Victorian Water Accounts 2012–2013

A statement of Victorian water resources

Printed by – Impact Digital, Brunswick

ISSN 1837-591X (print)
ISSN 1837-5928 (online)

Accessibility

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Acknowledgements

Edited by Ann White

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Foreword

Water reporting provides the Victorian Government with a vital insight into the state's water availability and use at the bulk supply level, and is a key element of planning the sustainable management of Victoria's water resources.

The 2012–13 report marks the tenth anniversary of the Victorian Water Accounts, a comprehensive statement of Victoria's water availability, distribution and use. In 10 years this publication has established itself as an important document that will provide a valuable record of Victoria's water resources in years to come.

The past decade has encompassed extreme conditions affecting Victoria's water resources: this includes the peak of the drought in 2006–07 to the floods of 2010–11. However, the *Victorian Water Accounts 2012–2013* show that Victoria's water resources recovered to volumes comparable to those levels reported in the early editions of the accounts.

In 2012, the Victorian Government developed a new framework for the management and reporting of groundwater resources. This framework has facilitated a detailed record of groundwater resources at the groundwater catchment level and, for the first time, these accounts contain a new section devoted to Victoria's groundwater resources.

Rainfall was below-average across the western and central parts of the state in 2012–13, with near-average conditions in the east. Despite the generally dry conditions, the total available volume of Victoria's surface water, groundwater and recycled water still totalled approximately 22,600,000 ML.

The below-average rainfall saw increased water taken for consumptive purposes in Victoria. Approximately 4,700,000 ML was taken in 2012–13, the highest amount in the last six years.

The three years prior to 2012–13 saw above-average rainfall and a rising trend in storage volumes. While the current accounts show that the total volume of water held in Victoria's major storages declined steadily through the summer and autumn of 2012–13, storage levels ended the year at 72 per cent of total capacity.

Information for the Victorian Water Accounts comes from the Victorian Water Register, which provides a comprehensive water accounting system to track water from where it is extracted in a waterway or aquifer through to its end use. My hope is that the Victorian Water Accounts will continue to be viewed as an equally invaluable, robust tool for the planning and management of Victoria's water resources for many more decades.

THE HON PETER WALSH MLA
Minister for Water

Contents

Introduction

Overview of the *Victorian Water Accounts 2012–2013*

The *Victorian Water Accounts 2012–2013* documents the key water resource management data for Victoria. This report is the tenth in a series that provides a summary of water availability, water allocation and use at bulk water supply level for both groundwater and surface water. The *Victorian Water Accounts 2012–2013* adds valuable relevance to groundwater reporting by presenting information by groundwater catchment for the first time. The report demonstrates the government's commitment to greater transparency and accountability in water resources.

As a signatory to the National Water Initiative, Victoria has obligations to implement water accounting systems and report on water entitlements, consumption, trade and environmental releases. The Victorian Water Accounts are an important contribution towards meeting Victoria's obligations. Information for the Victorian Water Accounts comes from the Victorian Water Register that provides a robust water accounting system to record Victoria's water at a retail and catchment scale.

The *Victorian Water Accounts 2012–2013* examines the entire state's water allocation and use for the 2012–13 year at bulk supply level. It consolidates information from all Victorian water corporations, catchment management authorities, the Department of Environment and Primary Industries, the Essential Services Commission, the Murray–Darling Basin Authority, the Victorian Alpine Resorts Commission, power generators and other major users of water.

The *Victorian Water Accounts 2012–2013* consists of two parts.

Part 1 provides a statewide overview that summarises water availability. It includes information on rainfall, streamflow and storage levels, water taken for consumptive purposes, and management of water for the environment.

Part 2 contains the surface water basin water accounts for each of Victoria's 29 river basins, groundwater accounts for each of Victoria's 20 groundwater catchments and the distribution system water accounts for each of the 19 water corporations in Victoria. The three sections combined track the movement of water from the catchment scale, in storages, rivers and groundwater aquifers to the point of end use. The surface water river basin and groundwater catchment accounts include quantitative data on available water and water use as well as concise commentary to give context to the data. The distribution system water accounts comprise water balances for urban, rural and wholesale water distribution systems.

2012–13: the year in water

Rainfall across Victoria in 2012–13 was considerably lower than 2011–12, with much of the western and central regions categorised as receiving below-average to very much below-average total rainfall for the year. The eastern part of the state generally received near-average rainfall for 2012–13, with East Gippsland being the only region to receive annual rainfall totals above the long-term average.

In most of western and central Victoria, rainfall in 2012–13 ranged between 40% and 80% of the long-term average, with some parts receiving between 80% and 100%. The majority of eastern Victoria received between 80% and 100% of the long-term average rainfall and parts of East Gippsland received up to 125%. The overall drier conditions were also reflected in seasonal rainfall, with below-average spring and autumn rainfall and close-to-average falls in winter. The summer of 2012–13 was one of the hottest on record and summer rainfall totals were lower than normal across most of the state. In particular, January 2013 was very dry, with much of Victoria receiving less than 20% of the long-term January average and large areas in the southern half of the state experiencing the lowest rainfall on record.

The widespread below-average rainfall experienced in 2012–13 saw a considerable decrease in total streamflows across Victoria compared to the wetter conditions of the previous two years. However, after the prolonged drought period and the wetter years between 2010 and 2012, the total flow volume was the closest to the long-term average since the Victorian Water Accounts were first published for 2003–04.

The total volume of water stored in Victoria's major reservoirs started the year at 10,317,026 ML (83% of capacity) and reached a peak of 94% of capacity at the end of September, which was the highest month-end volume since before the drought. However, the particularly low rainfall throughout summer and autumn led to a steady decline in storage volumes, reaching of low of 68% of capacity at the end of May 2013. Despite these dry conditions, the total storage volume in Victoria's major storages ended the year at a still-healthy 72% of capacity.

Victoria's regional reservoirs followed this trend, starting at 86% of capacity in July 2012 and ending at 72% of capacity in June 2013. In contrast, Melbourne's water storages started and ended the year at a similar volume, with 70% of total capacity in July 2012 and 71% at the end of June 2013.

In 2012–13, total groundwater licensed entitlement was approximately 967,695 ML across Victoria. The total groundwater use across the state, including domestic and stock use, was approximately 369,569 ML, which was more than the volume used in 2011–12 (316,322 ML). Groundwater level trends at the end of June 2013 were generally similar to 2011–12, however there was a slight increase in the number of Groundwater Management Units categorised as stable.

Water resource availability in Victoria

For the large majority of the state, surface water availability decreased compared to 2011–12. Overall, the total streamflow volume for Victoria was 81% of the long-term average, a significant drop from the 124% of long-term average reported for 2011–12.

While water availability decreased compared to the previous year, Victoria still experienced high levels of seasonal allocations of water in regulated surface water systems. The number of Victorian towns on water restrictions continued to decline, with only three towns having urban water restrictions in place at the end of June 2013 and all other towns reverting to permanent water saving rules. This is in stark contrast to over 470 towns being subject to restrictions at the peak of the drought.

Decreased water availability contributed to an increase in the volume of water taken under consumptive entitlements in 2012–13. The volume of water diverted for irrigation purposes in 2012–13 was around 720,000 ML greater than the volume diverted in 2011–12. The total volume of water taken under bulk entitlements in 2012–13 was 65% of the total volume of bulk entitlements, up from 53% in 2011–12. The particularly hot and dry conditions through summer resulted in an increased number of diversion restrictions imposed for unregulated streams.

In 2012–13, the Victorian Environmental Water Holder oversaw the delivery of more than 437,000 ML of water to 46 river reaches and 17 wetlands, providing significant benefit to a wide range of water-dependent plants and animals. Of the 122 potential priority watering actions identified in the *Seasonal Watering Plan for 2012–13*, some 111 (91%) were fully or partially achieved through natural river flows, river operations, or as a direct result of managed environmental releases.

Conclusion

Sustainable management of our water resources requires adequate monitoring, accounting and reporting. The *Victorian Water Accounts 2012–2013* provide public accountability for water availability, entitlements and use across Victoria. Importantly, Victoria's efforts in monitoring, reporting and accounting continue to improve.

Part 1: Overview of Victorian water resources 2012–13

Part 1 of the *Victorian Water Accounts 2012–2013* provides a statewide overview of Victorian water resources during the year. It reports on:

- the quantity of water available in terms of rainfall, streamflow, reservoirs and aquifers
- Victoria's water entitlement and planning framework and the mechanisms it provides for responding to water availability
- the quantity of water allocated for consumptive use from reservoirs, streams and aquifers under entitlements issued by government, as well as quantities used and recycled
- water available to the environment
- Victoria's water trade activity.

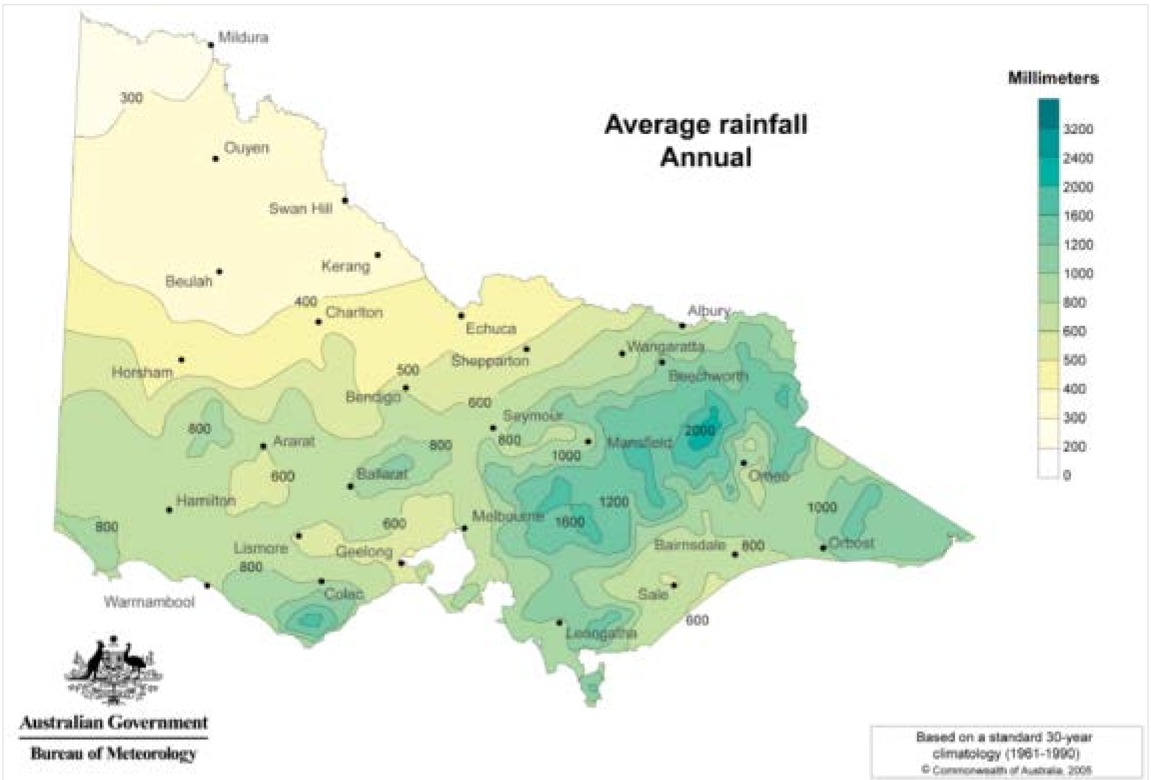
1 Water availability

This chapter presents an overview of surface water and groundwater availability in Victoria in 2012–13. It reports rainfall, streamflow and levels in major reservoirs compared to previous years and long-term averages. It also reports the annual trend in groundwater levels in Groundwater Management Areas and Water Supply Protection Areas.

1.1 Rainfall

The long-term average rainfall in Victoria varies from less than 300 millimetres a year in the north-west of the state, up to approximately 2,000 millimetres a year in the alpine area of north-east Victoria (Figure 1-1).

Figure 1-1 Victorian long-term average annual rainfall



Overall, 2012–13 was drier than usual for most of Victoria. Total annual rainfall ranged from 100 to 200 millimetres in the north-west of the state, through to 1,200 to 1,800 millimetres across much of the alpine area in north-east Victoria (Figure 1-2), with some isolated areas receiving between 1,800 to 2,400 mm.

Rainfall for 2012–13 was categorised as below average or very much below average across the majority of Victoria (Figure 1-3), generally ranging between 40% and 100% of the long-term average (Figure 1-4).

The lowest rainfall was seen in parts of the Mallee, Wimmera and Goulburn basins, where some areas received between 40% and 60% of the long-term average (Figure 1-4), with isolated areas of the northern Wimmera basin receiving the lowest rainfall on record for that region.

Rainfall in the eastern region of the state was predominantly categorised as average for 2012–13, with a relatively small area receiving above-average annual rainfall (Figure 1-3). Only parts of the Snowy and East Gippsland basins received over 100% of the long-term average (Figure 1-4).

These differences in rainfall in Victoria's regions were reflected in evapotranspiration. The statewide average evapotranspiration in 2012–13 was estimated at 476 millimetres, which is about 13% lower than the long-term average for Victoria (Appendix C). Across the eastern basins, evapotranspiration was close to average, reflecting the average rainfall conditions in this area, whereas in north-western Victoria evapotranspiration was around 25% less than the long-term average, reflecting the dry conditions experienced in that region in 2012–13 (Appendix C).

Figure 1-2 Victorian rainfall in 2012–13 (mm)

