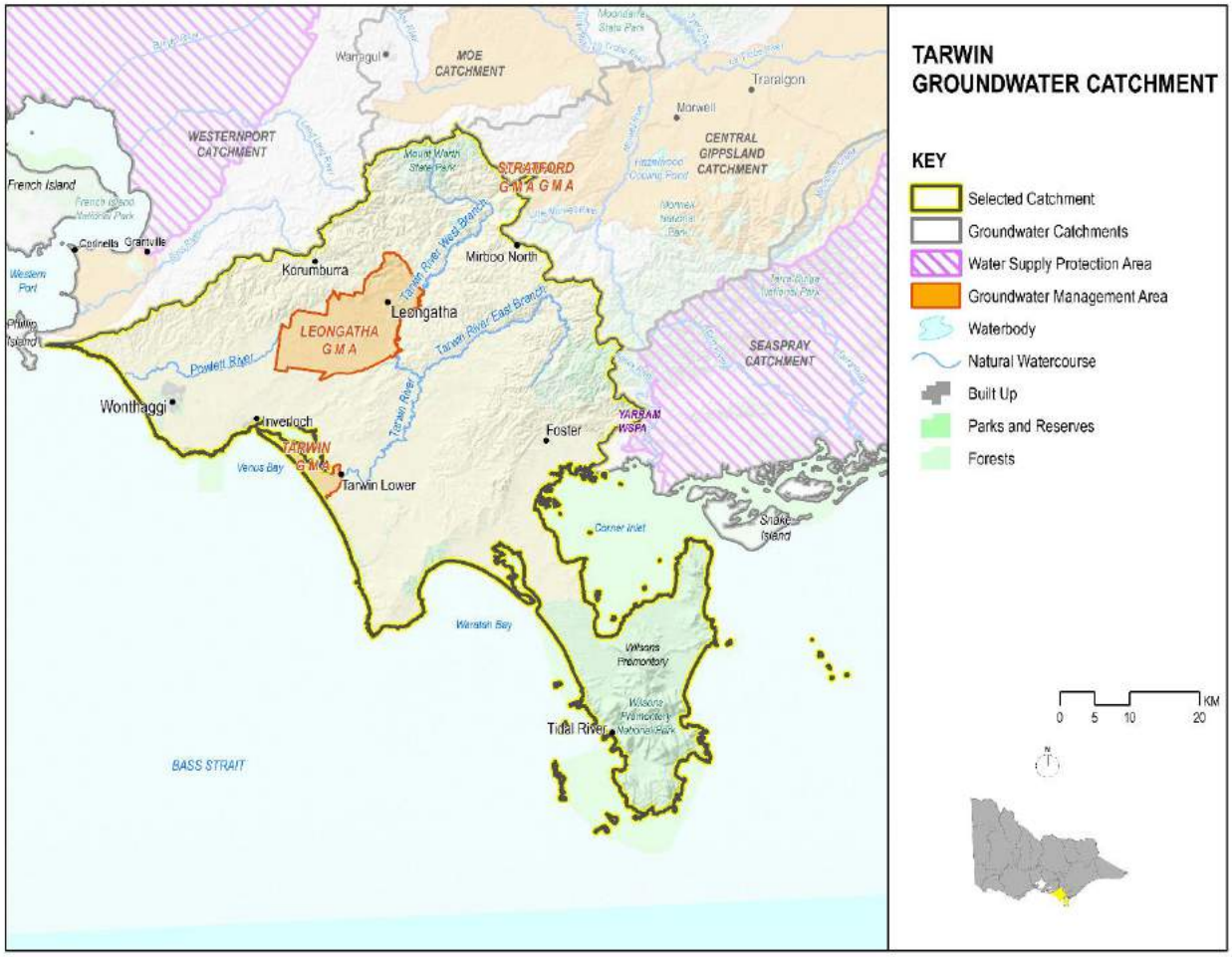
The basin's middle aquifers cover a large part of the area. They are made up of several formations, which are connected and act as one aquifer in each region. These aquifers vary in composition and include fine sands, coarse sand and gravel, clay and limestone. These aquifers are partially underlain 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 2019–20 groundwater resources overview

The groundwater level trends for 2019–20 are shown in Table 7-20. The groundwater level trends were stable during the year for both GMAs, with the Leongatha GMA ending the year with a rising trend.

Table 7-20 Groundwater level trends, Tarwin groundwater catchment

Groundwater management unit	Groundwater level trend 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Groundwater management area					
Leongatha	Stable	Stable	Stable	**Stable**	**Stable**
Tarwin	Stable	Stable	Stable	**Rising**	**Stable**

In 2019–20, 983 ML of water was extracted for consumptive purposes, which was less than the 1,163 ML extracted in the previous year. Of this volume 843 ML was estimated for domestic and stock use. There was no urban use in 2019–20.

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 (140 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.

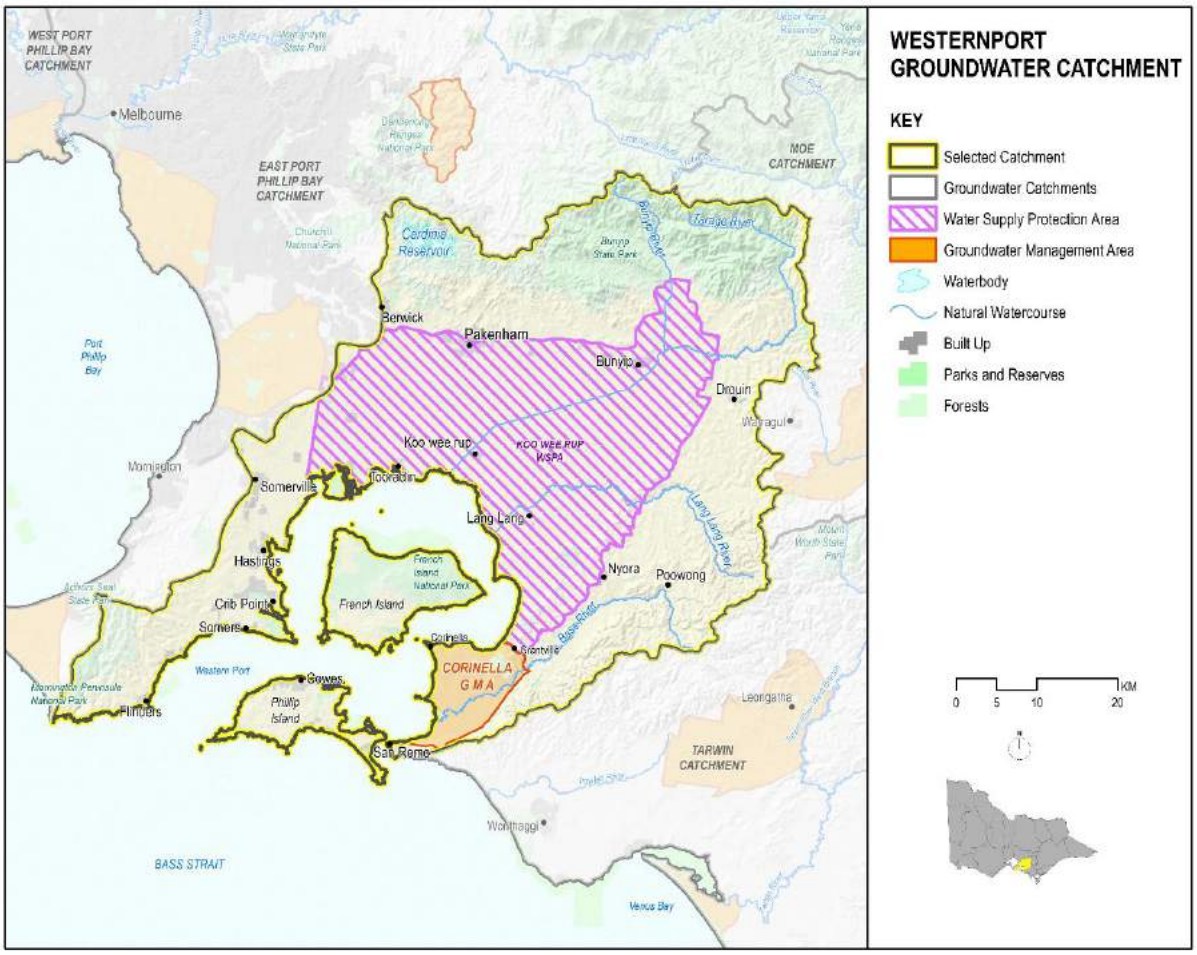
Table 7-21 Licensed groundwater volumes and use, Tarwin groundwater catchment

GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
Leongatha GMA	Licensed use (non-urban)	1,088	0	1,088	0	1,088	94
	Leongatha urban	715	0	715	0	715	0
	Domestic & stock	-	-	-	-	-	51
Tarwin GMA	Licensed use (non-urban)	58	0	58	0	58	10
	Domestic & stock	-	-	-	-	-	510
Outside management units	Licensed use (non-urban)	344	0	344	0	344	36
	Domestic & stock	-	-	-	-	-	299
Tarwin total 2019–20		**2,206**	**0**	**2,206**	**0**	**2,206**	**999**
Tarwin total 2018–19		2,206	-	2,206	0	2,206	1,163

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 Groundwater resources overview

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 2019–20 groundwater resources overview

Groundwater level trends for 2018–19 are shown in Table 7-22. Although the groundwater level trends in both GMUs were categorised as declining from July 2019 to the end of the March quarter, both ended the year with a stable trend.

Table 7-22 Groundwater level trends, Westernport groundwater catchment

Groundwater management unit	Groundwater level trend 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Water supply protection area					
Koo Wee Rup	Declining	Declining	Declining	**Stable**	**Declining**
Groundwater management area					
Corinella	Declining	Declining	Declining	**Stable**	**Declining**

In 2019–20, 4,609 ML of water was extracted for consumptive purposes, which was less than the 6,001 ML extracted in the previous year. Of this volume, 1,266 ML was estimated for domestic and stock use. There was no urban use in 2019–20.