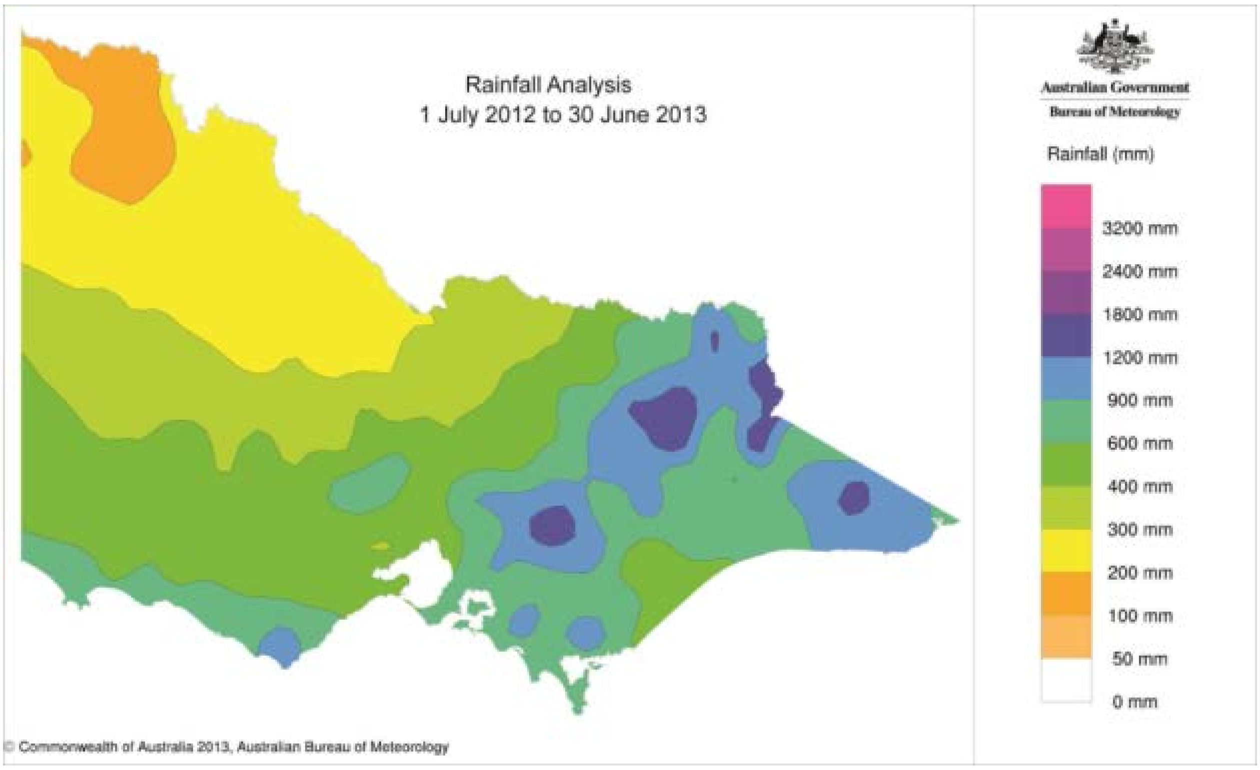


Figure 1-3 Victorian rainfall deciles in 2012–13

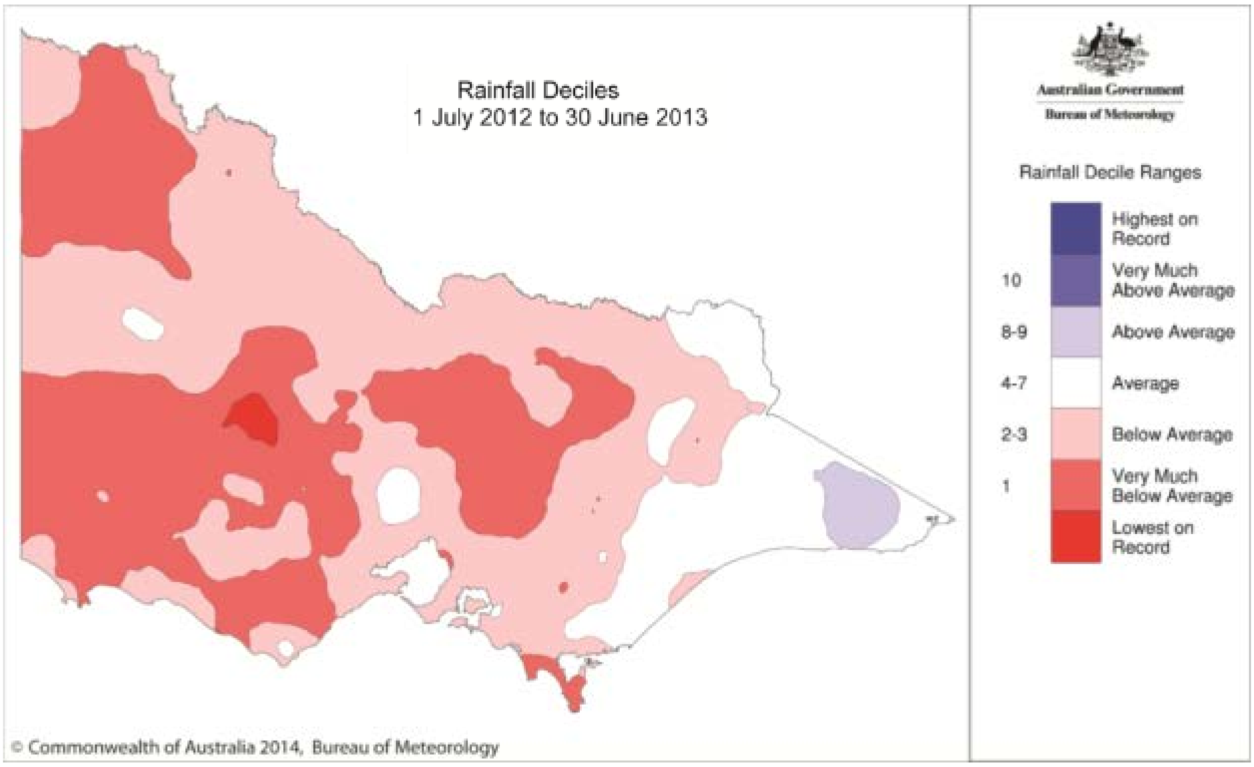
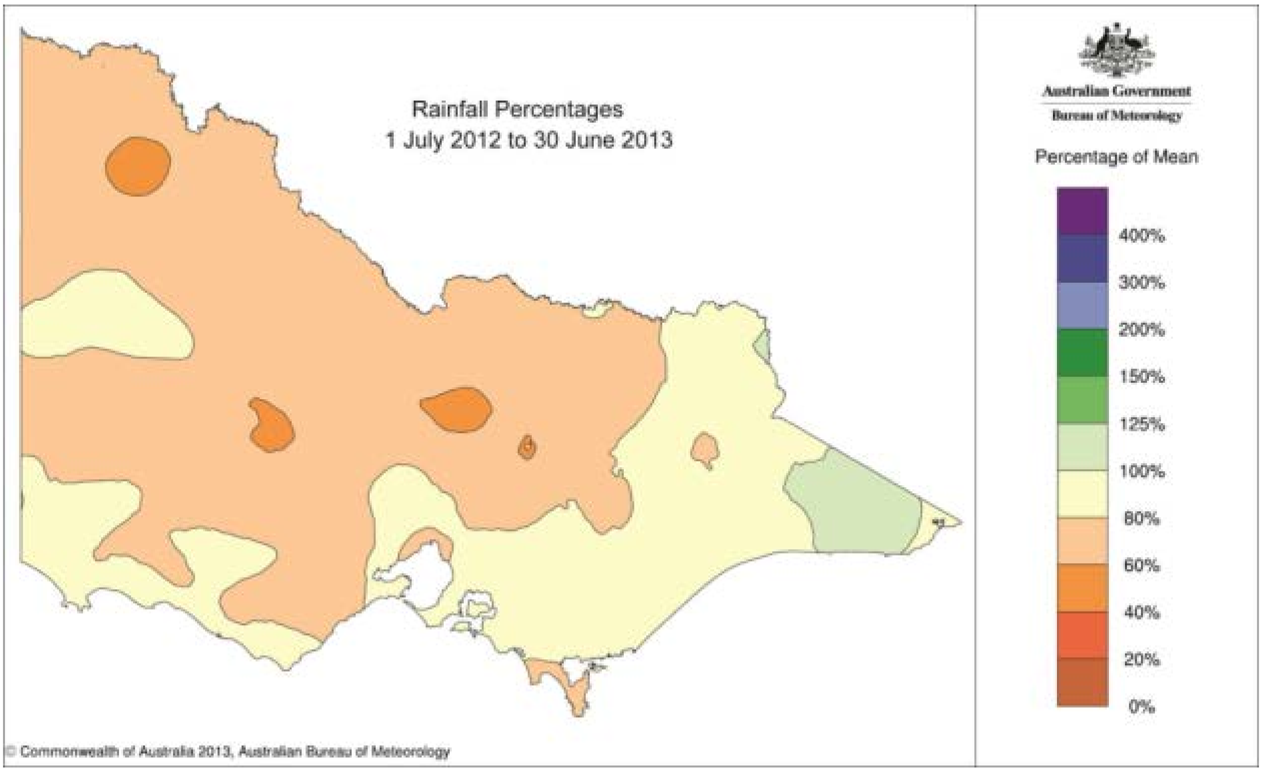


Figure 1-4 Victorian rainfall in 2012–13 as a percentage of long-term average rainfall



The overall drier than normal conditions were reflected in the seasonal rainfall, with below-average spring and autumn rainfall and close to average winter rainfall. The summer of 2012–13 was one of the hottest on record and summer rainfall totals were lower than normal across most of the state. In particular, January 2013 was very dry, with much of Victoria receiving less than 20% of the long-term January average (Figure 1-5) and large areas in the southern half of the state experiencing the lowest rainfall on record (Figure 1-6). Only small areas in eastern Victoria recorded rainfall greater than the average for January (Figure 1-5 and Figure 1-6).

Figure 1-5 Victorian rainfall in January 2013 as a percentage of the long-term monthly average

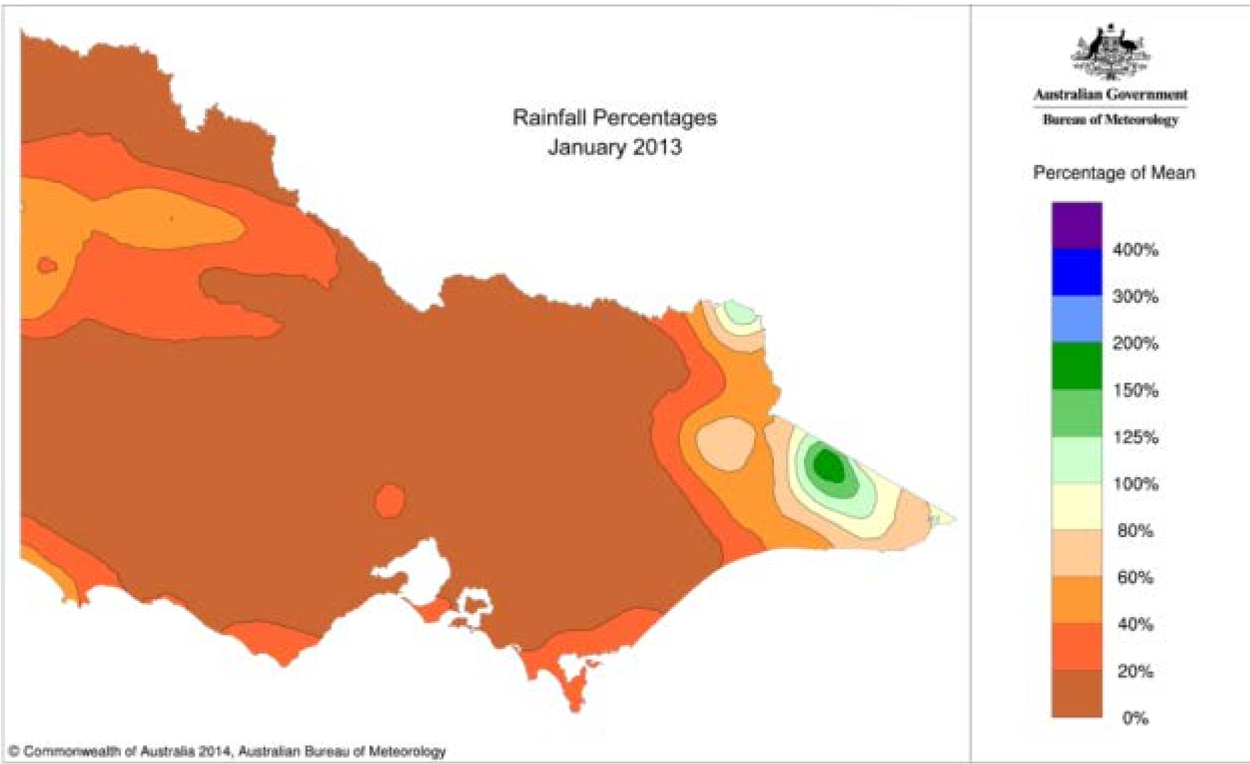
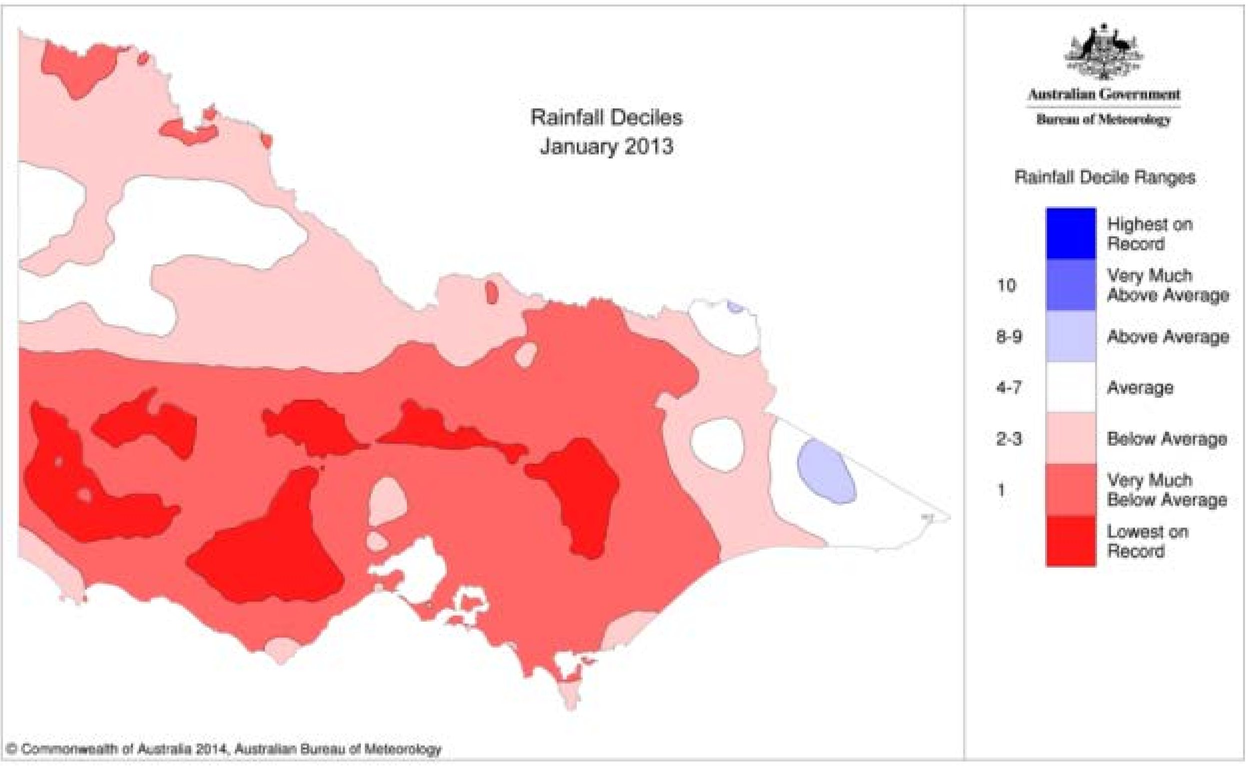


Figure 1-6 Victorian rainfall deciles in January 2013



Despite the overall dry trend in 2012–13, there were some high rainfall events in Victoria during winter, driven by a negative phase of the Indian Ocean Dipole. In particular, June 2013 was notably wet across much of the state, with over 400% of the average rainfall over areas of the Thompson and Mitchell basins (Figure 1-8). Parts of the Snowy basin received the highest June rainfall on record (Figure 1-8) with flooding and landslides at several locations across Gippsland.

Figure 1-7 Victorian rainfall in June 2013 as a percentage of the long-term monthly average

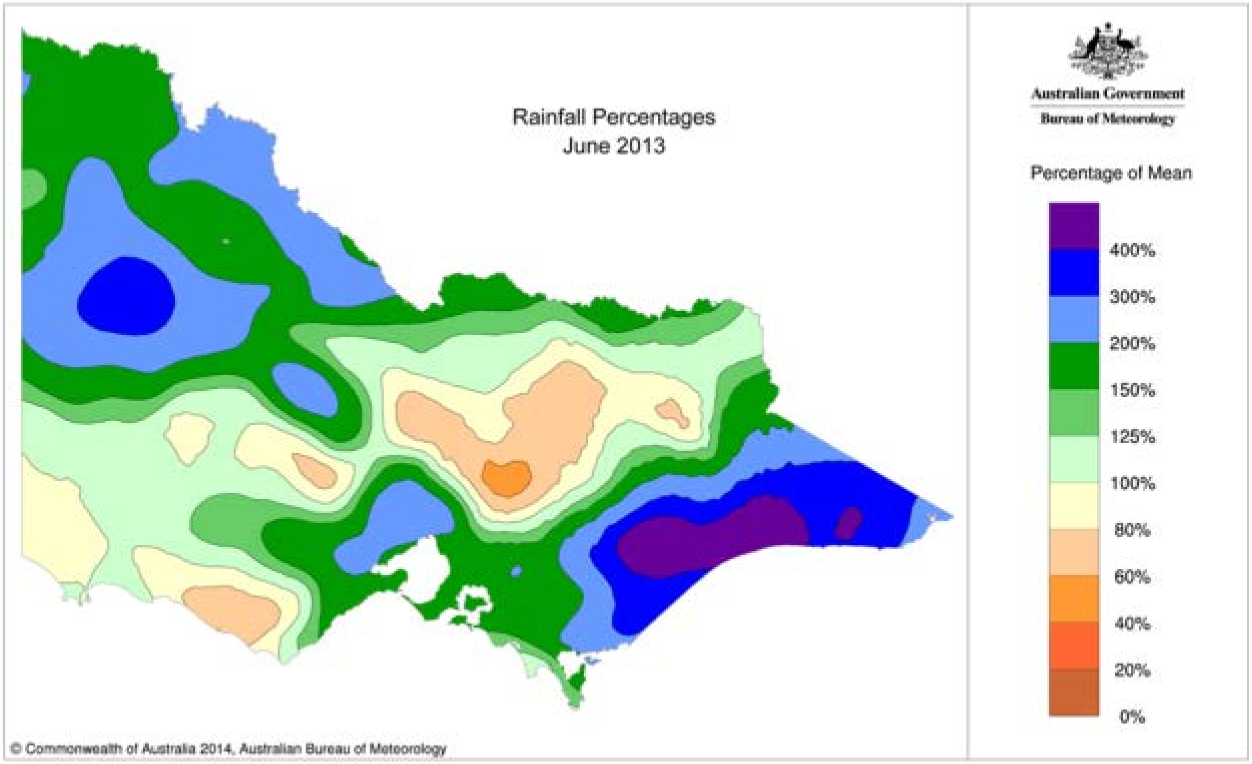
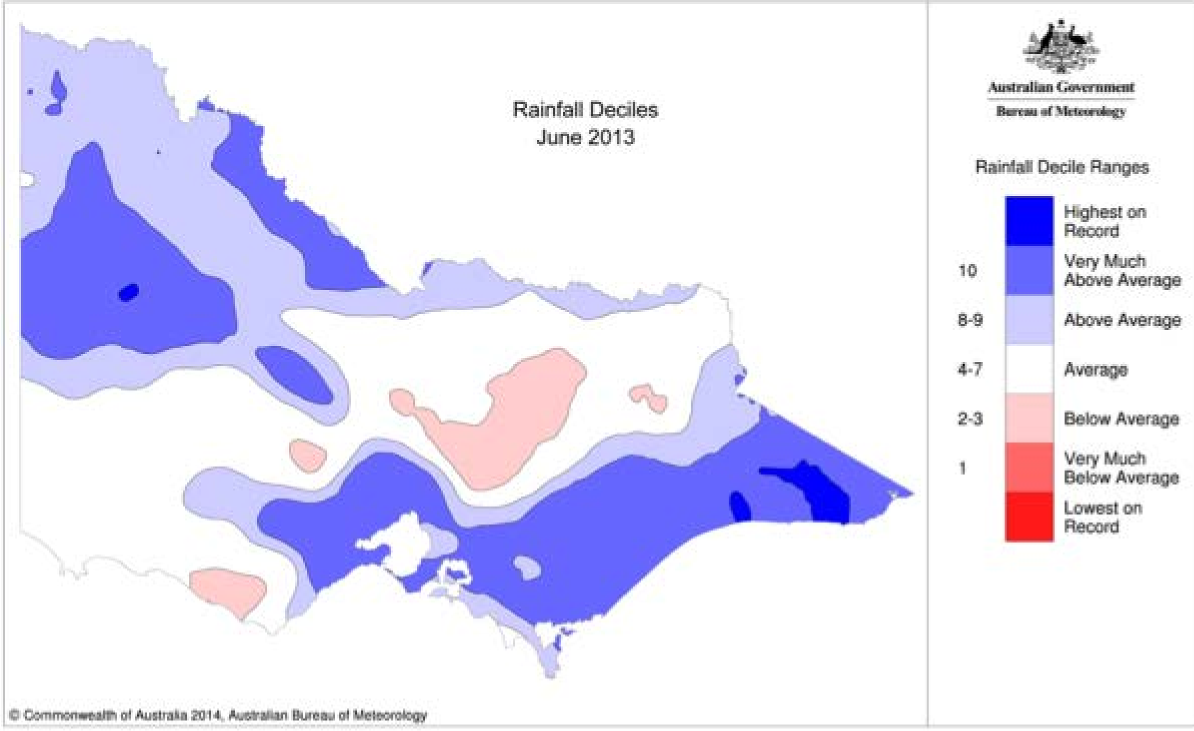


Figure 1-8 Victorian rainfall deciles in June 2013

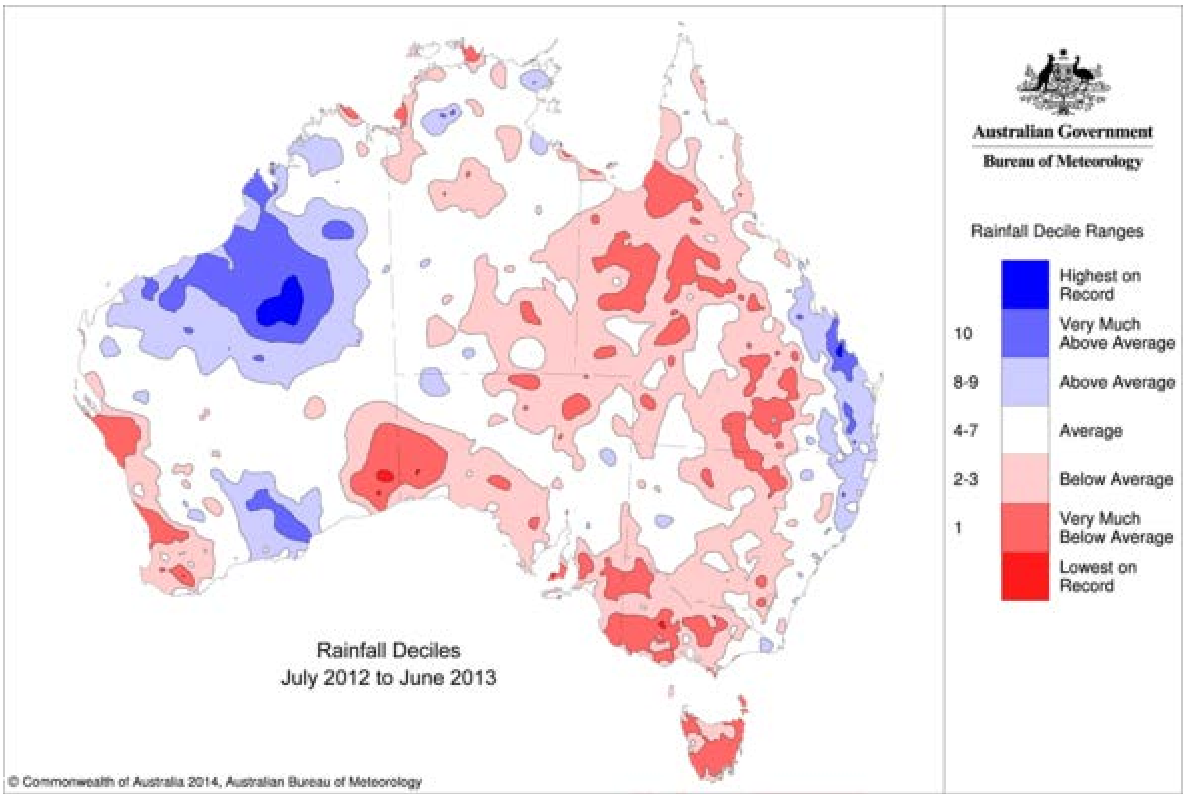


While Victoria was generally drier than usual in 2012–13, the Bureau of Meteorology classified the overall rainfall conditions across Australia as 'near-average' for 2012 and 2013 (Figure 1-10), following Australia's wettest 24-month period on record between April 2010 and March 2012.

Between early August and October 2012, a positive Indian Ocean Dipole event contributed to reduced winter and spring rainfall across the southern mainland. This effect was enhanced by unseasonably high atmospheric pressure that supressed storm activity. Similarly, January 2013 – which was the warmest month on record across the country – was generally drier than average in south-eastern Australia.

In contrast, in winter 2013 a negative phase of the Indian Ocean Dipole contributed to above-average rainfall over large parts of Australia between May and August.

Figure 1-9 Australian rainfall deciles, 1 July 2012 to 30 June 2013



1.2 Streamflow

Local factors influence how much rainfall becomes streamflow and these factors vary between river basins. Local influences include subsurface geology, permeability and moisture levels of the soil, vegetation cover and the pattern of individual rainfall events. Streamflows within a basin can vary between months, and this is captured in Victoria's Monthly Water Report, available online at: http://www.water.vic.gov.au/monitoring/monthly.

In 2012–13, local factors resulted in streamflows below average in 21 basins and greater than average in six basins (Table 1-1). Some of the basins that had streamflows higher than average in 2011–12, such as the Murray, Kiewa and Broken basins, had streamflows below average in 2012–13 (Table 1-1). Overall, the total streamflow volume for Victoria was 81% of the long-term average (Table 1-2). This is a significant drop from the 124% of long-term average reported for 2011–12.

The highest-yielding river basins in 2012–13 relative to their long-term averages were the Snowy, East Gippsland, South Gippsland and Bunyip basins. These basins experienced streamflows between 112% and 141% of the long-term average, which is significantly less than the previous year, when they experienced streamflows of between 190% and 280% of the long-term average.

The Avoca, Hopkins, Barwon, Glenelg and Campaspe basins were the driest in 2012–13. These basins recorded inflows of 18% to 47% of the long-term average.

Table 1-1 Basin streamflow compared with long-term average

Basin	Average annual streamflow (ML)	2012–13 streamflow[1]		2011–12 streamflow[1]	
		(ML)	(% of average)	(ML)	(% of average)
Murray	7,618,000	6,143,993	81%	9,195,297	121%
Kiewa	689,000	612,663	89%	850,533	123%
Ovens	1,758,000	1,234,059	70%	1,747,302	99%
Broken	308,000	201,296	65%	472,217	153%
Goulburn[2]	3,363,000	2,530,962	75%	3,187,532	95%
Campaspe	352,000	165,079	47%	155,699	44%
Loddon	373,000	194,784	52%	195,230	52%
Avoca	136,200	23,942	18%	26,975	20%
Mallee[3]	0	0	-	0	-
Wimmera	316,400	71,509	23%	145,567	46%
East Gippsland	714,000	953,355	134%	1,647,803	231%
Snowy[4]	1,022,000	1,441,377	141%	2,796,999	274%
Tambo	297,800	309,242	104%	839,137	282%
Mitchell	884,500	722,170	82%	1,264,868	143%
Thomson	1,101,760	876,174	80%	1,788,987	162%
Latrobe	847,400	900,762	106%	1,338,357	158%
South Gippsland	911,500	1,017,893	112%	1,854,567	203%
Bunyip	541,000	645,007	119%	1,033,964	191%
Yarra	1,054,000	914,537	87%	1,200,267	114%
Maribyrnong	113,000	81,471	72%	60,885	54%
Werribee	102,000	79,770	78%	64,557	63%
Moorabool	97,000	94,386	97%	109,037	112%
Barwon	360,000	155,726	43%	191,647	53%
Corangamite	316,000	145,591	46%	164,247	52%
Otway Coast	884,000	668,930	76%	780,800	88%
Hopkins	635,000	235,182	37%	303,486	48%
Portland Coast	361,000	338,902	94%	437,172	121%
Glenelg	964,000	426,508	44%	648,620	67%
Millicent Coast[3]	0	4	-	4	-
Total	**26,119,560**	**21,185,276**	**81%**	**32,501,756**[5]	**124%**

Notes:

(1) 'Streamflow' is equivalent to 'catchment inflows' in the water balances presented in Chapter 6.

(2) Includes inflows from Broken River. Note that the streamflows for 2011–12 differ from the value of 2,890,919 ML reported in the 2011–12 Victorian Water Accounts due to previously not including the inflows from Broken River.

(3) Surface water resources within the Mallee and Millicent Coast basins are limited and there are currently no streamflow gauges in these basins. Streamflow in the Millicent basin is 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 streamflow.

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

(5) The total 2011–12 streamflow differs from the value of 32,182,195 ML reported in the 2011–12 Victorian Water Accounts due to updated data for Murray, Broken and Goulburn basins.

Table 1-2 Total Victorian streamflow compared to the long-term average

Year	Streamflow (ML)	% of long-term average
2003–04	16,848,300	65%
2004–05	17,015,900	65%
2005–06	15,296,700	59%
2006–07	7,091,100	27%
2007–08	11,070,600	42%
2008–09	8,239,800	32%
2009–10	13,132,100	50%
2010–11	45,714,200	175%
2011–12[1]	32,501,756	124%
2012–13	**21,185,276**	**81%**

Note:

(1) The total 2011–12 streamflow differs from the value of 32,182,195 ML reported in the 2011–12 Victorian Water Accounts due to updated data for Murray, Broken and Goulburn basins.

Continuous records of streamflows for nine selected locations show a range from average to well below average flows in 2012–13 (Figure 1-10 to Figure 1-18), with none of the selected gauging sites recording above-average annual flows.

The Goulburn River at Dohertys (Figure 1-10) and Snowy Creek at Granite Flat (Figure 1-14) both experienced near to average flow conditions in 2012–13.

Below-average annual streamflows were recorded at five of the selected sites (Figure 1-11, Figure 1-15, Figure 1-16, Figure 1-17 and Figure 1-18), ranging from 58% to 78% of the respective long-term averages.

Two sites experienced very much below-average total streamflow for 2012–13, with the Avoca River at Coonooer and Wimmera River at Glynwylln recording flows that were even well below the average during the drought (Figure 1-12 and Figure 1-13).

Streamflows influence Victoria's water storages (section 1.3). In line with the below-average annual streamflows presented in Table 1-1, Table 1-2 and Figure 1-10 to Figure 1-18, the annual inflows to Melbourne's harvesting reservoirs in the Yarra and Thomson basins in 2012–13 were also below the long-term average of the available period of record (Figure 1-19).

Figure 1-10 Annual streamflow – Goulburn River at Dohertys (Station No. 405219)

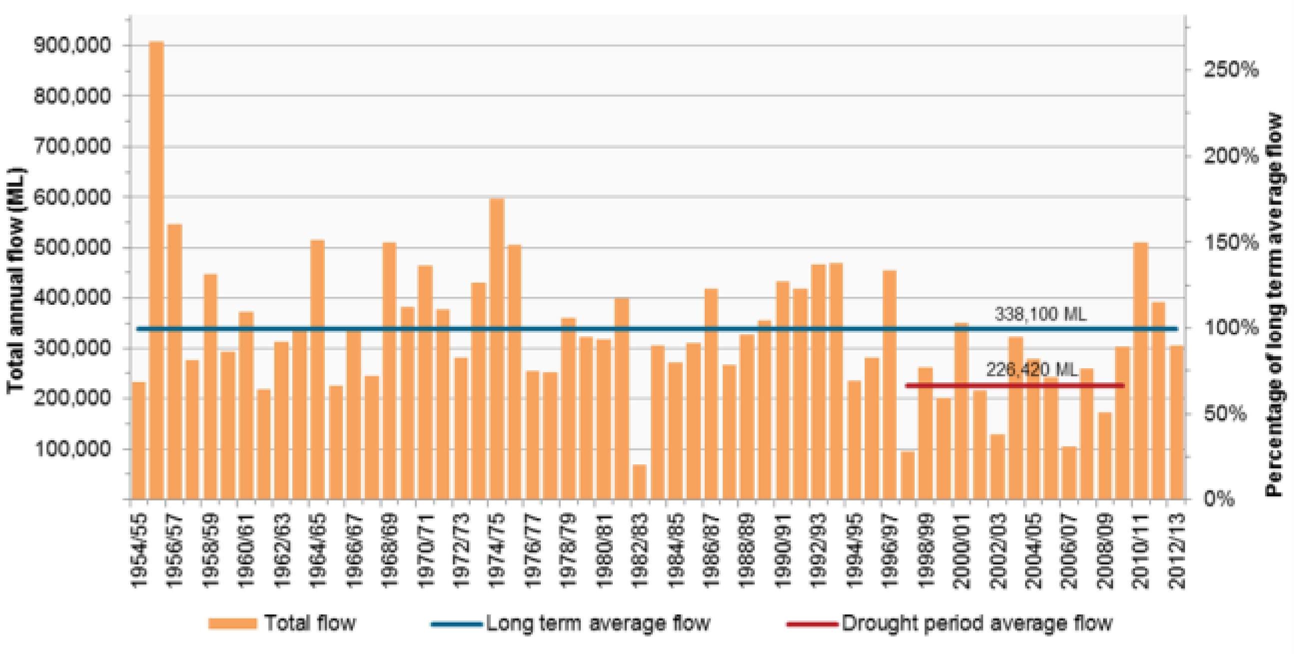


Figure 1-11 Annual streamflow – Loddon River at Vaughan (Station No. 407217)