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 (3,343 ML) was within the volume available for the year (17,444 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

GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
Corinella GMA	Licensed use (non-urban)	172	0	172	0	172	40
	Corinella / Grantville urban	490	0	490	0	490	0
	Domestic & stock	-	-	-	-	-	53
Koo Wee Rup WSPA (1)	Licensed use (non-urban)	12,345	0	12,345	119	12,464	2,912
	Lang Lang urban	119	0	119	(119)	0	0
	Domestic & stock	-	-	-	-	-	675
Outside management units	Licensed use (non-urban)	4,287	0	4,318	0	4,318	392
	Domestic & stock	-	-	-	-	-	545
Westernport total 2019–20		**17,413**	**0**	**17,444**	**()**	**17,444**	**4,615**
Westernport total 2018–19		17,414	-	17,793	0	17,793	6,001

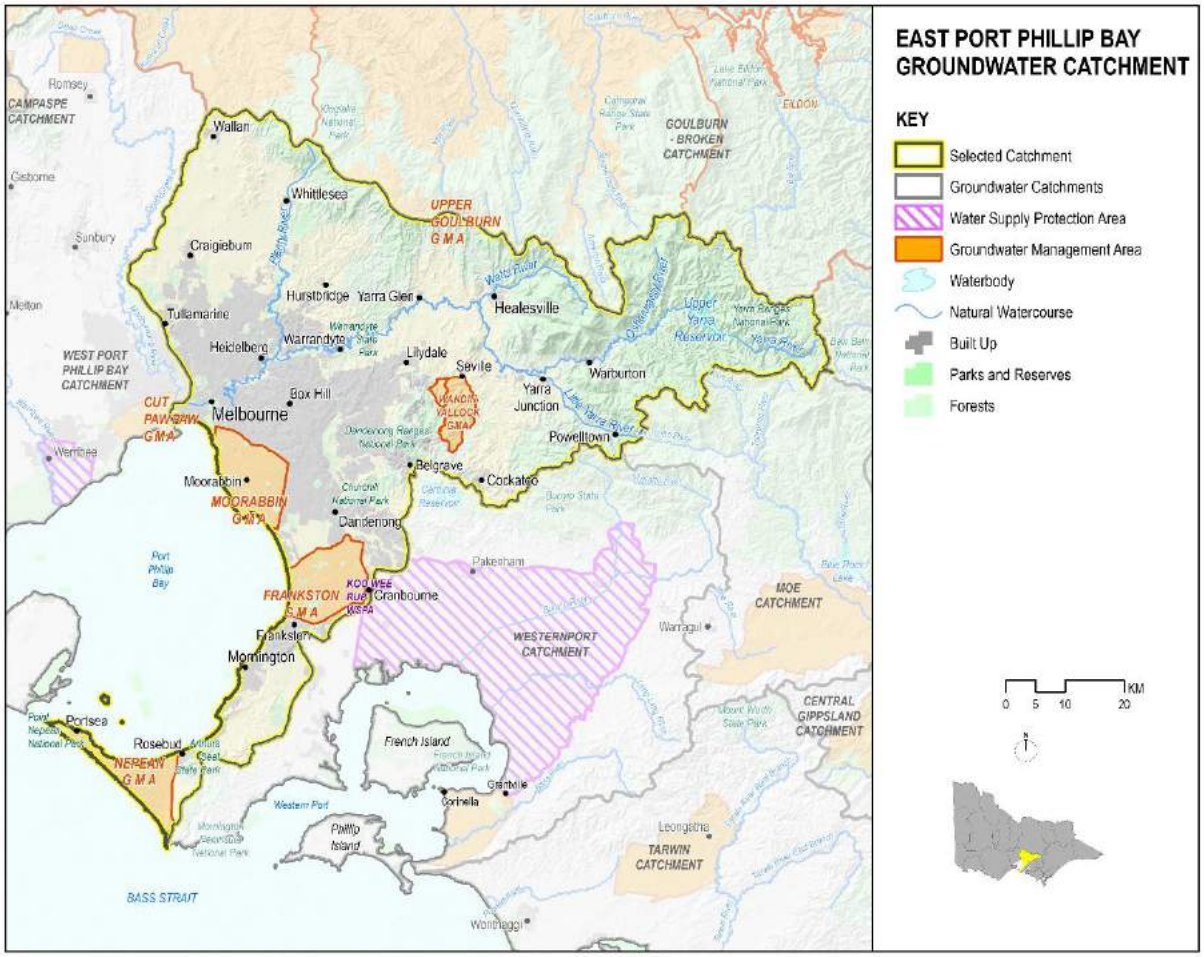
Note

(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 at 30 June 2020 was 12,575 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 Groundwater resources overview

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 2019–20 groundwater resources overview

Groundwater level trends for 2019–20 are shown in Table 7-24. They were generally declining for most GMUs except Nepean GMA and Moorabbin, which were categorised as stable and rising for most of the year.

Table 7-24 Groundwater level trends, East Port Phillip Bay groundwater catchment

Groundwater management unit	Groundwater level trend 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Water supply protection area					
Koo Wee Rup	Declining	Declining	Declining	**Stable-**	**Declining**
Groundwater management area					
Frankston	Declining	Declining	Declining-	**Declining**	**Declining**
Moorabbin	Declining	Stable	Rising	**Rising**	**Declining**

Nepean	Stable	Declining	Stable	**Stable**	**Stable**
Wandin Yallock	Declining	Declining	Declining	**Declining**	**Declining**

In 2019–20, 10,107 ML of water was extracted for consumptive purposes, which was less than the 10,603 ML extracted in the previous year. Of this volume, 3,620 ML was estimated 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 (6,487 ML) was within the volume available for the year (28,163 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

GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
Frankston GMA	Licensed use (non-urban)	2,212	0	2,212	0	2,212	686
	Domestic & stock	-	-	-	-	-	53
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	816
	Domestic & stock	-	-	-	-	-	257
Nepean GMA (2)	Licensed use (non-urban)	6,110	0	6,110	0	6,110	2,812
	Domestic & stock	-	-	-	-	-	1,785
Wandin Yallock WSPA	Licensed use (non-urban)	3,025	0	3,025	0	3,025	482
	Domestic & stock	-	-	-	-	-	65
Outside management units	Licensed use (non-urban)	14,074	0	14,081	0	14,081	1,691
	Domestic & stock	-	-	-	-	-	1,476
East Port Phillip Bay total 2019–20		**28,156**	**0**	**28,163**	**0**	**28,163**	**10,122**
East Port Phillip Bay total 2018–19		27,998	-	27,968	0	27,968	10,603

Notes

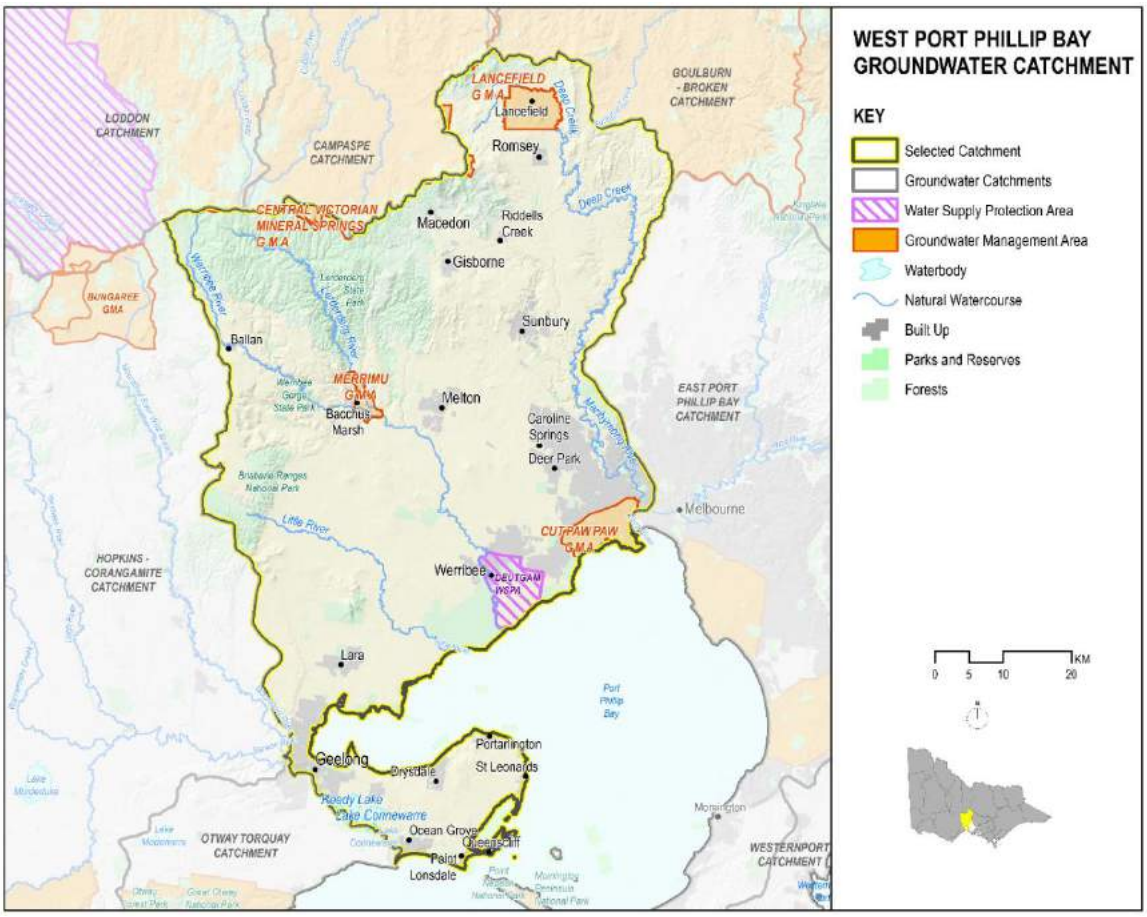
(1) The Koo Wee Rup WSPA extends into the Westernport groundwater catchment, and an additional 12,464 ML of entitlement volume is reported in the Westernport catchment account (Table 7-23). The total entitlement volume for the Koo Wee Rup WSPA as at 30 June 2020 was 12,575 ML.

(2) Estimated stock and domestic use in Nepean GMA is calculated using a factor 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 Groundwater resources overview

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. The Central Victorian Mineral Springs GMA extends into the Campaspe and Loddon groundwater catchments. Groundwater resources supply licensed entitlements and domestic and stock use and urban use to Blackwood, Lancefield and Romsey.

7.5.4.2 2019–20 groundwater resources overview

Groundwater level trends for 2019–20 are shown in Table 7-26. They were categorised as declining or rising. Like the previous year, Deutgam WSPA and Merrimu GMA were categorised as declining for the year and Lancefield had a mostly rising trend throughout the year. 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 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Water supply protection area					
Deutgam	Declining	Declining	Declining	**Declining**	**Declining**
Groundwater management area					
Lancefield	Rising	Rising	Rising	**Rising**	**Rising**
Merrimu	Declining	Declining	Declining	**Declining**	**Declining**

In 2019–20, 3,781 ML of water was extracted for consumptive purposes, which was less than the 4,535 ML extracted in the previous year. Of this volume, 127 ML was for urban use and 1,673 ML was estimated 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 (2,109 ML) was within the volume available for the year (14,662 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.

Deutgam WSPA had a seasonal allocation of 25% in 2019–20.

Table 7-27 Licensed groundwater volumes and use, West Port Phillip Bay groundwater catchment

GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
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	0	1,271	0	1,271	275
	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	71
	Domestic & stock	-	-	-	-	-	60
Merrimu GMA	Licensed use (non-urban)	10	0	10	0	10	0
	Domestic & stock	-	-	-	-	-	15
Outside management units	Licensed use (non-urban)	10,706	0	10,831	0	10,831	1,559
	Blackwood urban	50	0	50	0	50	6
	Romsey urban	600	0	600	0	600	50
	Domestic & stock	-	-	-	-	-	1,539
West Port Phillip Bay total 2019–20		**18,349**	**0**	**14,662**	**0**	**14,662**	**3,786**
West Port Phillip Bay total 2018–19		18,093	-	15,734	0	15,734	4,535

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.