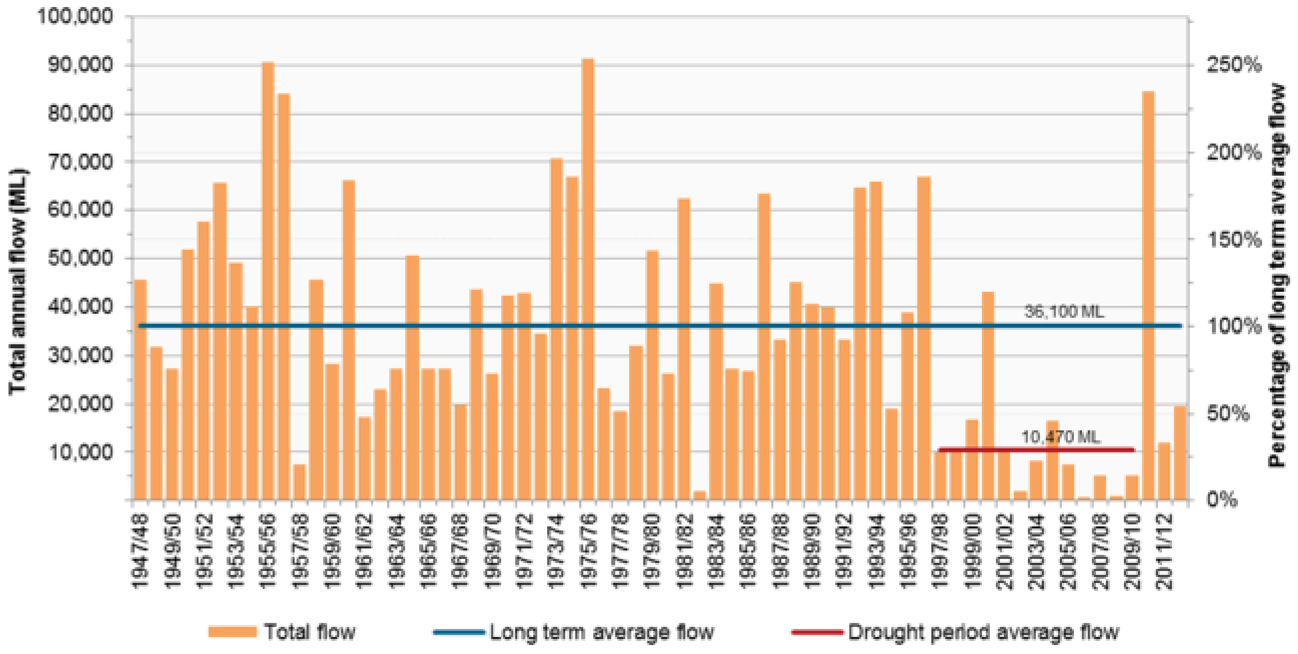


Figure 1-12 Annual streamflow – Avoca River at Coonooer (Station No. 408200)

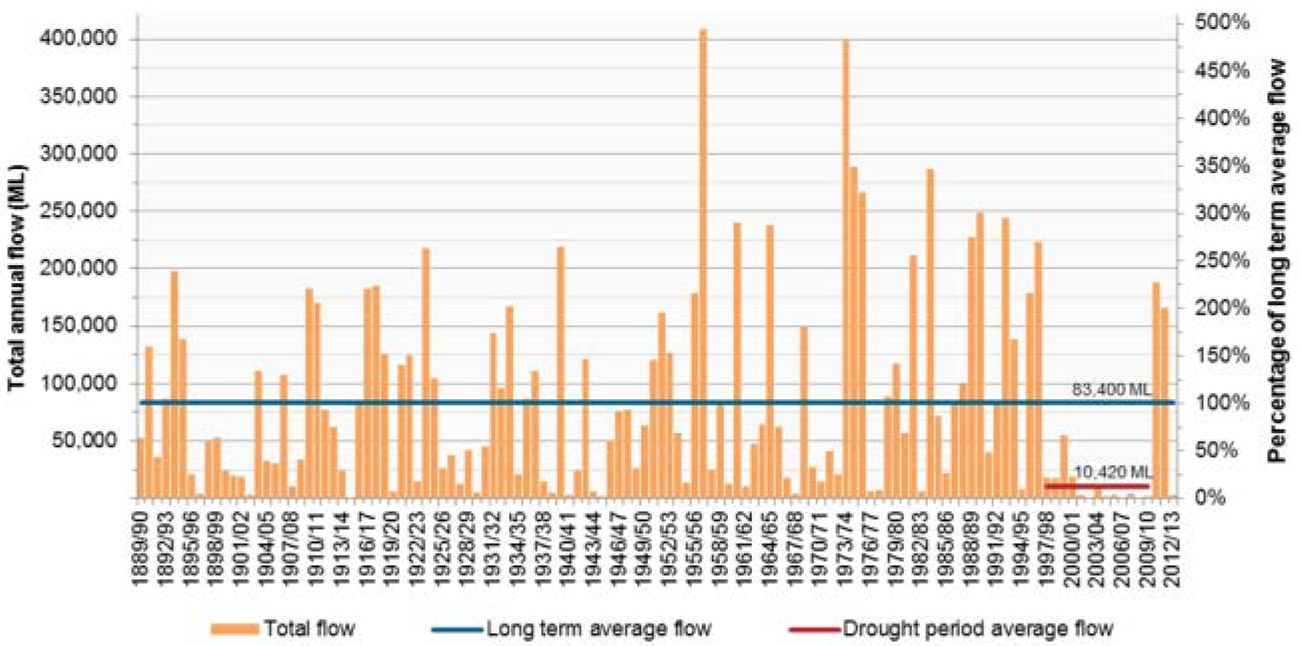


Figure 1-13 Annual streamflow – Wimmera River at Glynwylln (Station No. 415206)

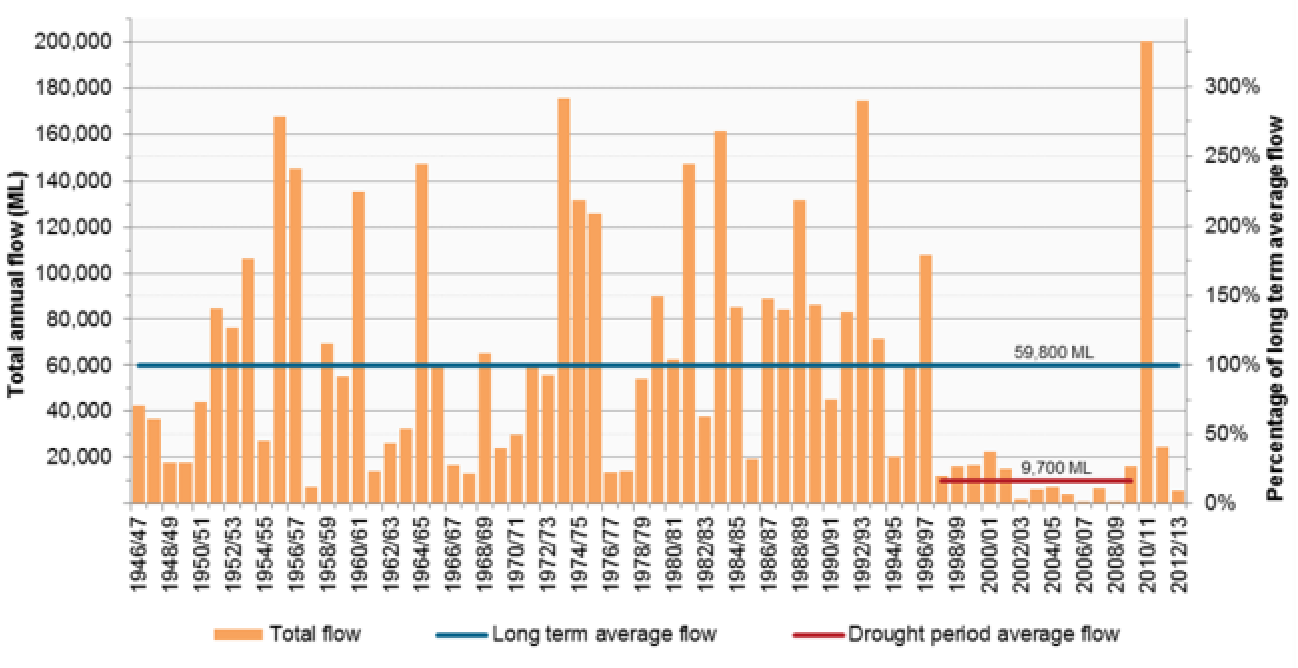


Figure 1-14 Annual streamflow – Snowy Creek at Granite Flat (Station No. 401210)

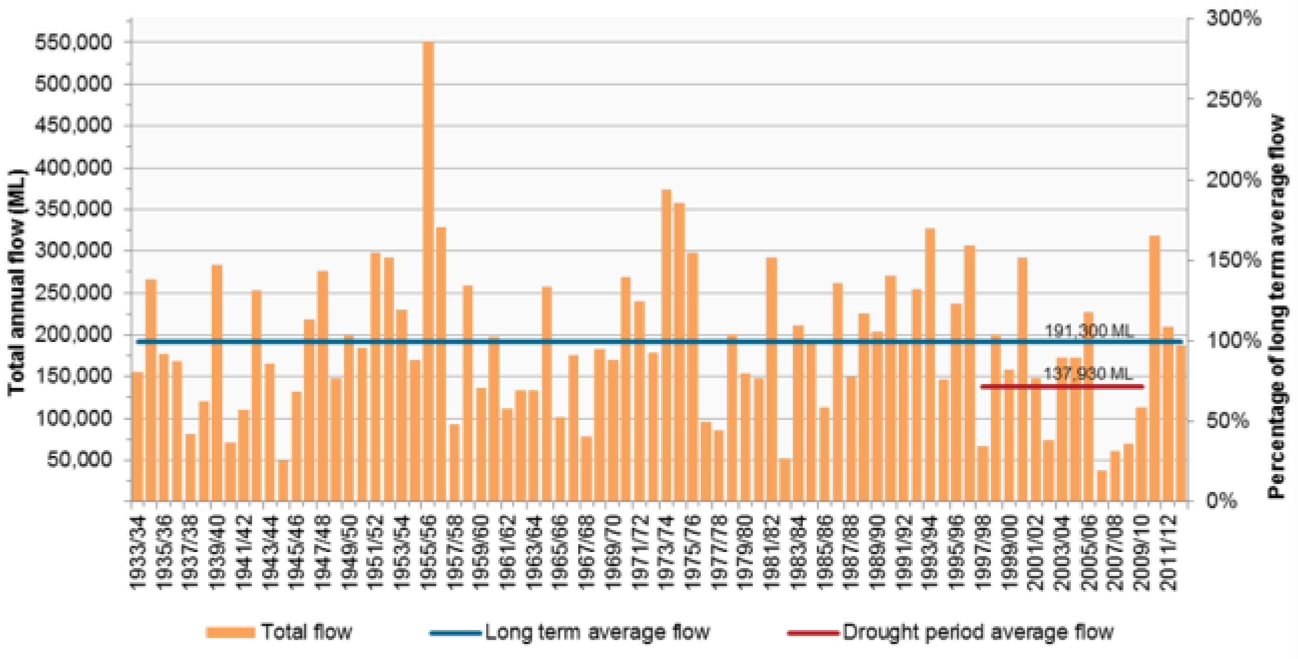


Figure 1-15 Annual streamflow – Mitchell River at Glenaladale (Station No. 224203)

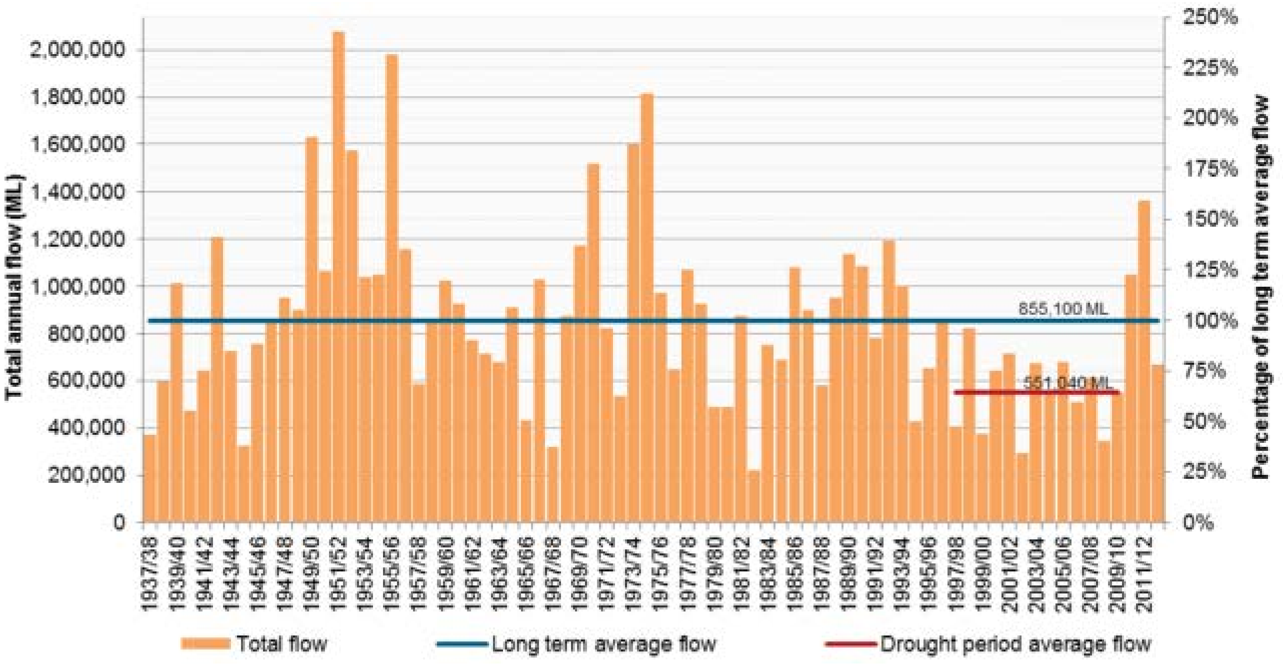


Figure 1-16 Annual streamflow – Deep Creek at Bulla (Station No. 230205)

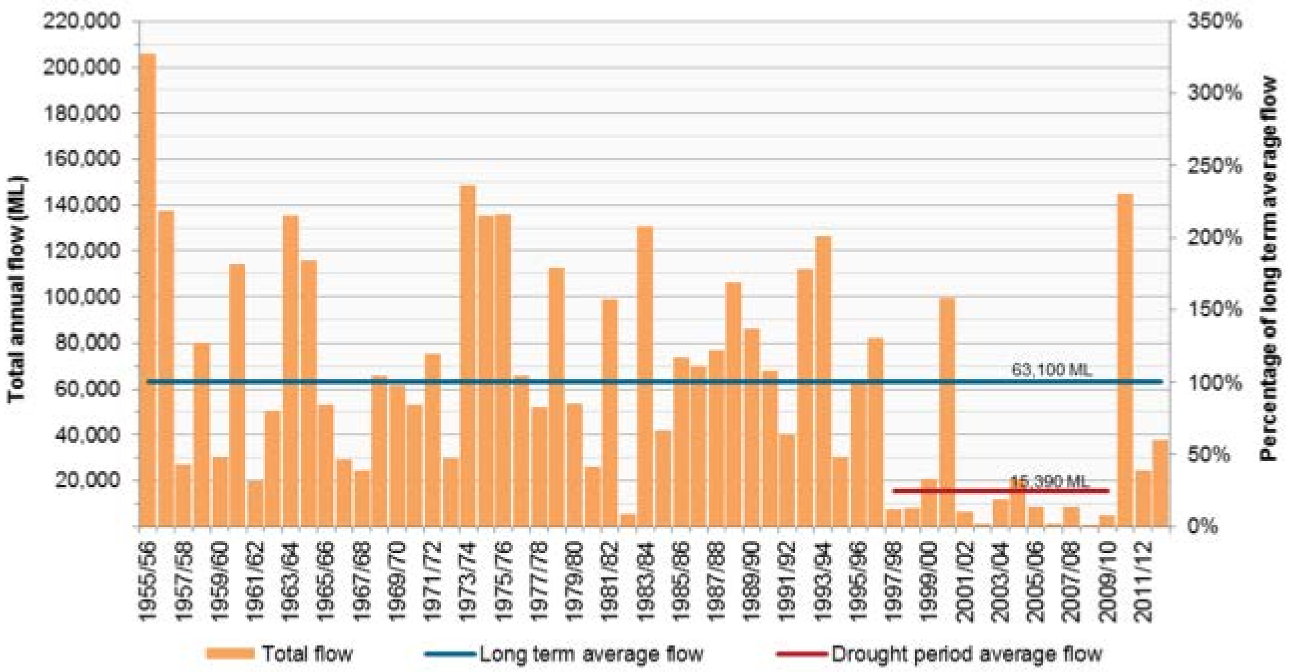


Figure 1-17 Annual streamflow – Werribee River at Ballan (Station No. 231225)

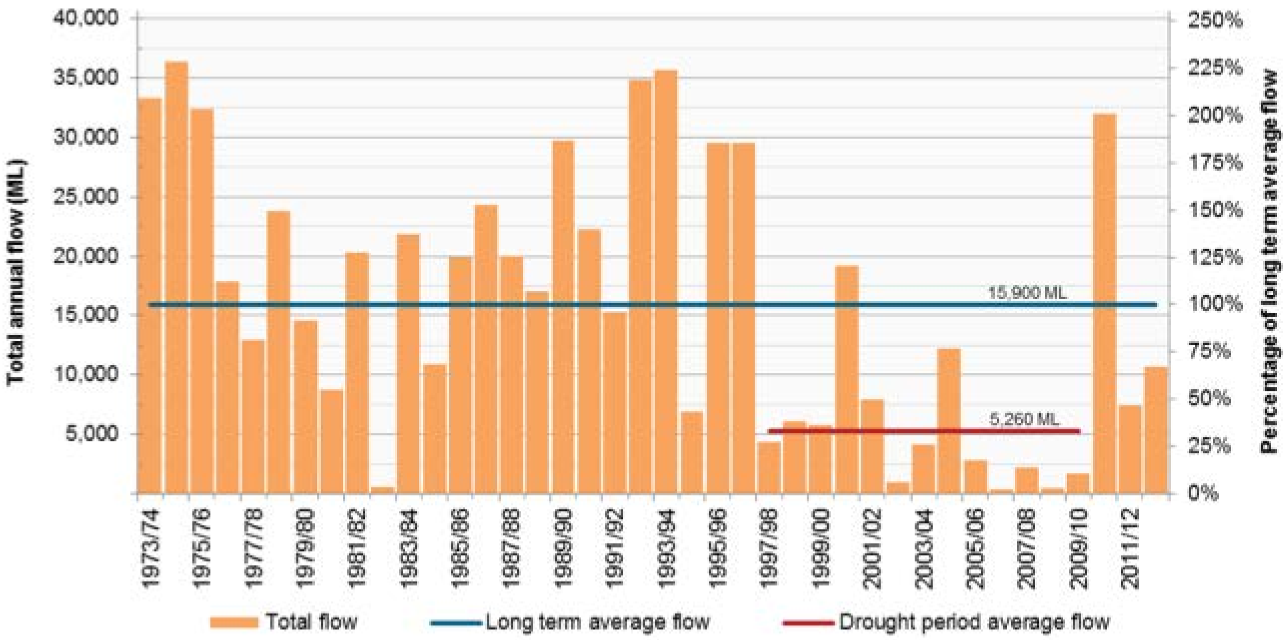


Figure 1-18 Annual streamflow – Moorabool River at Batesford (Station No. 232202)

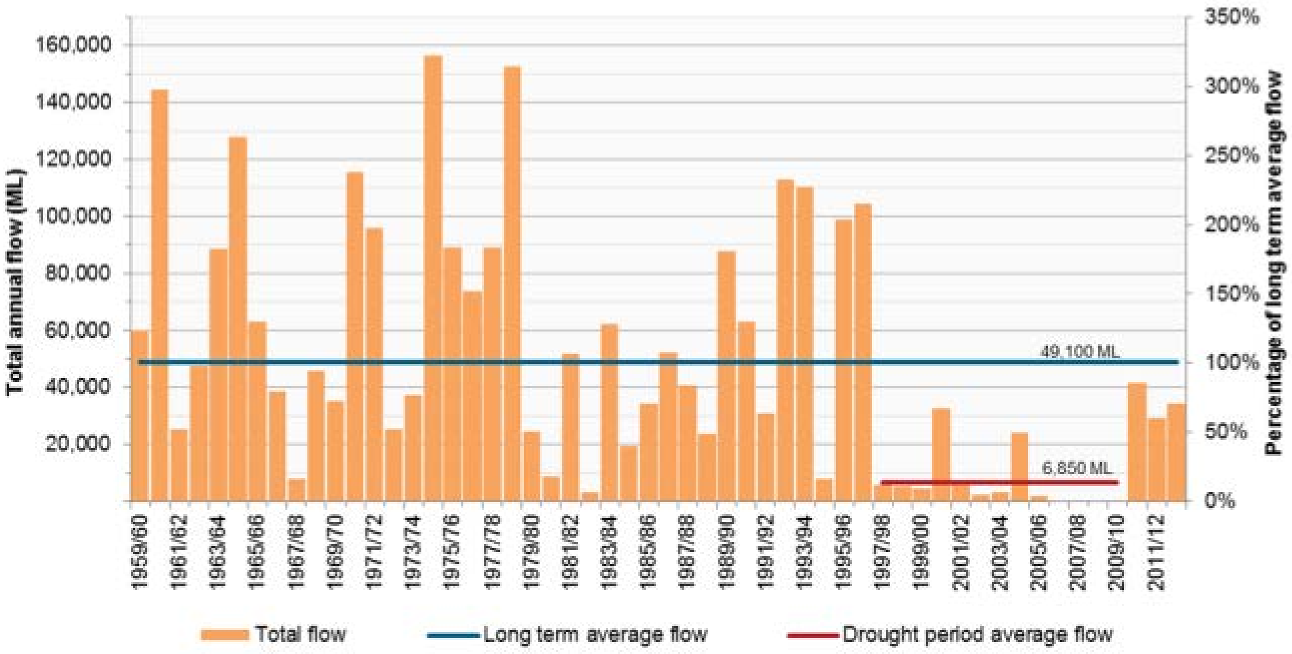
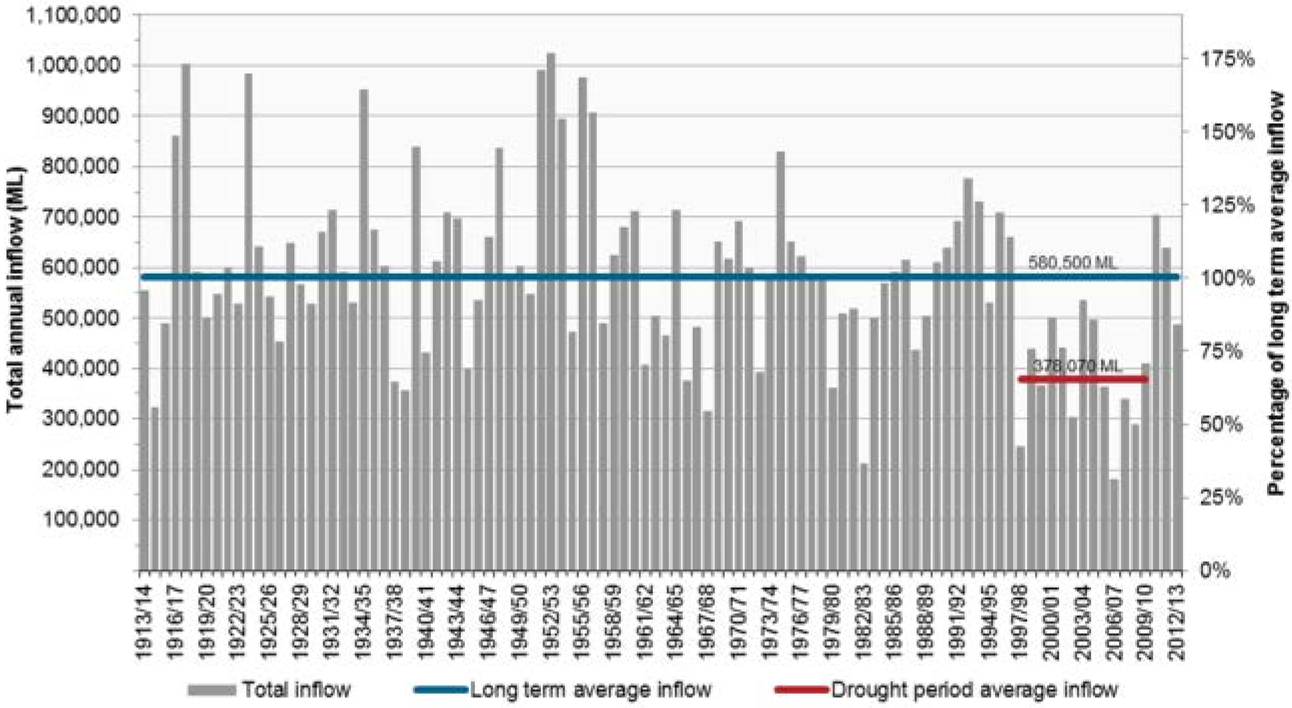


Figure 1-19 Annual inflows to Melbourne's main harvesting reservoirs[(1)]



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

1.2.1 Other factors affecting water availability across Victoria

In 2012–13 cyanobacteria blooms, also referred to as blue-green algal blooms or BGA, affected water availability in Victoria.

Cyanobacteria are a natural component of most aquatic systems and are found in streams, lakes, estuaries and the sea. The presence of significant numbers of cyanobacteria in water bodies can produce toxins that can have serious health implications for humans, animals, birds and livestock, as well as significant environmental impacts.

Many factors can trigger cyanobacteria blooms including nutrient loads, low inflows, low storage volumes and higher-than-normal temperatures. Cyanobacteria outbreaks generally occur in the summer months.

Cyanobacteria blooms are monitored regularly by water corporations and local waterway managers. In cases where the concentration of cyanobacteria exceeds the thresholds for safe water use, the bloom should be reported to DEPI and, in cases affecting drinking water supplies, the Department of Health. Local waterway managers should also activate their risk management plan, which may include erecting signage at the site and issuing a media release to the public. More information on the management of cyanobacteria blooms can be found in the Blue-Green Algae Circular, published online at www.depi.vic.gov.au.

In 2012–13, there were a total of 61 cyanobacteria alerts issued in Victoria, predominantly affecting recreational water use (Table 1-3). The waterbodies where cyanobacteria alerts were required for drinking water supplies were largely confined to the Werribee basin (Central region), South Gippsland basin (Gippsland region) and Loddon basin (Northern region).

Table 1-3 Cyanobacteria bloom alerts issued in 2012–13

Region	Alerts issued for drinking water supplies in 2012–13	Alerts issued for recreational water use in 2012–13	Total cyanobacteria alerts issued in 2012–13
Central region	8	24	**32**
Gippsland region	4	1	**5**
Northern region	3	10	**13**
Western region	-	11	**11**
Total	**15**	**46**	**61**

1.3 Storages

Victoria's major water storages are capable of holding around 12,372,551 ML. Of this, Melbourne's storage capacity is 1,812,175 ML and the combined capacity of the state's major regional storages is 10,560,376 ML.

Water availability

In 2012–13 Victoria's total storage levels started the year at 10,317,026 ML (83% of capacity) and ended at 8,878,800 ML (72% of capacity). The combined volume of water stored in Victoria's reservoirs varies both within a given year and between years (Figure 1-20 and Figure 1-21).

Storage levels in Victoria's regional reservoirs started the year at 9,048,365 ML (86% of capacity) and ended at 7,595,886 ML (72% of capacity). Storage levels increased during spring, reaching a peak of 96% of capacity in September, and declined throughout the summer to a minimum of 67% of capacity by April 2013 (Figure 1-20).

Melbourne's water storages started the year at 1,268,661 ML (70% of total capacity) and ended at a similar level of 1,282,914 ML (71% of total capacity), after reaching a peak of 81% in November 2012 (Figure 1-21). In the previous three years, Melbourne's storage levels were higher at the end of the year than they were at the beginning of the year. This is in contrast to the latter years of the millennium drought when, between 2006 and 2009, storages consistently ended each year at lower levels than at the start (Figure 1-21).

A subset of around 60 major storages was used to provide the summary information in Figure 1-20 and Figure 1-21. Information on levels held in all storages across Victoria's surface water basins is set out in Appendix A and in the water balances presented in Chapter 6.

Figure 1-20 Volume in major regional water storages, 1 July 2003 to 30 June 2013

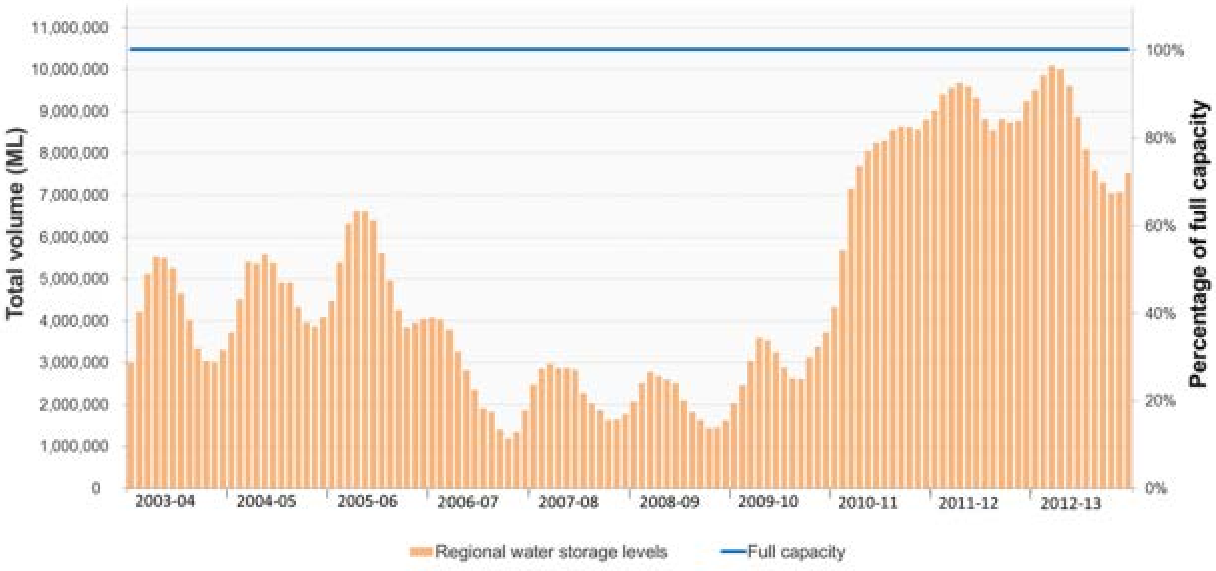
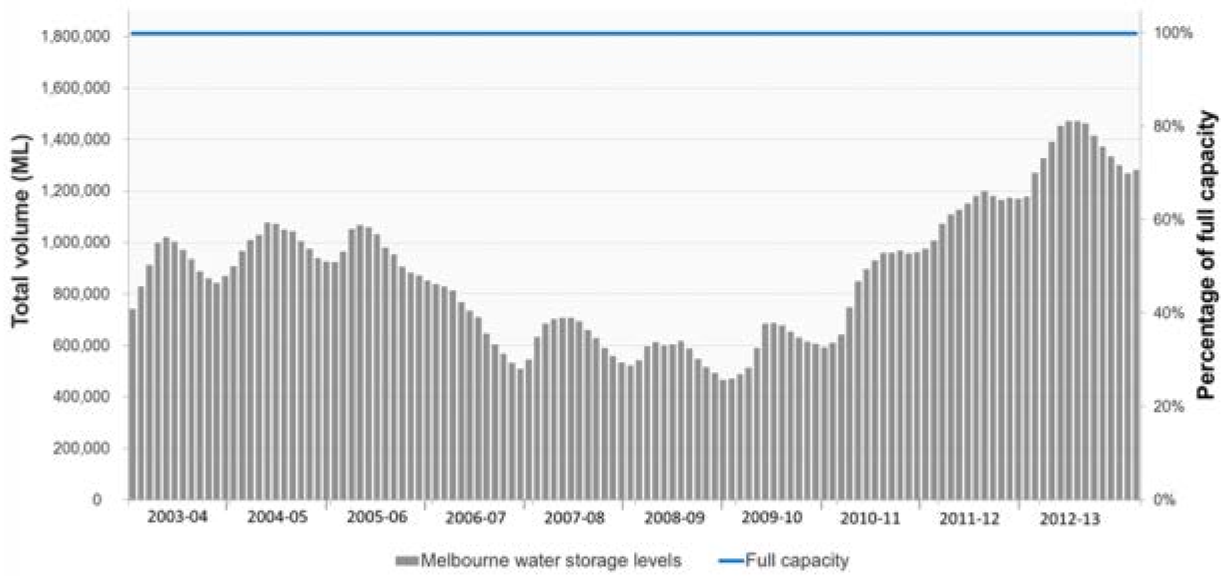