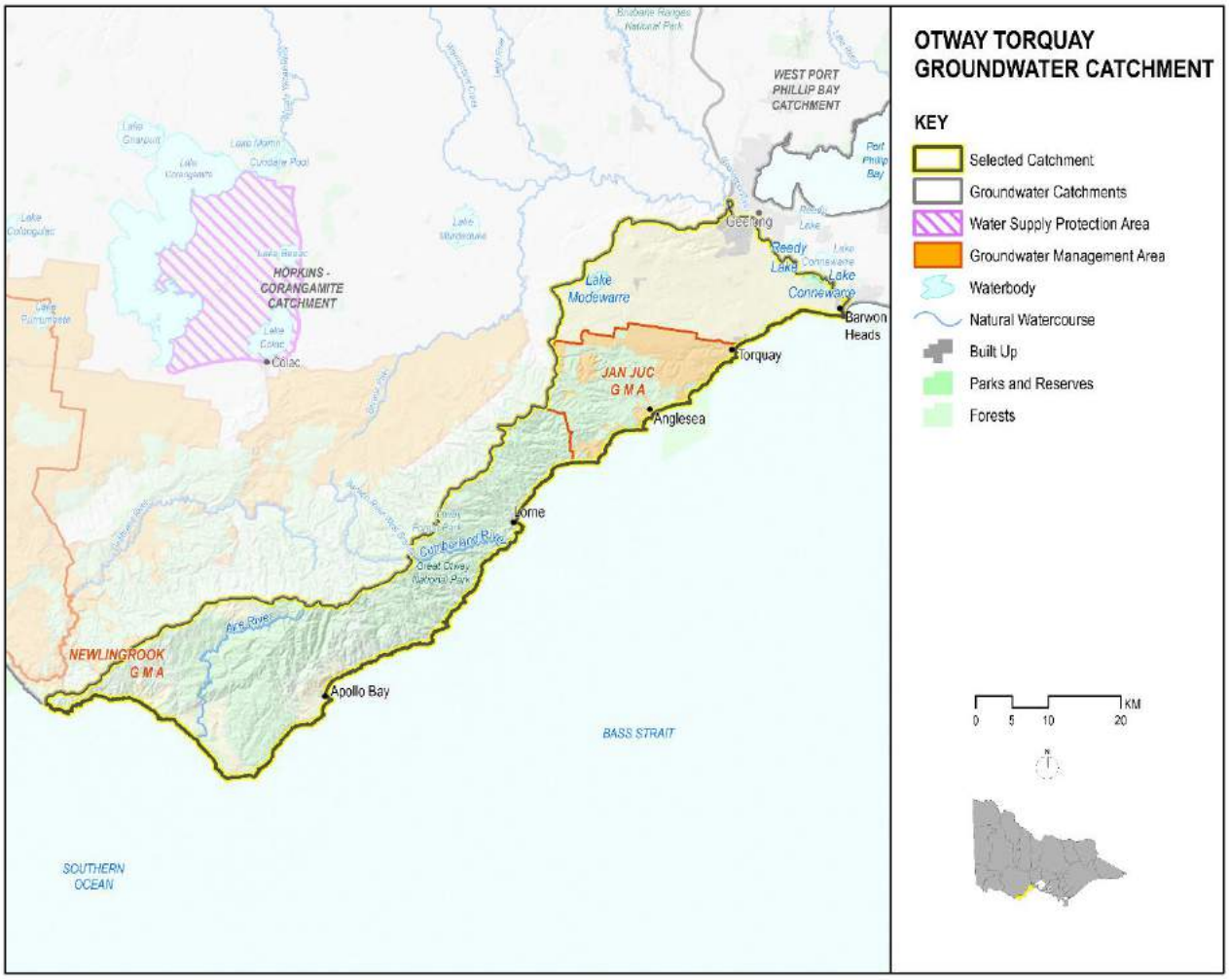
Most of the lower middle aquifer is confined by overlying layers and below by thick marl aquitards, except for the region along its northern reaches where it connects to the lower aquifers. The lower middle aquifer relies on upward and downward leakage from adjacent formations for recharge. Discharge 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 Groundwater resources overview

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 2019–20 groundwater resources overview

The groundwater level trend for 2019–20 is shown in Table 7-28. The groundwater level trend for Jan Juc GMA was categorised as rising at the start and end of 2019–20 and stable in the December 2019 and March 2020 quarters.

Table 7-28 Groundwater level trends, Otway–Torquay groundwater catchment

Groundwater management unit	Groundwater level trend 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Groundwater management area					
Jan Juc	Rising	Stable	Stable	**Rising**	**Rising**

In 2019–20, 2,301 ML of water was extracted for consumptive purposes, which was more than the 246 ML extracted in the previous year. Of this volume, 47 ML was estimated for domestic and stock purposes and 2,177 ML for urban use. The large increase in use in 2019–20 was due to the extraction of groundwater under the *Bulk Entitlement (Anglesea Groundwater) Order 2009*: this extraction did not occur in 2018–19.

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 (2,255 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

GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
Jan Juc GMA	Licensed use (non-urban)	4,250	0	4,250	0	4,250	77
	Greater Geelong (Anglesea Borefield) urban (1)	10,000	0	10,000	0	10,000	2,177
	Domestic & stock	-	-	-	-	-	6
Outside management units	Licensed use (non-urban)	158	0	158	0	158	1
	Domestic & stock	-	-	-	-	-	41
Otway–Torquay total 2019–20		**14,408**	**0**	**14,408**	**0**	**14,408**	**2,301**
Otway–Torquay total 2018–19		14,403	-	14,410	0	14,410	246

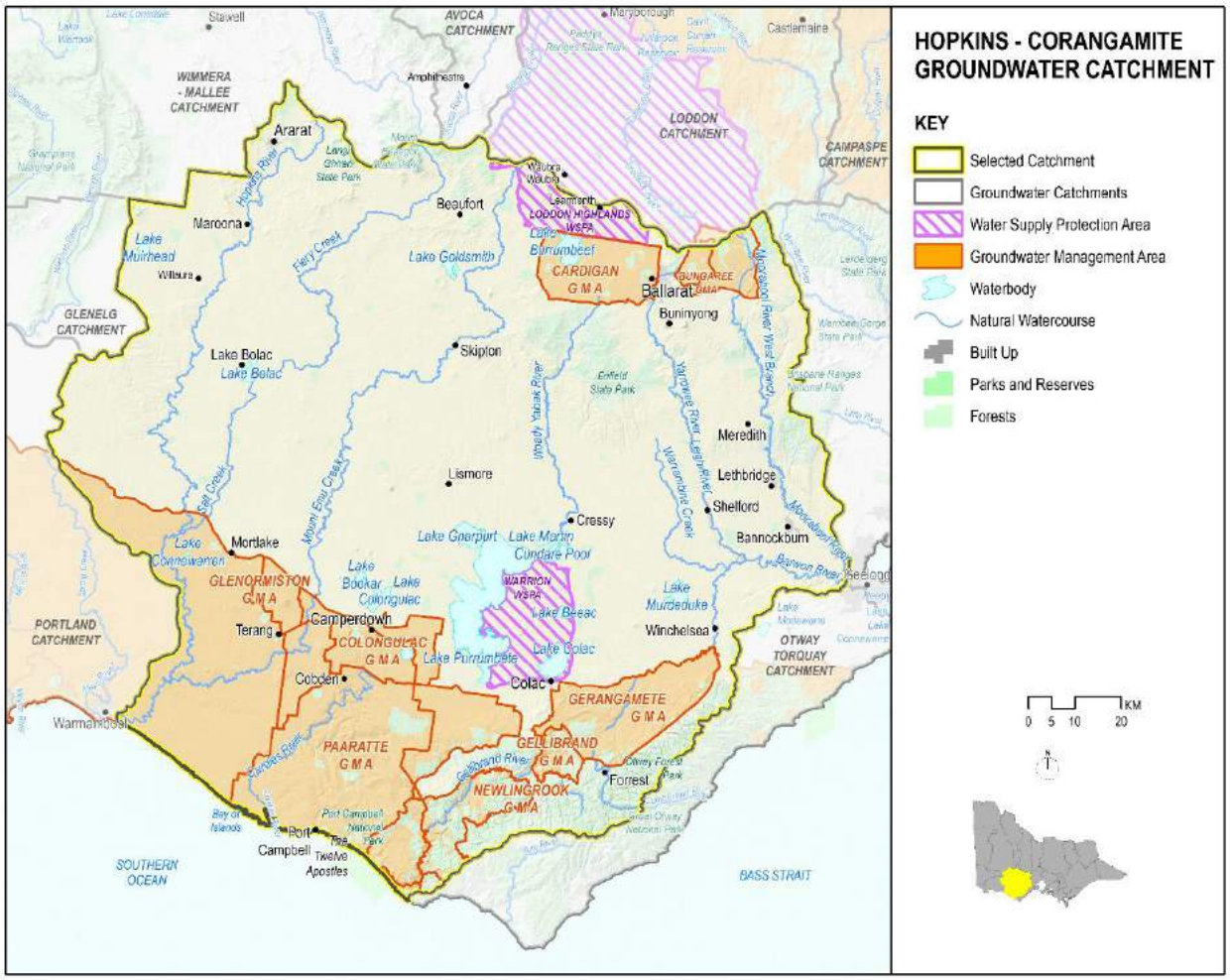
Note

(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 2011–12, when 4,019 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 Groundwater resources overview

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 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 Bungaree GMA, which had its WSPA status revoked by the Minister for Water in December 2016, is also in this groundwater catchment. 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.

7.6.2.2 2019–20 groundwater resources overview

Groundwater level trends for 2019–20 are shown in Table 7-30. They were generally categorised as stable for the majority of the year, with two GMAs finishing the year with a rising trend and the Paaratte and Newlingrook GMAs displaying declining trends during the year.

Table 7-30 Groundwater level trends, Hopkins–Corangamite groundwater catchment

Groundwater management unit [1]	Groundwater level trend 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Water supply protection area					
Warrion	Stable	Stable	Stable	**Stable**	**Stable**

Loddon Highlands [2]	Declining	Declining	Rising	**Declining**	**Declining**
Groundwater management area					
Bungaree	Rising	Rising	Stable	**Rising**	**Declining**
Cardigan	Stable	Rising	Stable	**Stable**	**Stable**
Colongulac	Stable	Stable	Stable	**Stable**	**Stable**
Gellibrand	Stable	Stable	Stable	**Stable**	**Stable**
Gerangamete	Declining	Declining	Stable	**Stable**	**Declining**
Newlingrook	Stable	Declining	Stable	**Stable**	**Stable**
Paaratte	Declining	Stable	Stable-	**Stable**	**Stable**
South West Limestone [3]	Stable	Stable	Rising	**Rising**	**Stable**

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 Hopkins–Corangamite, Portland and Glenelg groundwater catchments.

In 2019–20, 25,999 ML of water was extracted for consumptive purposes, which was less than the 33,549 ML extracted in the previous year. Of this volume, 953 ML was extracted for urban use and 2,425 ML was estimated 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.