Figure 1-21 Volume in Melbourne Water Corporation storages, 1 July 2003 to 30 June 2013

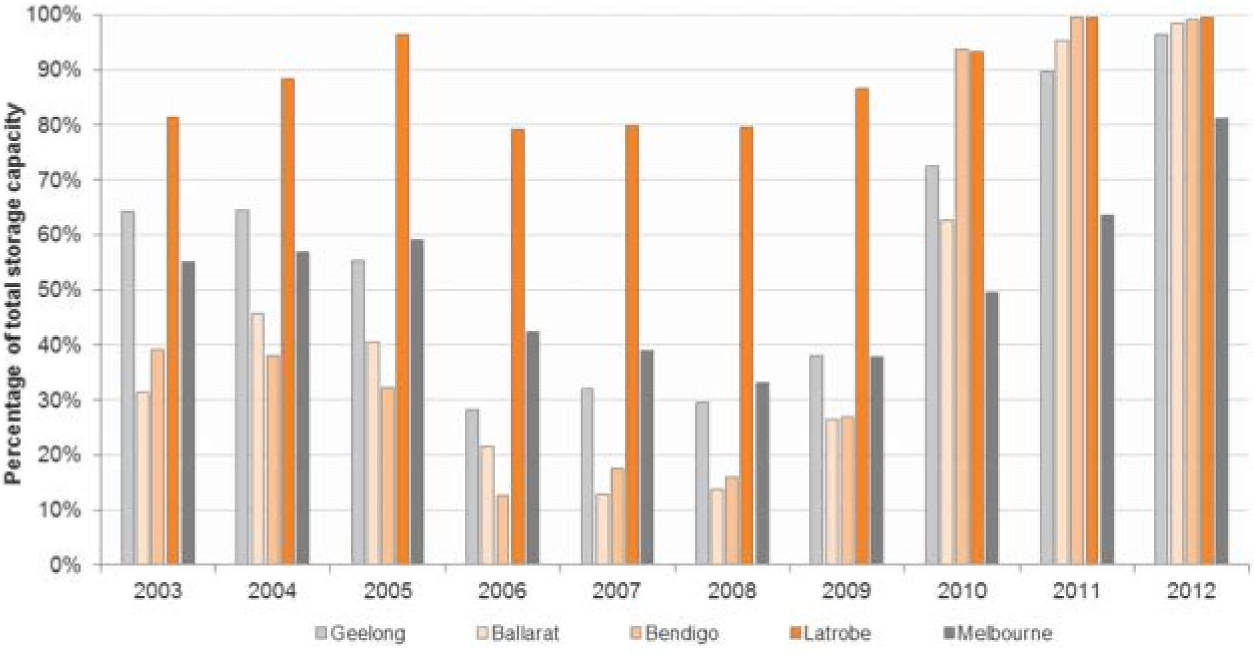


The total volume of water stored in Victoria's major reservoirs has historically been at its highest following winter and spring inflows, hence storage levels at the end of October are traditionally considered to be a good indication of water availability for the remainder of that year.

Figure 1-22 presents October storage levels as a percentage of storage capacity for Melbourne and selected major regional centres from October 2003 to October 2012.

During the drought, October storage levels generally declined from 2003 to 2007 (Figure 1-22), 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 the state (Figure 1-22). By October 2010, storage levels had recovered significantly, with further recovery during 2011–12 across all major centres (Figure 1-22). At the end of October 2012, storage levels for all the selected urban centres were at their highest in over a decade. Storages for all four regional centres were over 95% of capacity, while Melbourne storages continued the rising trend, increasing to 81% in October 2012 compared to 63% at the same time in the previous year (Figure 1-22).

Figure 1-22 Water in reservoirs for major urban centres at the end of October in each year between 2003 – 2012, percentage of total storage capacity



1.4 Groundwater

Groundwater is water that exists in the spaces and fractures in rock and sediment beneath the ground's surface. It originates as rainfall or snow, and then seeps from the surface into the groundwater system, where it eventually makes its way back to surface rivers and streams, lakes and wetlands and the ocean. Groundwater supports groundwater-dependent ecosystems, human consumption and agricultural, commercial and industrial uses and contributes to environmental flows in streams.

Trends in groundwater levels reflect changes in aquifer storage resulting from differences between the amount of water flowing into (recharge) and out of (discharge) an aquifer. Groundwater level trends in shallow aquifers are more likely to reflect changes in recharge, from either rainfall or irrigation, whereas deeper aquifer trends may show a greater influence from pumping.

Groundwater in Victoria is managed through Groundwater Management Units (GMUs). There are two types of GMU: Water Supply Protection Areas (WSPAs) and Groundwater Management Areas (GMAs). In 2012, the newly formed West Wimmera GMA replaced the following GMUs: Apsley WSPA, Balrootan GMA, Goroke GMA, Kaniva WSPA, Kaniva TCSA GMA, Little Desert GMA, Neuarpur WSPA, Nhill GMA and Telopea Downs WSPA.

The State Observation Bore Network (SOBN) is the collection of bores used for monitoring the movement, availability and quality of Victorian groundwater, and the linkages between groundwater and surface water systems throughout the state. The SOBN comprises approximately 2,500 bores that are monitored on a routine basis. Short-term groundwater level trends for GMUs have been determined based upon five years of consistent monitoring data from key bores in the SOBN. Trend determinations are made quarterly, when each reading is compared to the previous readings in the same season (i.e. a summer record is compared to previous summer records to account for seasonality). The bores for each GMU are selected on the basis of a number of factors, including the length and quality of records available, the geographic distribution or bores and the maximum possible distance from irrigation bores (to minimise the influence of pumping on the groundwater levels recorded).

Water availability

During 2012–13, groundwater level trends in Victoria's WSPAs remained similar to those observed in 2011–12 (Table 1-4 and Figure 1-23). The state's GMAs reflected greater stability in comparison to the previous year, with fewer areas being categorised as rising or in decline (Table 1-5 and Figure 1-24).

Table 1-4 Groundwater level trends in Water Supply Protection Areas

Water Supply Protection Area	Groundwater level trend 2012–13				Groundwater level trend June 2012
	September 2012	December 2012	March 2013	June 2013	
Bungaree	Rising	Rising	Rising	**Rising**	Rising
Condah	Stable	Rising	Rising	**Stable**	Rising
Denison	Stable	Stable	Stable	**Stable**	Stable
Deutgam	Rising	Rising	Rising	**Rising**	Rising
Glenelg	Stable	Stable	Stable	**Stable**	Stable
Katunga	Rising	Rising	Rising	**Rising**	Rising
Koo Wee Rup	Rising	Rising	Rising	**Rising**	Rising
Loddon Highlands	Rising	Rising	Rising	**Rising**	Rising
Lower Campaspe Valley	Rising	Rising	Rising	**Rising**	Rising
Murrayville	Stable	Stable	Stable	**Stable**	Stable
Nullaware	Rising	Rising	Rising	**Rising**	Rising
Sale	Stable	Stable	Stable	**Stable**	Stable
Shepparton Irrigation Region	Stable	Stable	Stable	**Stable**	Declining
Upper Ovens	Stable	Rising	Stable	**Stable**	Stable
Wandin Yallock	Rising	Rising	Rising	**Rising**	Rising
Warrion	Rising	Rising	Rising	**Rising**	Rising
Wy Yung	Stable	Stable	Rising	**Rising**	Rising
Yangery	Rising	Rising	Rising	**Rising**	Rising
Yarram	Declining	Stable	Declining	**Declining**	Stable

Figure 1-23 Groundwater trends in Water Supply Protection Areas

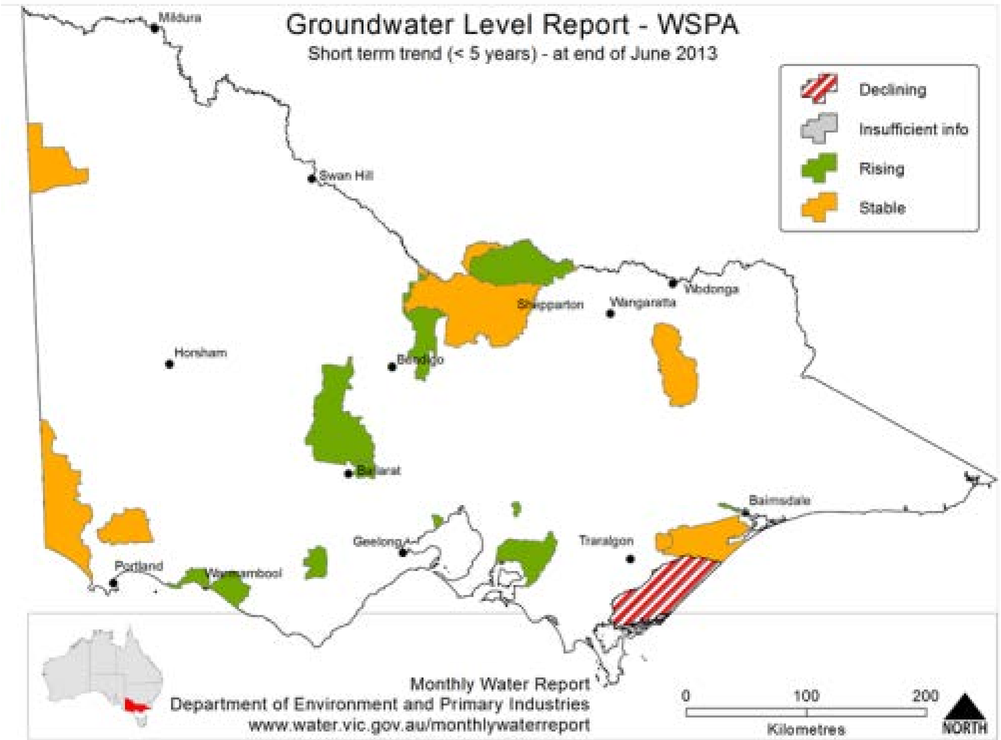


Table 1-5 Groundwater level trends in Groundwater Management Areas

Groundwater Management Area(1)	Groundwater level trend 2012–13				Groundwater level trend June 2012
	September 2012	December 2012	March 2013	June 2013	
Cardigan	Stable	Rising	Rising	**Rising**	Stable
Corinella	Rising	Rising	Rising	**Rising**	Rising
Frankston	Stable	Rising	Rising	**Stable**	Stable
Gellibrand	Declining	Declining	Declining	**Stable**	Declining
Gerangamete	Declining	Declining	Declining	**Declining**	Declining
Giffard	Rising	Rising	Rising	**Stable**	Rising
Hawksdale	Stable	Stable	Stable	**Stable**	Stable
Jan Juc	Declining	Declining	Declining	**Declining**	Declining
Lancefield	Stable	Stable	Stable	**Stable**	Stable
Leongatha	Stable	Stable	Stable	**Stable**	Stable
Lower Ovens	Rising	Rising	Stable	**Rising**	Rising
Merrimu	Declining	Declining	Declining	**Declining**	Declining
Mid-Goulburn	Declining	Stable	Stable	**Stable**	Declining
Mid-Loddon	Rising	Rising	Rising	**Rising**	Rising
Moe	Declining	Declining	Declining	**Declining**	Declining
Mullindolingong	Rising	Rising	Rising	**Rising**	Rising
Nepean	Stable	Stable	Stable	**Stable**	Stable
Newlingrook	Stable	Stable	Stable	**Stable**	Stable
Orbost	Rising	Rising	Stable	**Stable**	Rising
Paaratte	Stable	Stable	Stable	**Stable**	Stable
Portland	Stable	Stable	Stable	**Stable**	Stable
Rosedale	Declining	Declining	Declining	**Stable**	Declining
Stratford	Stable	Stable	Declining	**Declining**	Stable
Tarwin	Stable	Stable	Stable	**Stable**	Stable
Wa De Lock	Stable	Stable	Stable	**Stable**	Rising
West Wimmera(2)	Stable	Stable	Stable	**Stable**	Stable(3)

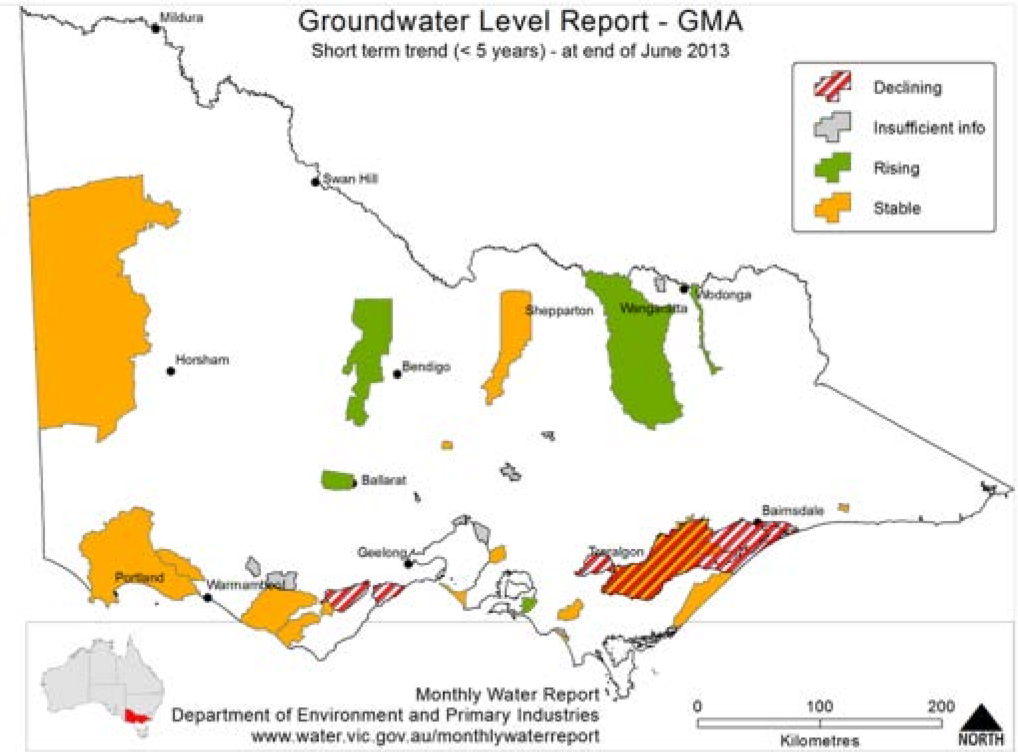
Note:

(1) The following Groundwater Management Areas 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: Alexandra, Barnawartha, Colongulac, Cut Paw Paw, Glenormiston, Heywood, Kinglake and Moorabbin.

(2) In 2012, the West Wimmera GMA replaced the following Groundwater Management Units: Balrootan GMA, Nhill GMA, Goroke GMA, Kaniva TCSA GMA and Little Desert GMA, Apsley WSPA, Kaniva WSPA, Neuarpur WSPA and Telopea Downs WSPA.

(3) In 2011–12, the groundwater level trend for all Groundwater Management Units that were replaced by the West Wimmera GMA (see note 2) were categorised as 'stable'.

Figure 1-24 Groundwater trends in Groundwater Management Areas



2 Management of Victoria's water resources

Victoria's *Water Act 1989* provides the basis for managing Victoria's water resources. Under the Act, the Crown holds the rights to all of Victoria's water and may issue it to consumptive users and the environment via a range of mechanisms (Figure 2-1).

Given the considerable variation in water availability from year to year (Chapter 1), Victoria's ability to deal with a range of conditions is built on providing both certainty and flexibility in how water is shared and managed through its water entitlement and planning frameworks.

Under the water entitlement framework, entitlement holders are responsible for managing their own water supplies, including the risks to these supplies due to drought or climate variability. Entitlements to water are transferable and transfers are facilitated through water markets wherever possible.

The entitlement framework contains tools to actively manage consumptive and environmental water entitlements and is supported by a planning framework that spans the short, medium and long terms.

In exceptional circumstances, such as unprecedented droughts, the Minister for Water may intervene to alter water-sharing arrangements to ensure that critical human needs can be supplied when there are no other practical alternatives.

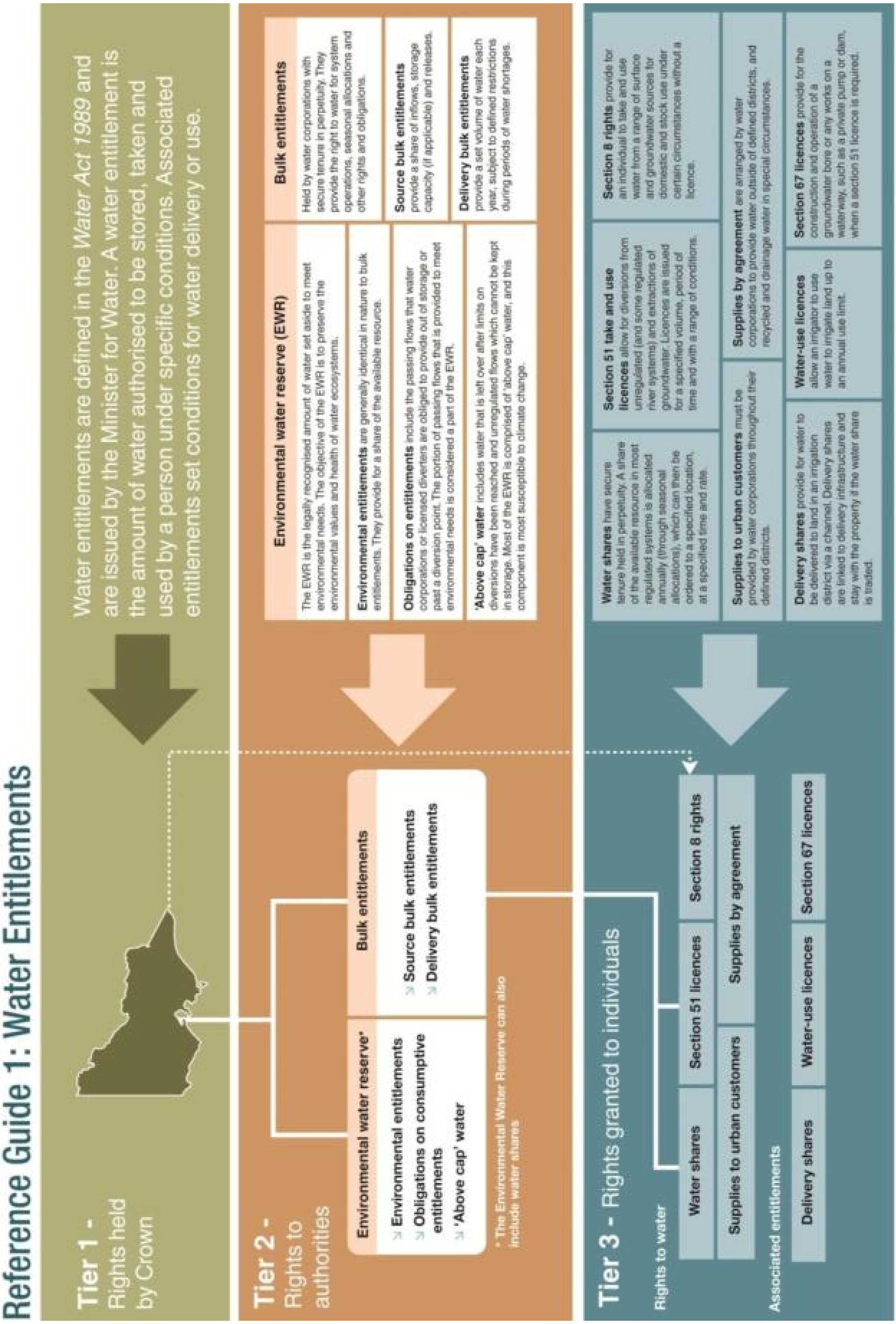
2.1 Victoria's water entitlement and planning framework

The establishment of the Victorian Water Entitlement Framework in the Water Act was one of the major reforms in Victoria's water management history. The framework takes a whole-of-system water management approach and considers all water resources for both consumptive and environmental purposes.

The following are established by the framework:

- **Secure entitlements** (Figure 2-1): These entitlements are recognised in the Act and can be considered equivalent to property rights, with legal tenure that is certain and protected, and known arrangements for sharing available water during dry and drought years.
- **Limits on water entitlements:** It is important that water taken under an entitlement does not reduce reliability of supply to other entitlement holders or impact important environmental values. A range of tools such as caps and diversion limits confine water entitlements.
- **Clear consultative processes for changing entitlements:** The Act sets out clear processes to be followed before an entitlement can be changed in order to protect the integrity of entitlements.
- **Annual processes to allocate water to entitlements:** The framework provides the ability to restrict annual water use in response to seasonal variability. Annual use can be restricted through seasonal allocations, urban water restrictions and rosters, restrictions or bans on unregulated river or groundwater systems (Chapter 2.2).
- **Ability to trade:** Markets can be used to facilitate efficient use of water resources, giving water users the flexibility to buy and sell their water and water entitlements (see Chapter 5 for information on trade in 2012–13).
- To support and guide management of water allocated under the entitlement framework, Victoria has an integrated water planning framework, supported in legislation and with specified timeframes for review. This framework incorporates:
  - year-to-year or short-term planning through measures such as seasonal resource determinations on rural regulated systems and drought response plans in urban systems
  - local planning to balance the demand for water and available supply over the medium to long term
  - local planning to maintain and improve the health of rivers and wetlands through the development of regional waterway management strategies
  - strategic planning through the development of regional sustainable water strategies
  - long-term assessments of the resource base and river health every 15 years.

Figure 2-1 Victoria's entitlement framework



2.2 Responding to water availability

The amount of water available for consumptive use and environmental purposes will vary from year to year. The entitlement and planning framework includes mechanisms to conserve and share water between users in response to seasonal variability and water shortage. These mechanisms include urban water restrictions, seasonal allocations in regulated systems, and restrictions on licence holders in groundwater systems and unregulated surface water catchments.

When these mechanisms for managing variability in water availability are not sufficient, water corporations also undertake other measures such as water carting to augment local supplies.

In exceptional circumstances, the Minister for Water has emergency powers under section 33AAA of the Water Act to declare that a water shortage exists and to qualify rights to water. The Minister for Water did not qualify any rights to water in 2012–13.

Water markets are also a very important mechanism for individual entitlement holders in regulated systems to manage seasonal variation in water availability and facilitate the sharing of available resources. Information on trade in 2012–13 is presented in Chapter 5.

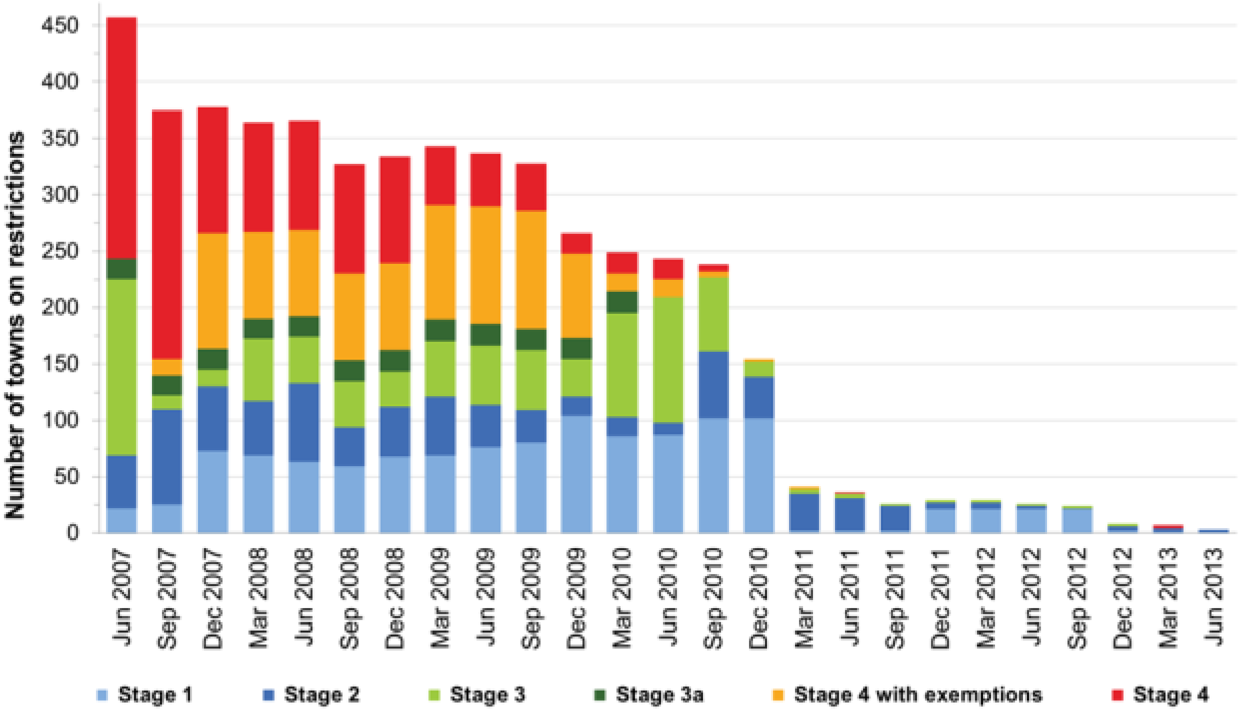
2.2.1 Urban water restrictions

All Victorian towns are subject to a uniform scale of water restrictions under the Victorian Uniform Drought Water Restriction Guidelines. The scale has four key stages of restrictions, with increasing levels of severity. While water businesses can tailor the restrictions under each stage to suit local conditions (that is, by providing exemptions), each stage's restrictions are mostly generic. The trigger points for each stage of water restrictions are outlined in the drought response plan of each water business. These plans also include contingency measures for temporary water supplies or savings beyond Stage 4.

Each urban water business also has a permanent water savings plan which applies at all times and sets basic conditions for water use when water restrictions are not in place.

In 2012–13, the number of Victorian towns on water restrictions continued to decline relative to the widespread restrictions during the millennium drought. By the end of June 2013, only three townships were subject to water restrictions, compared to over 450 towns at the peak of the drought in 2007 (Figure 2-2).

Figure 2-2 Number of Victorian towns on restrictions, June 2007 to June 2013



2.2.1.1 Central region and Melbourne metropolitan area

In central Victoria, the long-standing water restrictions for Redbank remained in place, with the township subject to Stage 2 restrictions throughout 2012–13. Central Highlands Water removed Stage 2 restrictions in August 2012 for the towns of Blackwood and Barrys Creek – the first time since 2003 that these towns supplied by the Blackwood system have not been subject to restrictions.

In December 2012, Stage 1 water restrictions were removed across metropolitan Melbourne – the first time since 2006 that Melbourne had not been subject to restrictions on urban water use. Melbourne's water storages recovered to above 80%, the highest level since the drought, allowing the metropolitan area to revert to Permanent Water Saving Rules. In line with this decision, 17 towns in Western Water's service area (Table 2-1) followed suit, with Stage 1 restrictions lifted and Permanent Water Saving Rules coming into effect in December.

As with previous years, Barwon Water implemented mandatory summer restrictions for the coastal townships of Apollo Bay, Marengo and Skenes Creek in November 2012. Mandatory restrictions ensure that the limited storage capacity of the Marengo basin copes with the tourist influx through summer and autumn. The restrictions commenced at Stage 2 in November, however the severity was increased to Stage 4 in March after hot and dry conditions in early 2013 caused a sharp decline in storage volumes. The towns returned to Permanent Water Saving Rules in May 2013.

Barwon Water introduced Stage 2 restrictions in May 2013 for ten towns supplied by the Colac system (see Table 2-1). The restrictions were implemented in response to declining storage levels after the area received the lowest rainfall on record for the January to March period. By late June 2013, reservoirs had recovered sufficiently to allow these townships to return to Permanent Water Saving Rules.

2.2.1.2 Northern region

Coliban Water lifted Stage 3 restrictions for Raywood and Sebastian in January 2013 following the completion of a pipeline connecting the towns to the Bendigo supply system. This is the first time that these townships have not been subject to restrictions since 2002.

Goulburn Valley Water introduced Stage 1 restrictions for Pyalong in February 2013 in response to low flows in Mollisons Creek. Continued low flows caused the restrictions to be increased to Stage 2 in March and they remained in place for the rest of 2012–13.

2.2.1.3 Western region

In February 2013, GWMWater lifted long-standing Stage 1 restrictions from the town of Edenhope in the Wimmera region. Permanent Water Saving Rules came into effect following the completion of upgrade works at the Edenhope Water Treatment Plant and the development of additional borefields.

GWMWater maintained Stage 2 restrictions at Harrow in the Wimmera region throughout 2012–13.

2.2.1.4 Gippsland region

At the end of January 2013, South Gippsland Water introduced Stage 1 restrictions for Korumburra in response to hot, dry summer conditions. Restrictions were raised to Stage 2 in February due to the continued dry spell and remained in place until storages had sufficiently recovered. The restrictions were removed in June 2013 and the township returned to Permanent Water Saving Rules.

Table 2-1 Urban water restrictions in 2012–13

Water corporation	Water system and towns	Level and duration of restrictions in 2012–13
Central region		
Barwon Water	Marengo system (Apollo Bay, Skenes Creek, Marengo)	PWSR applied 1 July to 3 November 2012 Stage 2 restrictions applied 4 November 2012 to 24 March 2013 Stage 4 restrictions applied 25 March to 11 May 2013 PWSR applied 12 May to 1 July 2013
	Colac system (Colac, Alvie, Beeac, Coragulac, Cororooke, Cressy, Elliminyt, Irrewarra, Ondit, Warrion)	PWSR applied 1 July to 11 May, 22 June to 30 June Stage 2 restrictions applied 12 May to 21 June.
	All other towns	PWSR applied all year
Central Highlands Water	Blackwood system (Blackwood, Barrys Reef)	Stage 2 restrictions applied 1 July to 8 August PWSR applied 9 August to 30 June
	Redbank	Stage 2 restrictions applied all year
	All other towns	PWSR applied all year
Melbourne Metropolitan Retailers (Yarra Valley Water, South East Water, City West Water)	Metropolitan Melbourne	Stage 1 restrictions applied 1 July to 30 November 2012 PWSR applied 1 December 2012 to 30 June 2013
Southern Rural Water (Werribee & Bacchus Marsh systems)	All towns	PWSR applied all year
Westernport Water	All towns	PWSR applied all year
Western Water	Bacchus Marsh, Bulla, Diggers Rest, Gisborne, Lancefield, Long Forest, Macedon, Melton, Monegeetta, Mount Macedon, Myrniong, Riddells Creek, Rockbank, Romsey, Sunbury, Toolern Vale, Woodend	Stage 1 restrictions applied 1 July to 30 November 2012 PWSR applied 1 December 2012 to 30 June 2013
	All other towns	PWSR applied all year

Water corporation	Water system and towns	Level and duration of restrictions in 2012–13
Northern region		
Coliban Water	Raywood, Sebastian	Stage 3 restrictions applied 1 July 2012 to 18 January 2013 PWSR applied 19 January to 30 June 2013
	All other towns	PWSR applied all year
Goulburn–Murray Water	All towns	PWSR applied all year
Goulburn Valley Water	Pyalong	PWSR applied 1 July 2012 to 21 February 2013 Stage 1 restrictions applied 22 February to 14 March 2013 Stage 2 restrictions applied 15 March to 30 June 2013
	All other towns	PWSR applied all year
Lower Murray Water	All towns	PWSR applied all year
North East Water	All towns	PWSR applied all year
Western region		
GWMWater	Edenhope	Stage 1 restrictions applied 1 July 2012 to 24 February 2013 PWSR applied 25 February to 30 June 2013
	Harrow	Stage 1 restrictions applied all year
	All other towns	PWSR applied all year
Wannon Water	All towns	PWSR applied all year
Gippsland region		
East Gippsland	All towns	PWSR applied all year
Gippsland Water	All towns	PWSR applied all year
South Gippsland Water	Korumburra	PWSR applied 1 July 2012 to 30 January 2013 Stage 1 restrictions applied 31 January to 18 February 2013 Stage 2 restrictions applied 19 February to 17 June 2013 PWSR applied 18 June to 30 June 2013
	All other towns	PWSR applied all year
Southern Rural Water (Macalister system)	All towns	PWSR applied all year

Note:
PWSR: Permanent Water Saving Rules

2.2.2 Seasonal allocation of water in declared systems

In declared water systems, water rights and licences have been unbundled from land. Water entitlements in the regulated systems of northern Victoria were converted to high reliability and low reliability water shares when unbundled on 1 July 2007. Unbundling extended to the Werribee–Bacchus Marsh and Thomson–Macalister water systems on 1 July 2008.