✓ **The total volume extracted under licences (23,588 ML) was within the volume available for the year (83,921 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 provide urban groundwater supply to Willaura. Although Willaura is in the Hopkins–Corangamite groundwater catchment, the bores that supply the town are located 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

GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
Bungaree GMA	Licensed use (non-urban)	5,194	0	5,256	0	5,256	2,185
	Ballarat Supply urban	69	0	69	0	69	0
	Dean urban	30	0	30	0	30	11
	Domestic & stock	-	-	-	-	-	161
Cardigan GMA	Licensed use (non-urban)	889	0	892	0	892	224
	Ballarat urban [1]	3,000	0	2,997	0	2,997	508
	Domestic & stock	-	-	-	-	-	104
Colongulac GMA	Licensed use (non-urban)	4,404	0	4,404	0	4,404	1,138
	Domestic & stock	-	-	-	-	-	90
Gerangamete GMA	Licensed use (non-urban)	238	0	238	0	238	112
	Domestic & stock	-	-	-	-	-	5
Glenormiston GMA	Licensed use (non-urban)	2,636	0	2,636	0	2,636	1,141
	Domestic & stock	-	-	-	-	-	56
Loddon Highlands WSPA	Licensed use (non-urban)	2	0	2	5	7	2
	Domestic & stock [2]	-	-	-	-	-	110

Newlingrook GMA	Licensed use (non-urban)	158	0	158	0	158	11
	Otway system (Carlisle) urban	1,800	0	1,800	0	1,800	4
	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	304
	Domestic & stock	-	-	-	-	-	2
South West Limestone GMA (3) (4)	Licensed use (non-urban)	28,276	7,552	27,781	566	35,899	11,384
	Domestic & stock	-	-	-	-	-	831
Warrion WSPA	Licensed use (non-urban)	14,075	0	14,075	0	14,075	2,913
	Domestic & stock	-	-	-	-	-	177
Outside management units	Licensed use (non-urban)	11,676	0	11,696	0	11,696	3,512
	Beaufort urban	200	0	200	0	200	73
	Darlington urban	10	0	10	0	10	3
	Mortlake (part) urban	335	0	335	0	335	23
	Streatham urban	60	0	60	0	60	41
	Domestic & stock	-	-	-	-	-	899
Hopkins – Corangamite total 2019–20		**76,211**	**7,552**	**75,798**	**571**	**83,921**	**26,022**
Hopkins – Corangamite total 2018–19		95,110	7,540	95,099	2	102,641	33,549

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) 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.

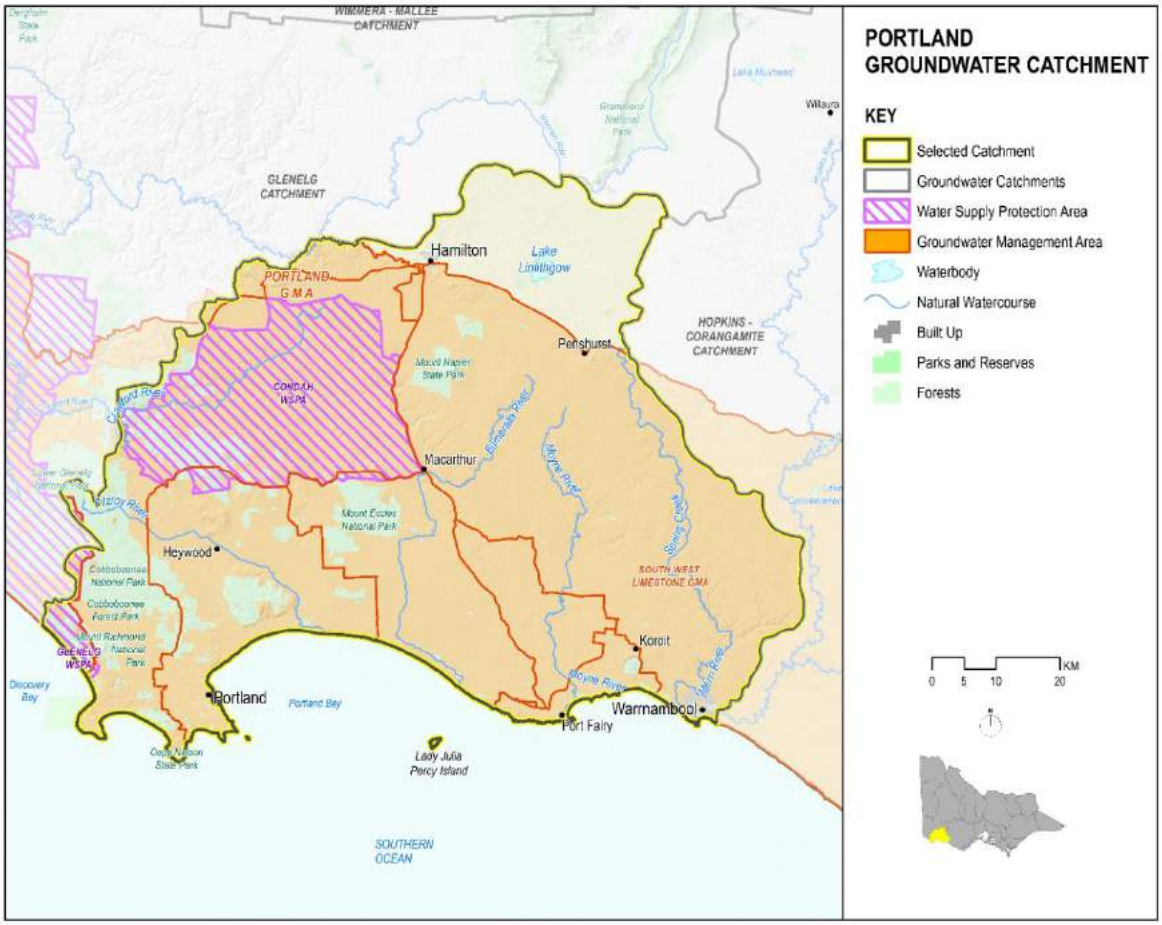
(3) The South West Limestone GMA extends into the Portland and Glenelg groundwater catchments, and an additional 35,749 ML and 17,169 ML of entitlement volume is reported in the Portland and Glenelg catchment accounts respectively (Table 7-33 and Table 7-35). The total entitlement volume for the South West Limestone GMA as at 30 June 2020 was 81,194 ML.

(4) 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.

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 Groundwater resources overview

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 straddle this catchment and the Glenelg groundwater catchment. Groundwater resources supply licensed entitlements, domestic and stock use and urban use to12 towns in the area. 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 2019–20 groundwater resources overview

Groundwater level trends for 2019–20 are shown in Table 7-32. They were categorised as declining in the Portland GMA for the start of the year and stable at the end; stable in the South West Limestone GMA in the first half and rising from January to June 2020; and initially stable to rising in the Condah WSPA then finishing with a declining trend in the June 2020 quarter.

Table 7-32 Groundwater level trends, Portland groundwater catchment

Groundwater management unit	Groundwater level trend 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Water supply protection area					
Condah	Stable	Rising	Rising	**Declining**	**Stable**
Groundwater management area					
Portland (1)	Declining	Declining	INS-DATA	**Stable**	**Declining**
South West Limestone (2)	Stable	Stable	Rising	**Rising**	**Stable**

Notes
(1) Insufficient data was available for the January to March 2020 quarter to determine a trend.
(2) The South West Limestone GMA extends into the Hopkins–Corangamite, Portland and Glenelg groundwater catchments.

In 2019–20, 19,589 ML of water was extracted for consumptive purposes, which was less than the 25,204 ML extracted in the previous year. Of this volume, 2,924 ML was for urban use and 2,402 ML was estimated 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 located 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 of 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 (17,204 ML) was within the volume available for the year (66,988 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.

Table 7-33 Licensed groundwater volumes and use, Portland groundwater catchment

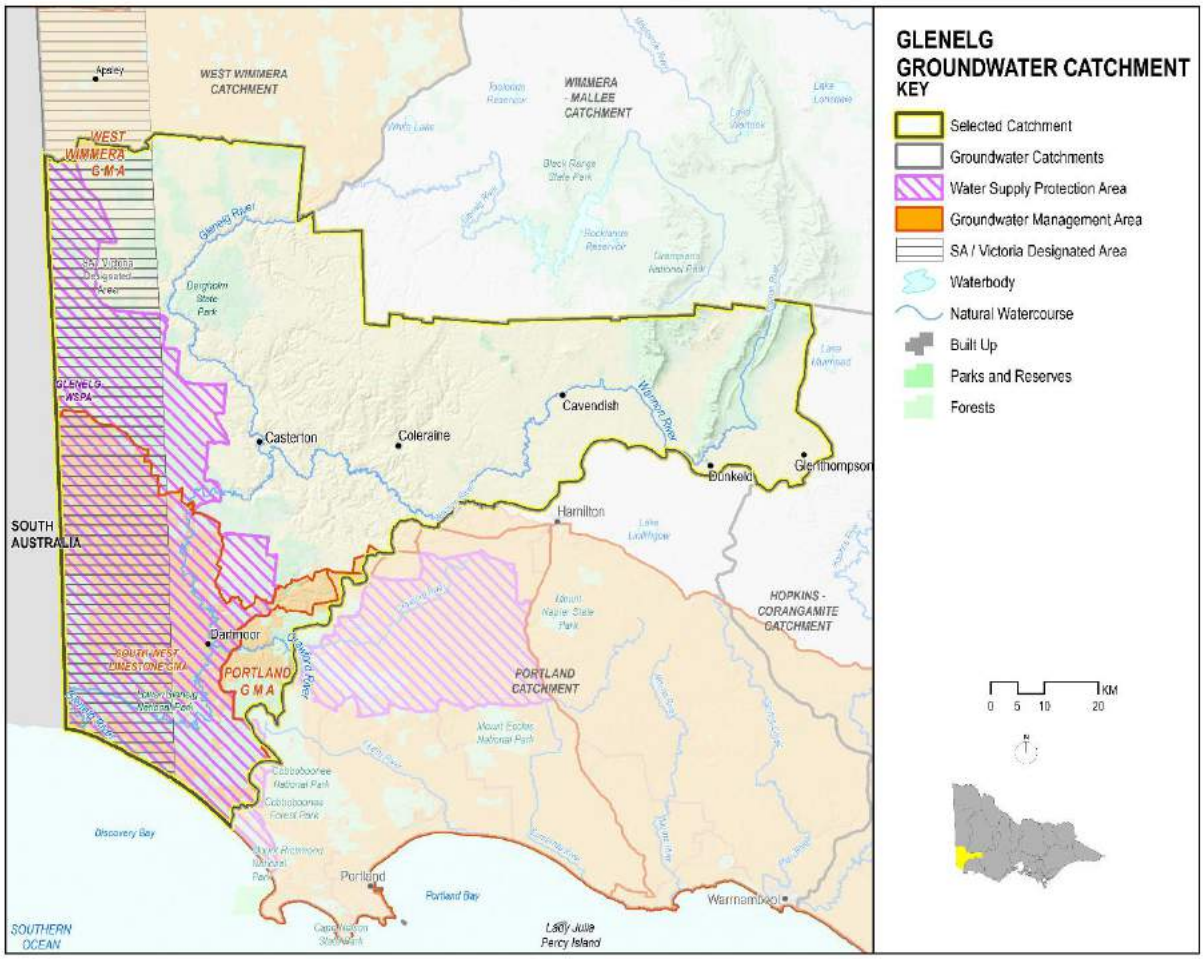
GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
Condah WSPA	Licensed use (non-urban)	7,340	0	7,340	0	7,340	2,301
	Macarthur urban	130	0	130	0	130	25
	Domestic & stock	-	-	-	-	-	104
Portland GMA	Licensed use (non-urban)	213	0	213	0	213	0
	Heywood urban	333	0	333	0	333	169
	Port Fairy urban	1,026	0	1,026	0	1,026	624
	Portland urban	6,222	0	6,222	0	6,222	1,618
	Domestic & stock	-	-	-	-	-	2
South West Limestone GMA (1) (2)	Licensed use (non-urban)	34,475	10,271	35,235	334	45,840	11,132
	Koroit urban	524	157	524	0	681	0
	Warrnambool, Allansford and Koroit (part) urban	750	225	750	0	975	414
	Domestic & stock	-	-	-	-	-	2,136
Outside management units	Licensed use (non-urban)	3,927	0	3,927	0	3,927	830
	Caramut urban	50	0	50	0	50	23
	Penshurst urban	250	0	250	0	250	69
	Domestic & stock	-	-	-	-	-	171
Portland total 2019–20		**55,240**	**10,654**	**56,000**	**334**	**66,988**	**19,616**
Portland total 2018–19		56,128	10,967	57,226	0	68,193	25,204

Notes
(1) The South West Limestone GMA extends into the Hopkins–Corangamite and Glenelg groundwater catchments, and an additional 28,276 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 at 30 June 2020 was 81,194 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.

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 Groundwater resources overview

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 straddle this catchment and the Portland groundwater catchment. Groundwater resources supply licensed entitlements, domestic and stock use and urban use in Casterton, Dartmoor and Merino.

7.6.4.2 2019–20 groundwater resources overview

Groundwater level trends for 2019–20 are shown in Table 7-34. They were categorised as mostly stable throughout the year for both GMUs and rising in the South West Limestone GMA from January to June 2020.

Table 7-34 Groundwater level trends, Glenelg groundwater catchment

Groundwater management unit	Groundwater level trend 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Water supply protection area					
Glenelg	Stable	Stable	Stable	**Stable**	**Stable**
Groundwater management area					
South West Limestone (1)	Stable	Stable	Rising	**Rising**	**Stable**

Note
(1) The South West Limestone GMA extends into the Hopkins–Corangamite, Portland and Glenelg groundwater catchments.

In 2019–19, 11,018 ML of water was extracted for consumptive purposes, which was less than the 11,466 ML extracted in the previous year. Of this volume, 434 ML was for urban use and 660 ML was estimated 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 total volume extracted under licences (10,358 ML) was within the volume available for the year (39,185 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.

Table 7-35 Licensed groundwater volumes and use, Glenelg groundwater catchment

GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
Glenelg WSPA	Licensed use (non-urban)	14,942	0	15,092	(100)	14,992	5,335
	Casterton urban	1,000	0	1,000	0	1,000	406
	Dartmoor urban	150	0	150	0	150	28
	Domestic & stock	-	-	-	-	-	476
South West Limestone GMA (1) (2)	Licensed use (non-urban)	17,169	4,807	17,025	(800)	21,032	4,531
	Domestic & stock	-	-	-	-	-	27
Outside management units	Licensed use (non-urban)	812	0	909	0	909	59
	Hamilton Tarrington Dunkeld urban	1,102	0	1,102	0	1,102	0
	Merino urban	0	0	0	0	0	0
	Domestic & stock	-	-	-	-	-	159
Glenelg total 2019–20		**35,175**	**4,807**	**35,278**	**(900)**	**39,185**	**11,019**
Glenelg total 2018–19		35,272	4,708	35,496	0	40,204	11,466

Notes
(1) The South West Limestone GMA extends into the Hopkins–Corangamite and Portland groundwater catchments, and an additional 28,276 ML and 35,749 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 at 30 June 2020 was 81,194 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.

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.

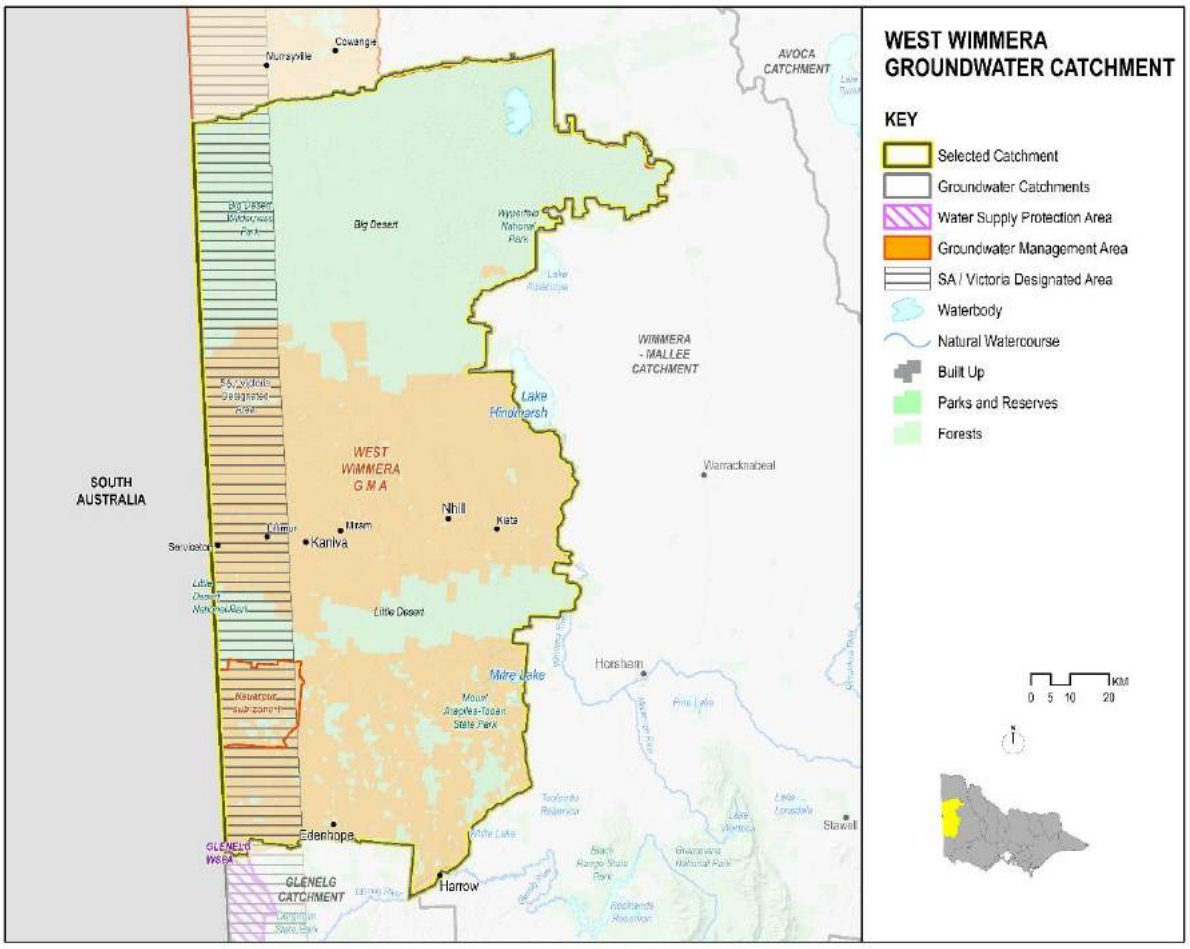
In most areas, all the aquifers are understood to be connected, with thin aquitards between the aquifers in part or all of the catchment. The Renmark Group Aquifer in the West Wimmera GMA is the exception: it is considered to be disconnected from the water above it.

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 Groundwater resources overview

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 2019–20 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.

Groundwater level trends for 2019–20 are shown in Table 7-36. Although groundwater level trends in the West Wimmera GMA were categorised as 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 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Groundwater management area					
West Wimmera	Stable	Stable	Stable	**Stable**	**Declining**
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 2019–20, 25,344 ML of water was extracted for consumptive purposes, less than the 27,470 ML extracted in the previous year. Of this volume, 668 ML was for urban use and 824 ML was estimated 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 (24,520 ML) was within the volume available for the year (60,929 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.

In line with the West Wimmera GMA strategy, which assists with managing the declining levels in the western part of the West Wimmera groundwater catchment, an 80% seasonal allocation remained in place in the Neuarpur subzone 1 in 2019–20.

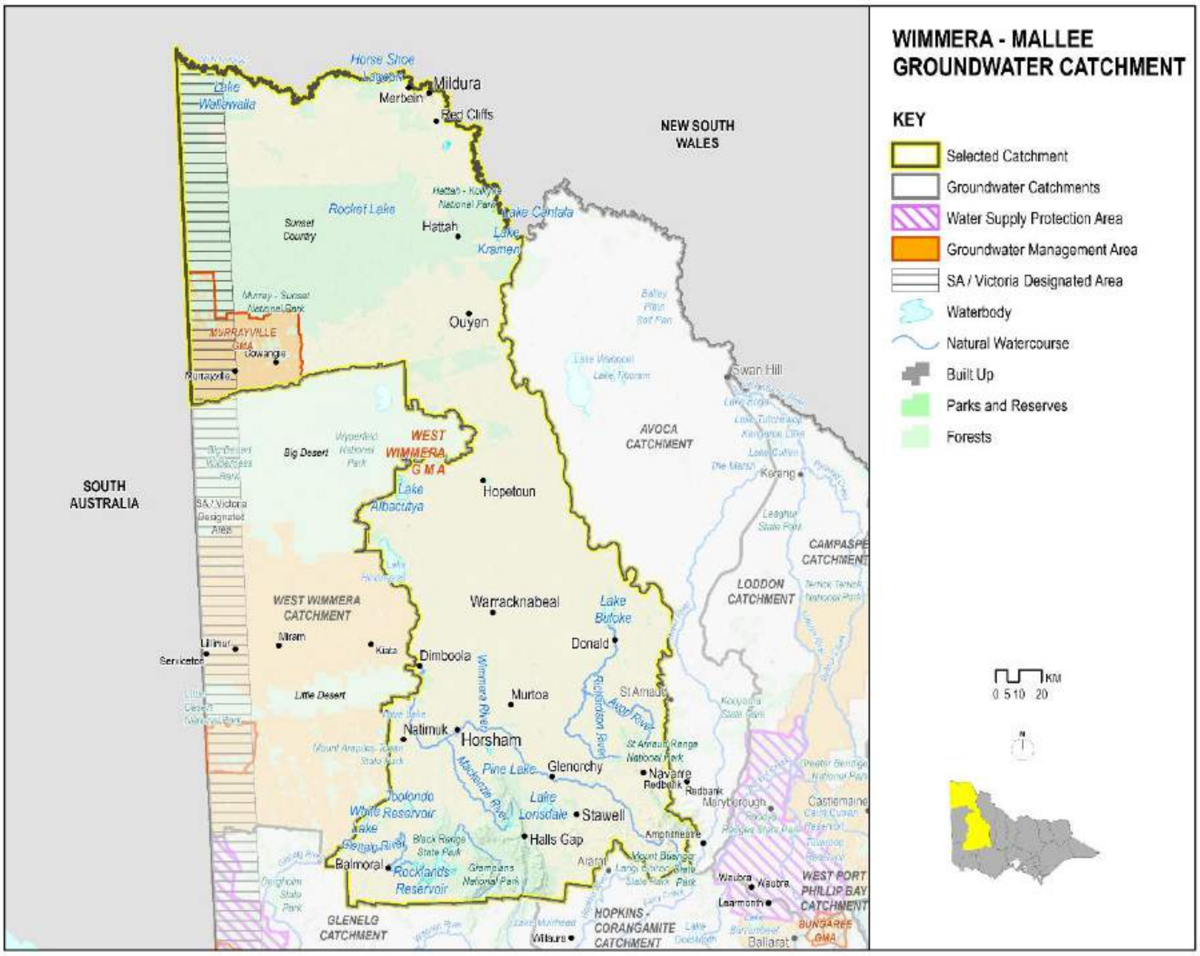
Table 7-37 Licensed groundwater volumes and use, West Wimmera groundwater catchment

GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
West Wimmera GMA	Licensed use (non-urban)	51,548	10,721	47,440	6	58,166	23,852
	Apsley urban	40	12	40	0	52	34
	Edenhope urban	250	75	250	(6)	319	146
	Goroke urban	86	26	86	0	112	51
	Harrow urban	60	18	60	0	78	47
	Kaniva urban	600	180	600	0	780	145
	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	226
	Serviceton urban	25	8	25	0	33	7
	Domestic & stock	-	-	-	-	-	842
West Wimmera total 2019–20		**53,688**	**11,363**	**49,580**	**0**	**60,942**	**25,362**
West Wimmera total 2018–19		53,598	10,821	49,485		60,306	27,470

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 *Groundwater resources overview*

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 *2019–20 groundwater resources overview*

Groundwater level trends for 2019–20 are shown in Table 7-38. In 2019–20, the groundwater level trend in the Murrayville GMA was categorised as stable.

Table 7-38 Groundwater level trends, Wimmera-Mallee groundwater catchment

Groundwater management unit	Groundwater level trend 2019–20				Groundwater level trend June 2019
	Sep-19	Dec-19	Mar-20	Jun-20	
Groundwater management area					
Murrayville	Stable	Stable	Stable	**Stable**	**Stable**

In 2019–20, 6,157 ML of water was extracted for consumptive purposes, which was less than the 7,176 ML extracted in the previous year. Of this volume, 342 ML was for urban use and 380 ML was estimated 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 (5,777 ML) was within the volume available for the year (18,309 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

GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
Murrayville WSPA	Licensed use (non-urban)	9,240	1,710	9,240	0	10,950	5,159
	Cowangie urban	40	12	40	0	52	3
	Murrayville urban	475	143	475	0	618	124
	Domestic & stock	-	-	-	-	-	84
Outside management units	Licensed use (non-urban)	5,120	0	5,120	0	5,120	276
	Horsham Mt Zero urban	1,200	0	1,200	0	1,200	27
	Landsborough urban	150	0	150	0	150	42
	Willaura urban (1)	220	0	220	0	220	147
	Domestic & stock	-	-	-	-	-	298
Wimmera – Mallee total 2019–20		**16,445**	**1,865**	**16,445**	**0**	**18,309**	**6,159**
Wimmera – Mallee total 2018–19		16,420	1,237	16,241	0	17,478	7,176

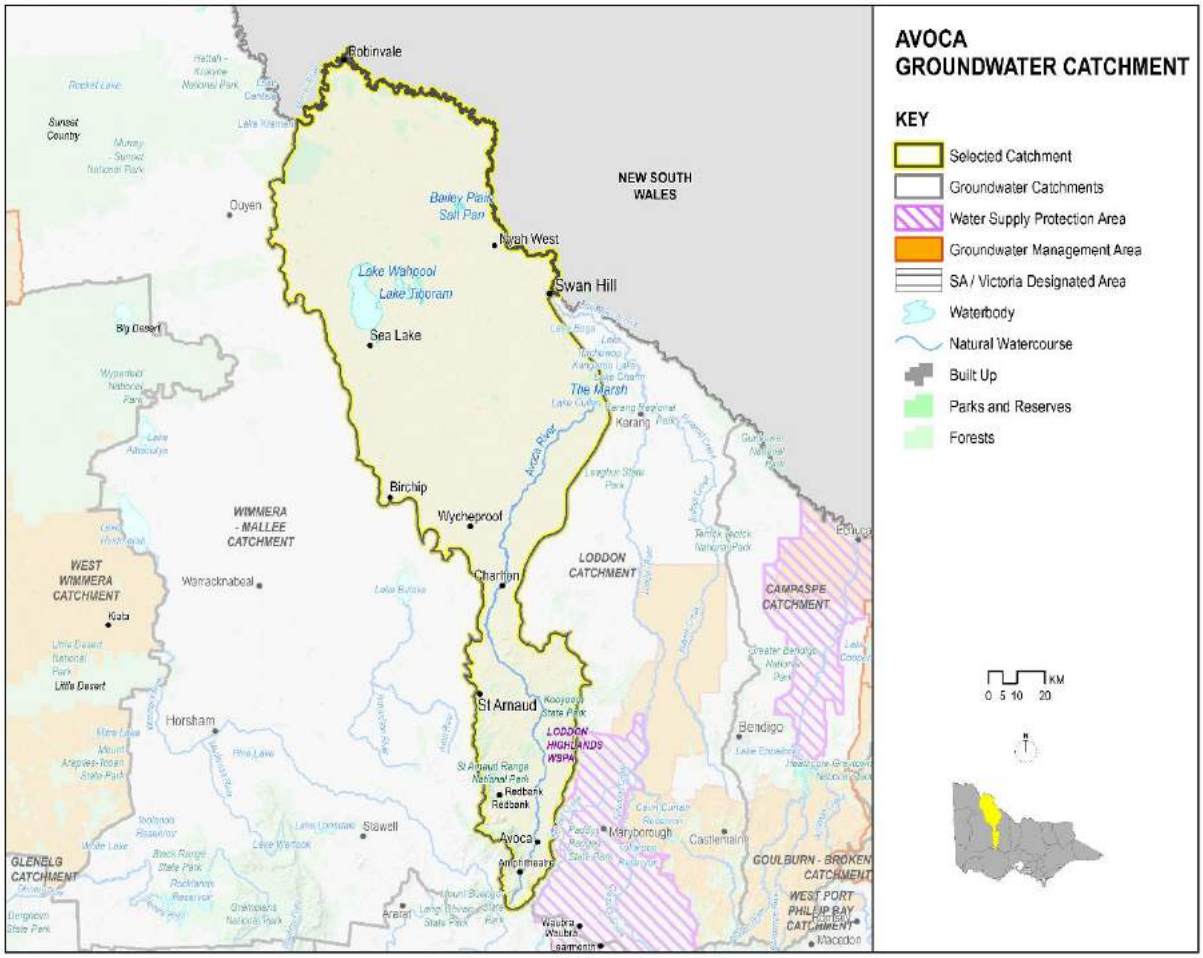
Note

(1) Willaura is in the Hopkins–Corangamite groundwater catchment, but the bores that supply it are in the Wimmera–Mallee groundwater catchment at Mafeking.

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 Groundwater resources overview

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. Central Highlands Water also supplies groundwater to Amphitheatre, Avoca and Redbank. 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 2019–20 groundwater resources overview

In 2019–20, 1,680 ML of water was extracted for consumptive purposes, which was less than the 1,751 ML extracted in the previous year. Of this volume, 5 ML was for urban use and 74 ML was estimated 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 (1,606 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 three towns in the Avoca groundwater catchment.

Table 7-40 Licensed groundwater volumes and use, Avoca groundwater catchment

GMU	Use type	Licensed entitlement (ML/year)	Carryover	Licensed volume allocated	Net trade	Total water available	Water extracted
Outside management unit	Licensed use (non-urban)	2,915	0	2,915	0	2,915	1,602
	Amphitheatre urban	20	0	20	0	20	1
	Redbank urban	50	0	50	0	50	4
	Domestic and stock use	-	-	-	-	-	74
Avoca total 2019–20		**2,985**	**0**	**2,985**	**0**	**2,985**	**1,680**
Avoca total 2018–19		2,725	-	2,725	0	2,725	1,751

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 2019–20.

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)[4]. Previous editions of the Victorian Water Accounts used estimates based on results from the SoilFlux model, a one-dimensional water balance model.

The AWRA-L evapotranspiration output used is "E_{tot}" — the modelled landscape actual evapotranspiration, or the total evapotranspiration from vegetation, soil and groundwater.

Basin estimates of average annual evapotranspiration comparing the AWRA-L and SoilFlux methods have been calculated for 2017–18 and 2018–19, and the results did not vary significantly. 36% of results varied within +/- 5%, and 72% of results varied within +/- 10%. The largest absolute difference between the compared estimates was 17%. There was no obvious negative or positive bias in the compared data.

The new approach has 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 2019–20

Evapotranspiration amounts vary considerably across Victoria depending on a range of factors including water availability. Averaged across Victoria as a whole, evapotranspiration in 2019–20 was estimated to be 520 mm, which is about 5% below the long-term average calculated based on a post-1975 historic climate reference period. Previous editions of the Victorian Water Accounts used the 1961–90 long-term average. This is another significant change to the method.

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 2019–20 was lower than and within +/- 10% of the long-term average for most Victorian basins. The exceptions were the Mallee, Snowy, Tambo and East Gippsland basins, where there was a greater-than-10% reduction in estimated annual evapotranspiration, relative to the long-term average. This is because of below-average rainfall over the model period.

Figure A-2 shows evapotranspiration as a proportion of rainfall in Victoria's basins. In 2019–20, the proportion of evapotranspiration to rainfall was generally higher than the long-term average. This is consistent with below-average rainfall generally being observed, because the proportion of evapotranspiration to rainfall generally decreases as rainfall increases. As a result, less rainfall became streamflow or groundwater recharge in 2019–20 than would be the case in an average year.

North-east Victoria (Goulburn to Upper Murray basins)

Generally average to below-average rainfall over north-eastern Victoria in 2019–20 resulted in estimates of evapotranspiration that were below average for the north-eastern basins. The estimated evapotranspiration ranged from 470 mm in the Broken basin to 740 mm in the Kiewa basin. Comparisons with the long-term average ranged from 10% below average in the Broken basin to 3% below average in the Goulburn basin (Figure A-1).

In 2019–20, evapotranspiration as a proportion of rainfall in the north-eastern basins was generally about the same or lower than the long-term average. The Broken basin was estimated to have the north-east's highest evapotranspiration as a proportion of rainfall — 86%, compared to the long-term average of 92% — and the lowest was in the Kiewa basin: 68%, compared to the long-term average of 69% (Figure A-2).

[4] http://www.bom.gov.au/water/landscape/assets/static/publications/AWRALv6_Model_Description_Report.pdf

Figure A-1 Modelled evapotranspiration per unit area

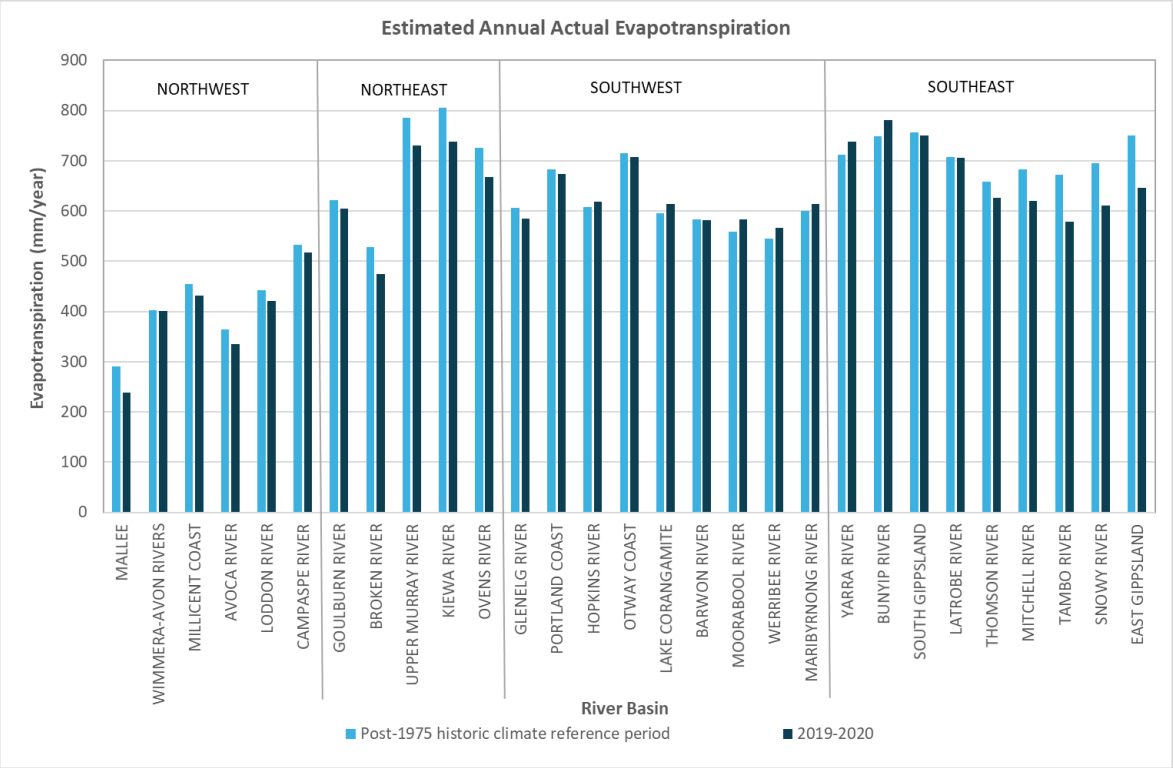
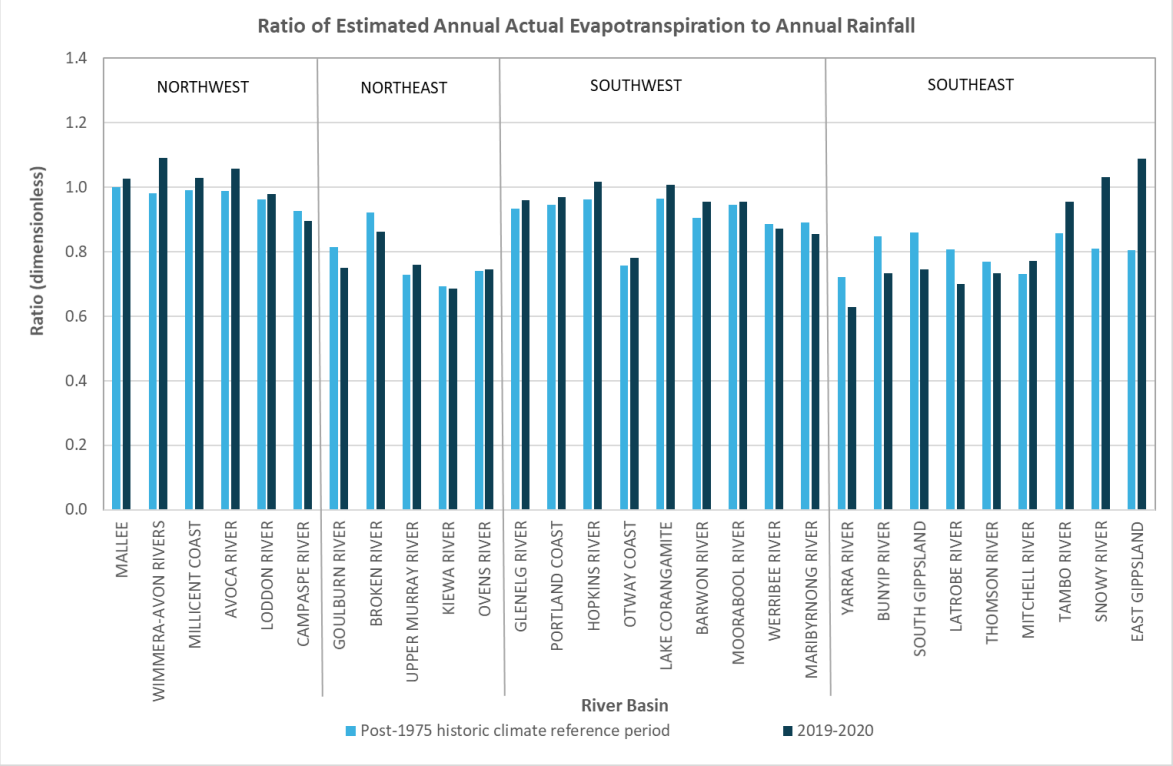


Figure A-2 Modelled evapotranspiration as a percentage of rainfall



South-eastern Victoria (East Gippsland to Yarra basins)

Rainfall over south-eastern Victoria ranged from below-average in the far east, to average or above-average in central areas. The impact of the 2019–20 bushfires was not considered when estimating evapotranspiration rates for south-eastern Victoria, so actual evapotranspiration rates may have been lower than the estimated rates.

The estimated evapotranspiration ranged from 580 mm in the Tambo basin to 780 mm in the Bunyip basin. Comparisons with the long-term average ranged from 14% below average in the Tambo and East Gippsland basins to 4% above average in the Yarra and Bunyip basins (Figure A-1).

In 2019–20, evapotranspiration as a proportion of rainfall also varied across south-eastern basins. The East Gippsland basin was estimated to have the south-east's highest evapotranspiration as a proportion of rainfall — 109%, compared to the long-term average of 80% — and the lowest was in the Yarra basin: 62%, compared to the long-term average of 72% (Figure A-2).

South-western Victoria (Maribyrnong to Glenelg basins)

Rainfall over south-western Victoria in 2019–20 was typical of the long-term average, and this resulted in estimates of evapotranspiration that were also typical. The estimated evapotranspiration ranged from 570 mm in the Werribee basin to 710 mm in the Otway Coast basin. Comparisons with the long-term average ranged from 3% below average in the Glenelg basin to 4% above-average in the Moorabool and Werribee basins (Figure A-1).

In 2019–20, evapotranspiration as a proportion of rainfall in the south-western basins also resembled the long-term average. The Hopkins basin was estimated to have the south-west's highest evapotranspiration as a proportion of rainfall – 102%, compared to the long-term average of 96% — and the lowest was in the Otway Coast basin: 78%, compared to the long-term average of 76% (Figure A-2).

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. The estimated evapotranspiration ranged from 240 mm in the Mallee basin to 520 mm in the Campaspe basin. Comparisons with the long-term average ranged from 18% below average in the Mallee basin to no difference in the Wimmera basin (Figure A-1).

In 2019–20, evapotranspiration as a proportion of rainfall in the north-western basins was generally higher than the long-term average. The Wimmera basin was estimated to have the north-west's highest evapotranspiration as a proportion of rainfall — 109%, compared to the long-term average of 98% — and the lowest was in the Campaspe basin: 90%, compared to the long-term average of 93% (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)[5].

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
- not accounting for areas of forest burnt by fire (such as the forests of east Gippsland burnt in the 2019–20 bushfires).

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.

[5] 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 2019	% full at 30 June 2020
Murray	Lake Dartmouth (Victoria's share)	On-stream	1,928,116	73%	49%
	Lake Hume (Victoria's share)	On-stream	1,502,579	19%	37%
	Lake Victoria (Victoria's share)	On-stream	338,500	44%	88%
	Menindee Lakes (Victoria's accessible share)	On-stream	865,500	0%	0%
	Kangaroo Lake	Off-stream	39,200	85%	80%
	Kow Swamp	Off-stream	51,710	78%	80%
	Lake Boga	Off-stream	37,000	73%	82%
	Lake Charm	Off-stream	22,000	92%	92%
	Lake Cullulleraine	Off-stream	5,270	84%	84%
Kiewa	Lake Guy	On-stream	1,416	59%	47%
	Rocky Valley	On-stream	28,294	63%	62%
	Clover Pondage	Off-stream	255	20%	37%
	Pretty Valley basin	Off-stream	355	100%	100%
Ovens	Lake Buffalo	On-stream	23,340	61%	61%
	Lake William Hovell	On-stream	13,690	101%	102%
Broken	Lake Nillahcootie	On-stream	40,400	26%	67%
	Loombah-McCall Say	On-stream	1,747	47%	100%
Goulburn	Goulburn Weir	On-stream	25,500	86%	80%
	Lake Eildon	On-stream	3,334,158	38%	49%
	Sunday Creek Reservoir	On-stream	1,650	23%	68%
	Greens Lake	Off-stream	32,500	48%	32%
	Waranga basin	Off-stream	432,360	43%	86%
Campaspe	Campaspe Weir	On-stream	2,624	98%	103%
	Lake Eppalock	On-stream	304,651	36%	38%
	Lauriston Reservoir	On-stream	19,790	81%	83%
	Malmsbury Reservoir	On-stream	12,034	19%	20%
	Upper Coliban Reservoir	On-stream	37,770	71%	84%
Loddon	Cairn Curran Reservoir	On-stream	147,130	37%	39%
	Hepburn Lagoon	On-stream	2,424	57%	65%
	Laanecoorie Reservoir	On-stream	8,000	78%	37%
	Newlyn Reservoir	On-stream	3,012	77%	57%
	Tullaroop Reservoir	On-stream	72,950	47%	60%
	Evansford Reservoir	Off-stream	1,346	102%	61%
	Sandhurst Reservoir	Off-stream	2,595	92%	84%
	Spring Gully Reservoir	Off-stream	1,680	61%	61%
East Gippsland	None	-	-	-	-
Snowy	None	-	-	-	-
Tambo	None	-	-	-	-
Mitchell	None	-	-	-	-
Thomson	Lake Glenmaggie	On-stream	177,640	24%	79%
	Thomson Reservoir	On-stream	1,068,000	46%	60%
Latrobe	Blue Rock Lake	On-stream	198,280	77%	100%
	Lake Narracan	On-stream	7,230	88%	66%
	Moondarra Reservoir	On-stream	30,458	82%	100%
South Gippsland	Candowie Reservoir	On-stream	4,463	49%	100%
	Hyland Reservoir	On-stream	671	44%	100%
	Lance Creek Reservoir	On-stream	4,200	89%	100%
	Western Reservoir	On-stream	1,137	64%	100%
Bunyip	Tarago Reservoir	On-stream	37,580	58%	84%
Yarra	Maroondah Reservoir	On-stream	22,179	37%	100%
	O'Shannassy Reservoir	On-stream	3,123	10%	83%

	Upper Yarra Reservoir	On-stream	200,579	48%	39%
	Yan Yean Reservoir	On-stream	30,266	72%	86%
	Cardinia Reservoir	Off-stream	286,911	60%	73%
	Greenvale Reservoir	Off-stream	26,839	74%	81%
	Silvan Reservoir	Off-stream	40,445	85%	88%
	Sugarloaf Reservoir	Off-stream	96,253	45%	94%
Maribyrnong	Rosslynne Reservoir	On-stream	25,368	19%	22%
Werribee	Djerriwarrh Reservoir	On-stream	1,014	66%	72%
	Melton Reservoir	On-stream	14,364	44%	71%
	Merrimu Reservoir (total)	On-stream	32,516	34%	33%
	Pykes Creek Reservoir	On-stream	22,119	83%	82%
Moorabool	Bostock Reservoir	On-stream	7,360	45%	55%
	Korweinguboora Reservoir	On-stream	2,327	15%	52%
	Lal Lal Reservoir	On-stream	59,549	65%	84%
	Moorabool Reservoir	On-stream	6,192	38%	55%
	Wilsons Reservoir	On-stream	1,010	29%	14%
	Upper Stony Creek Reservoir	Off-stream	9,494	51%	75%
Barwon	Gong Gong Reservoir	On-stream	1,902	75%	39%
	West Barwon Reservoir	On-stream	22,064	26%	22%
	White Swan Reservoir	On-stream	14,107	58%	75%
	Wurdee Boluc Reservoir	Off-stream	40,032	33%	54%
Corangamite	None	-	-	-	-
Otway Coast	West Gellibrand Reservoir	On-stream	1,860	100%	93%
Hopkins	None	-	-	-	-
Portland Coast	None	-	-	-	-
Glenelg	Konongwootong Reservoir	On-stream	1,920	94%	94%
	Moora Moora Reservoir	On-stream	6,300	43%	43%
	Rocklands Reservoir	On-stream	296,000	29%	24%
Millicent Coast	None	-	-	-	-
Wimmera	Fyans Lake	On-stream	18,460	70%	74%
	Green Lake	On-stream	5,350	45%	44%
	Lake Bellfield	On-stream	78,550	69%	62%
	Lake Lonsdale	On-stream	53,300	19%	13%
	Taylors Lake	On-stream	27,060	35%	40%
	Toolondo Reservoir	On-stream	50,530	27%	16%
	Wartook Reservoir	On-stream	29,300	39%	37%
Mallee	None	-	-	-	-
Avoca	None	-	-	-	-
Total			**12,405,848**		

Appendix C: Groundwater entitlement and use

GMU	PCV	Licenses			Domestic and stock		Total use (licensed + domestic and stock)
		Licensed entitlement (ML)	No. of licences	Usage (ML)	No. of domestic and stock bores [1]	Estimated use (ML) [2]	
Goulburn-Murray Water							
Water supply protection areas							
Katunga	60,577	60,203	268	**37,837**	776	**1,552**	**39,389**
Loddon Highlands [3]	20,697	20,502	181	**6,071**	432	**864**	**6,935**
Lower Campaspe Valley [4]	55,875	55,860	130	**41,752**	365	**730**	**42,482**
Upper Ovens River [5]	n/a	3,605	99	**873**	138	**276**	**1,149**
Groundwater management areas							
Barnawartha	2,100	375	4	**8**	30	**60**	**68**
Broken	3,732	2,993	69	**509**	332	**664**	**1,173**
Central Victorian Mineral Springs	6,024	5,082	142	**1,154**	1,102	**2,204**	**3,358**
Eildon	1,496	605	26	**216**	298	**596**	**812**
Kiewa	3,852	3,115	101	**394**	227	**454**	**848**
Lower Ovens	25,200	19,877	265	**7,442**	981	**1,962**	**9,404**
Mid Goulburn	12,470	12,375	65	**4,029**	127	**254**	**4,283**
Mid Loddon	34,037	33,927	102	**20,147**	166	**332**	**20,479**
Shepparton Irrigation Region [6] [7]	n/a	184,937	1,054	**106,719**	1,046	**2,092**	**108,811**
Strathbogie	1,660	1,446	59	**558**	224	**448**	**1,006**
Upper Goulburn	8,568	6,115	116	**968**	520	**1,040**	**2,008**
Upper Murray	7,674	3,532	74	**470**	175	**350**	**820**
West Goulburn [8]	n/a	3,071	45	**1,277**	60	**120**	**1,397**
Outside management units							
Goulburn-Murray Water	n/a	14,679	98	**4,899**	724	**1,448**	**6,347**
GWMWater							
Groundwater management areas							
Murrayville	11,005	9,755	39	**5,285**	42	**84**	**5,369**
West Wimmera [9] [10]	57,409	53,688	167	**24,520**	421	**842**	**25,362**
Outside management units							
GWMWater	n/a	9,612	51	**2,098**	186	**372**	**2,470**
Southern Rural Water							
Water supply protection areas							
Condah	7,475	7,470	33	**2,325**	69	**104**	**2,429**
Deutgam [11]	5,100	5,082	148	**275**	39	**59**	**333**
Glenelg	33,262	16,092	34	**5,768**	317	**476**	**6,244**
Koo-Wee-Rup	12,915	12,575	340	**2,912**	450	**675**	**3,587**
Sale	21,238	21,203	114	**14,092**	243	**365**	**14,457**
Warrion	14,086	14,075	131	**2,913**	118	**177**	**3,090**
Yarram	25,690	25,688	85	**8,194**	227	**341**	**8,535**
Groundwater management areas							
Bungaree	5,334	5,293	98	**2,196**	107	**161**	**2,357**
Cardigan	3,967	3,889	21	**732**	69	**104**	**835**
Colongulac	4,695	4,404	65	**1,138**	60	**90**	**1,228**
Corinella	2,550	662	13	**40**	35	**53**	**92**
Cut Paw Paw	3,650	523	4	**0**	3	**5**	**5**
Denison [12]	18,502	18,499	120	**6,394**	75	**113**	**6,506**
Frankston	3,200	2,212	27	**686**	35	**53**	**739**

Gellibrand [13]	0	0	0	**0**	0	**0**	**0**
Gerangamete [14]	239	238	3	**112**	3	**5**	**116**
Giffard	5,689	5,689	19	**2,618**	76	**114**	**2,732**
Glenormiston	2,698	2,636	45	**1,141**	37	**56**	**1,197**
Jan Juc [15]	14,250	14,250	3	**2,254**	4	**6**	**2,260**
Lancefield	1,485	1,378	15	**220**	40	**60**	**280**
Leongatha	6,500	1,803	33	**94**	34	**51**	**145**
Merrimu	451	10	2	**0**	10	**15**	**15**
Moe	8,200	3,882	97	**567**	83	**125**	**692**
Moorabbin	2,700	2,624	54	**816**	171	**257**	**1,072**
Nepean [10]	6,110	6,110	77	**2,812**	1,785	**1,785**	**4,597**
Newlingrook	1,977	1,958	6	**15**	1	**2**	**16**
Orbost	1,217	1,217	4	**241**	3	**5**	**246**
Paaratte	4,606	3,159	1	**304**	1	**2**	**305**
Portland	7,795	7,794	8	**2,411**	1	**2**	**2,412**
Rosedale [9] [16]	22,372	22,322	69	**7,682**	106	**159**	**7,841**
South West Limestone [17]	n/a	81,194	831	**27,461**	1,996	**2,994**	**30,455**
Stratford [9] [16]	27,686	37,084	11	**22,198**	12	**24**	**22,222**
Tarwin	1,300	58	4	**10**	340	**510**	**520**
Wa De Lock [9] [12]	30,795	29,124	250	**6,294**	262	**393**	**6,687**
Wandin Yallock	3,027	3,025	194	**482**	43	**65**	**547**
Wy Yung [9]	7,463	7,462	59	**919**	7	**11**	**930**
Outside management units [12]							
Southern Rural Water	n/a	72,003	1,347	**12,898**	4,104	**6,156**	**19,054**
Total 2019–20	**n/a**	**948,037**	**7,520**	**406,438**	**19,338**	**32,307**	**438,744**
Total 2018–19	n/a	965,641	7,487	466,514	19,012	31,716	498,229

Notes

(1) The number of unlicensed domestic and stock bores includes all bores from 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.

(2) 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 used (unless otherwise noted) and the Nepean GMA, where 1 ML per bore is used as a more accurate estimate.

(3) Extractions from Newlyn trading zone in the Loddon Highlands WSPA were restricted to 75% allocation.

(4) Extractions from Barnadown trading zone in the Lower Campaspe Valley WSPA were restricted to 75% allocation.

(5) The Minister for Water approved the revocation of the PCV on 3 March 2013. A PCV is not required for the Upper Ovens River WSPA because the management plan prevents additional entitlements or an increase in entitlement volume from being issued except by trade.

(6) There is no PCV for the Shepparton Irrigation GMA as there is no limit on the total volume of shallow groundwater entitlement available.

(7) Groundwater use in the Shepparton Irrigation Region GMA is estimated at the end of each season using a method which 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 2019–20 was 1,277 ML, 42% of total licensed volume.

(9) The PCVs that applies to the West Wimmera GMA, Wy Yung GMA, Nepean GMA, Rosedale GMA, Stratford GMA and Wa De Lock GMA total the sum of the PCVs for all zones within each GMU.

(10) Extractions from Neuarpur subzone 1 — a trading zone in the West Wimmera GMA — were restricted to 80% allocation.

(11) Extractions from Deutgam WSPA were restricted to 25% allocation.

(12) The volumes of use in the Denison GMA, Wa De Lock GMA and the Central Gippsland outside management units include metered extractions for salinity control: Denison GMA 306 ML, Wa De Lock GMA 297 ML and outside management units 871 ML.

(13) The Gellibrand GMA PCV of 0 ML was gazetted at the end of 2018–19.

(14) The Gerangamete GMA PCV decreased to 239 ML in 2019–20. The volume reported for the previous year was 20,239; the decrease was due to the non-renewal of Barwon Water's 20,000 ML licence.

(15) The Jan Juc GMA PCV is Zone 1 all formations 250 ML, Zone 2 Upper Eastern View formation 4,000 ML and Zone 2 Lower Eastern View formation 35,000 ML in any five-year period. The Jan Juc bulk entitlement, which applies to Zone 2 Lower Eastern View formation, is based on a five-year total of 35,000 ML with a maximum annual extraction of 10,000 ML. The total of 14,250 ML includes 4,250 ML and the maximum annual bulk entitlement extraction volume of 10,000 ML.

(16) The use and licensed entitlement volume reported in the Rosedale and Stratford GMAs includes metered extractions from Latrobe Valley coal mines: Rosedale GMA 931 ML use and 9,304 ML entitlement, and Stratford GMA 22,163 ML use and 36,207 ML entitlement. These coal mine licences are in the Rosedale and Stratford physical area, but the licence volume and extraction is not actually assigned to or assessed against the GMAs. For this reason, the licence volume in the Stratford GMA is shown as exceeding the PCV.

(17) 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. Abolition of the Nullawarre and Yangery WSPAs was approved on 24 October 2014 and published in the Victorian Government Gazette on 30 October 2014. 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.

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
	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

Basin	Entitlements	Holder
	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
	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

Basin	Entitlements	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 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
	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

Basin	Entitlements	Holder
	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
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 which 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 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 which 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 a 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 which 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) which 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 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 which form the end point 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.