Restrictions on water use in declared water systems are determined by the seasonal water allocation. The seasonal allocation differs from urban restrictions by allocating to each water share entitlement a share of the available resource proportional to the volume of the entitlement. Seasonal allocations are expressed as a percentage of entitlement (either high reliability or low reliability water shares).

Initial allocations are made early in the water year based on the current volume of water in storage, estimated inflows during the season and the amount of water required to provide for subsequent years. Allocations are reviewed by rural water corporations throughout the irrigation season and increased if the available water exceeds their forecasts. The initial seasonal allocations are often low because water corporations do not know until late spring how much water will be available for use.

All Victorian irrigation districts in northern Victoria reached 100% allocation for high reliability entitlements in 2012–13 (Table 2-2). Low reliability allocations reached 100% in the Broken, Campaspe and Bullarook systems but remained at 0% in the Murray, Goulburn and Loddon systems.

In southern Victoria, high reliability entitlements reached 100% in both the Thomson–Macalister and Werribee and Bacchus Marsh systems in 2012–13. Low reliability allocations reached 20% in the Thomson–Macalister system and 40% in the Werribee and Bacchus Marsh system.

Table 2-2 Seasonal water allocations in declared water systems

Water system	Water shares	2012–13			2011–12
		Initial allocation(1) (% of entitlement)	Mid-season allocation(2) (% of entitlement)	Final allocation(3) (% of entitlement)	Final allocation (% of entitlement)
Goulburn–Murray Water					
Murray	High reliability	52	100	**100**	**100**
	Low reliability	0	0	**0**	**0**
Goulburn	High reliability	100	100	**100**	**100**
	Low reliability	0	0	**0**	**0**
Broken	High reliability	36	100	**100**	**100**
	Low reliability	0	100	**100**	**100**
Campaspe	High reliability	100	100	**100**	**100**
	Low reliability	25	100	**100**	**100**
Loddon	High reliability	100	100	**100**	**100**
	Low reliability	0	0	**0**	**0**
Bullarook	High reliability	100	100	**100**	**100**
	Low reliability	100	100	**100**	**100**
Southern Rural Water					
Thomson–Macalister	High reliability	90	100	**100**	**100**
	Low reliability	0	0	**20**	**100**
Werribee and Bacchus Marsh	High reliability	100	100	**100**	**100**
	Low reliability	15	40	**40**	**75**

Notes:

(1) Allocations in August are provided as an indication of the initial allocation for the season.

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

(3) Goulburn–Murray Water announces final allocations in April while Southern Rural Water announces final allocations in June.

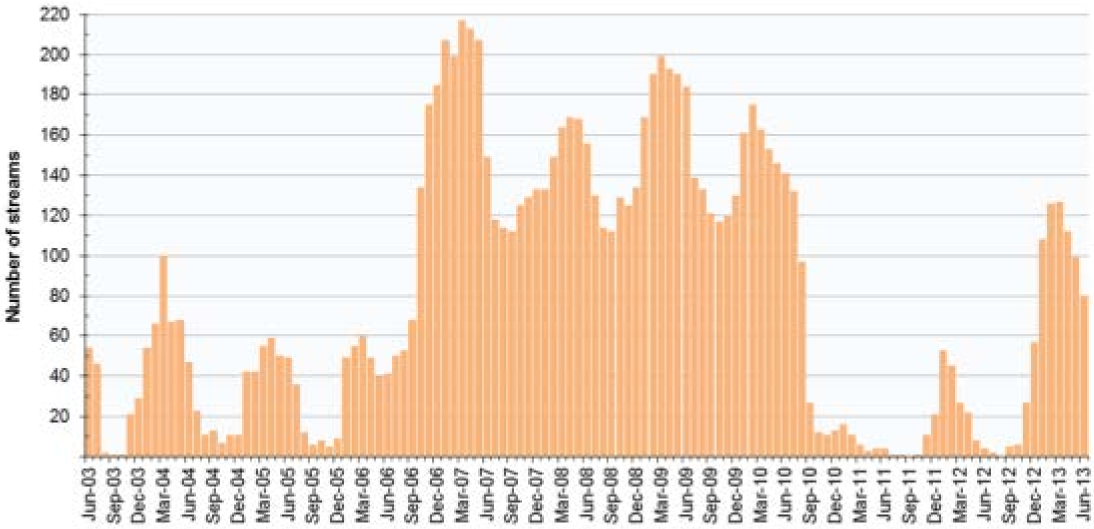
2.2.3 Restrictions on diversions from unregulated streams

Stream Flow Management Plans and Local Management Plans determine how water in unregulated streams will be shared between consumptive uses and the environment in times of water shortage. Under these plans, water corporations 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 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.

The need to implement restrictions on diversions from unregulated streams fluctuates over the course of 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.

As shown in Figure 2-3, restrictions on diversions in 2012–13 followed this general trend. The total number of unregulated streams subject to diversion restrictions was higher than the previous year due to Victoria experiencing one of the hottest summers on record with below-average summer rainfall totals across the state (see Chapter 1).

Figure 2-3 Number of Victorian unregulated streams on restrictions, 2003–04 to 2012–13



2.2.4 Seasonal allocations of groundwater in Groundwater Management Units

Seasonal allocations are announced in accordance with the groundwater management plans developed for Water Supply Protection Areas (WSPAs) and Groundwater Management Areas (GMAs). An allocation of less than 100% of the licensed entitlement may be put in place to achieve one or more of the following:

- Reduce the risks from falling groundwater levels. (Risks can include increased pumping costs, bores drying up and compromising access to domestic and stock groundwater, and potential long-term irreversible impacts on the quality of the resource if all entitlement is extracted).
- Allow the resource to be shared between all users.
- Recognise and reduce the social and environmental costs of lowering groundwater levels.

In 2012–13, two Groundwater Management Units were subject to restrictions on groundwater use, compared to four in the previous year. Katunga WSPA received a seasonal allocation of 70% in all zones for the 2012–13 season, while Neuarpur sub-zone 1 (part of the West Wimmera GMA) received a 92% seasonal allocation for 2012–13.

2.2.5 Water carting

Water carting is another option used by water corporations to augment supplies when local sources cannot meet demand. Doing so, however, is a time-consuming and expensive exercise and is therefore usually only implemented as a last resort to supply smaller towns. In contrast to recent years in which water carting was required to address water scarcity, only five towns received carted water in 2012–13.

Only one of these towns required carted water to address low water availability. Pyalong received water from Seymour from late April through to the end of June 2013 due to low flows in Mollisons Creek.

Two towns received carted water during 2012–13 as a result of water quality issues. The summer bushfires caused water quality issues for the town of Harrietville, which received carted water from Bright and Myrtleford while a temporary filtration plant was constructed. The township of Bright also received carted drinking water from Myrtleford due to water quality issues caused by bushfire sediment following heavy rainfall, which impacted the town's ability to cope with demand over the Easter period.

Two towns, Raywood and Sebastian, continued to receive carted water from Bendigo due to ongoing infrastructure works that have been in progress since 2007. Carting ceased in January 2013 after completion of the Raywood-Sebastian Pipeline Project that connected the towns to the Bendigo system.

Table 2-3 summarises the towns that received carted water in 2012–13.

Table 2-3 Towns receiving carted water 2012–13

Basin	Water corporation	Town(s) receiving water	Source of water	Period
Loddon	Coliban Water	Raywood, Sebastian	Bendigo	1 July 2012 to 19 January 2013
Ovens	North East Water	Harrietville	Bright, Myrtleford	27 February to 15 April 2013
	Goulburn Valley Water	Bright	Myrtleford	28 March to 3 April 2013
Goulburn	Goulburn Valley Water	Pyalong	Seymour	28 April to 30 June 2013

3 Water for consumptive use

Water for consumptive use in Victoria is taken from reservoirs, streams and aquifers under entitlements issued by the Victorian Government and authorised under the *Water Act 1989* (Vic) ('the Act'). Victoria's water entitlement framework is discussed in Chapter 2.

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 licence. In addition to the entitlements that are formally issued, the Act enables individuals to take water for domestic and stock purposes from a range of surface water and groundwater sources without a licence (e.g. from a farm dam). These domestic and stock rights are defined in the Act and are not formally issued.

As well as consumptive uses, the Act provides for water to be used for environmental purposes – see Chapter 4 for details.

Table 3-1 shows the volume of water defined in entitlements for consumptive use in Victoria in 2012–13 and 2011–12. The total volume of consumptive entitlements changes each year as new entitlements are issued or existing entitlements are modified. Most basins in the state are capped and therefore there is only a minor change in the total number of entitlements from one year to the next. In capped catchments, no new entitlements are created unless the entitlement is purchased from an existing user. This ensures no net increase in entitlement in a capped catchment.

Table 3-1 Consumptive water entitlements in Victoria in 2012–13 and 2011–12

Entitlement type	Volume 2012–13 (ML)	Volume 2011–12 (ML)
Surface water		
Bulk entitlements(1)	5,617,655	5,800,890
Licences(2)	282,412	410,556
Small catchment dams(3)	522,949	522,949
Total surface water entitlements	***6,423,016***	***6,734,395***
Groundwater		
Licences	957,695	976,839
Bulk entitlements(4)	10,000	7,000
Total groundwater entitlements	***967,695***	***983,839***
Total entitlements	**7,390,711**	**7,718,234**

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 trade, caps that are climatically adjusted, or caps that are long-term rolling averages. Bulk entitlements and environmental entitlements held by the Victorian Environmental Water Holder 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 2011–12 licence volume included licences for farm dams; these amounts (around 128,000 ML) have not been included in the 2012–13 volume. The volume of licences within regulated water supply systems is not included as these licences are included under rural water businesses' bulk entitlements.

(3) Not all small catchment dams are required to be licensed or registered under the *Water Act 1989* (i.e. farm dams for domestic and stock use). 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 Jan Juc bulk entitlement was reported last year with an average annual volume of 7,000 ML (35,000 ML over 5 years). This year it is reported as 10,000 ML (the maximum extraction per year).

The availability and use of Victoria's water resources for 2012–13 is summarised in Table 3-2.

It is important to note that the water use data presented in this overview and in the Victorian Water Accounts is reported as the volume of water diverted from a water source. It is not the 'use' on a farm or in a town, it is the bulk volume of water extracted from a stream or groundwater bore.

The total available volume of Victoria's surface water, groundwater and recycled water in 2012–13 was approximately 22,655,000 ML. Of this, approximately 4,740,000 ML (or 21%) was taken for consumptive purposes in 2012–13.

Surface water availability in 2012–13 was far greater than the total volume of water granted in surface water entitlements. The volume of surface water taken in 2012–13 was 67% of the total entitlement volume.

Table 3-2 Victoria's water availability and water taken for consumptive use in 2012–13

Water source	Available resource (ML)	Total entitlements (ML)	Total taken (ML)
Surface water[1]	21,185,276	6,423,016	4,275,070
Groundwater[2]	988,160	967,695	369,569
Recycled water	450,355	Not applicable	91,327

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 allocation limit.

3.1 Surface water entitlements and use

This section provides an overview of surface water taken under consumptive entitlements across Victoria.

The information on water taken from Victoria's rivers is summarised according to river basins as defined by the Australian Water Resource Council (AWRC). The exception to this 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. The extent of each of Victoria's river basins is shown in Figure 3-1.

Figure 3-1 Surface water river basins in Victoria

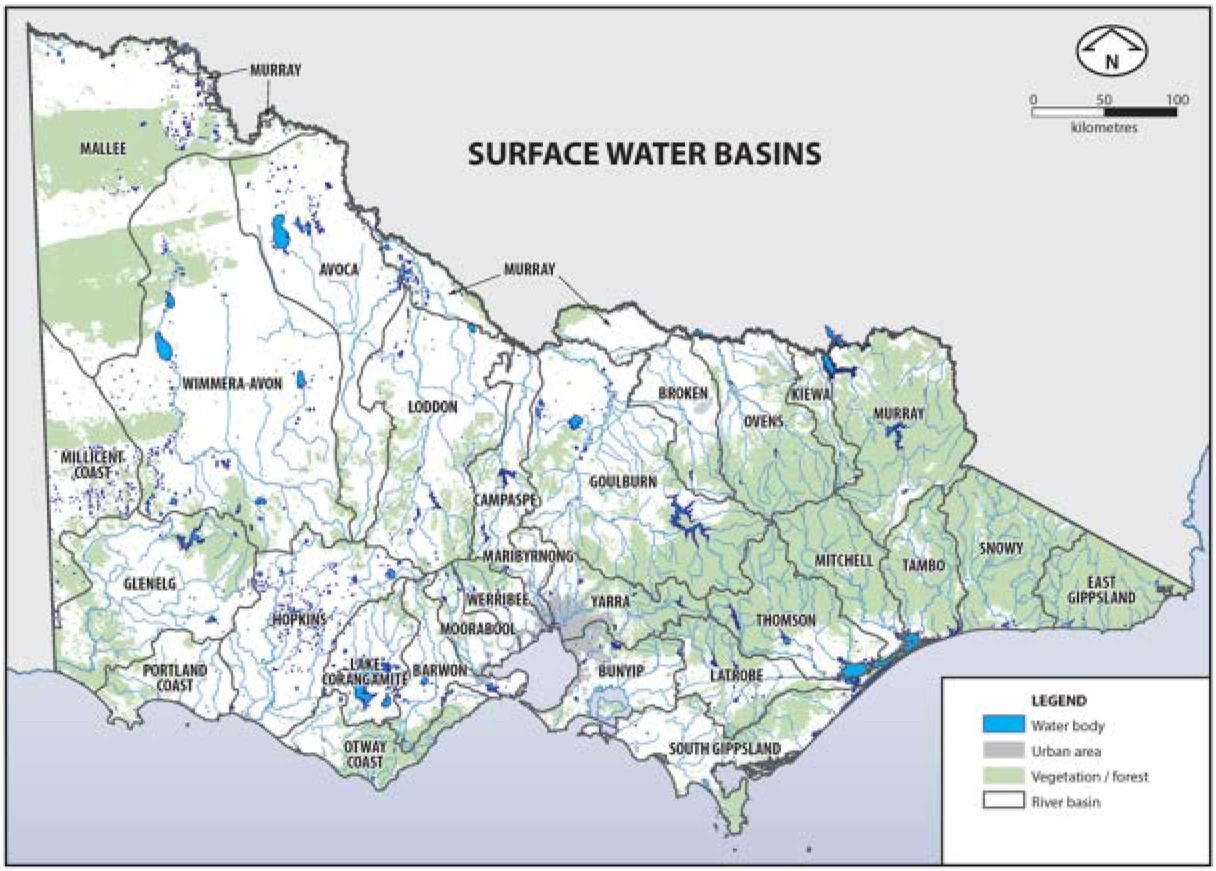


Table 3-3 summarises the volume of water taken under bulk entitlements, licences and small catchment dams in each basin in 2012–13. More detail on diversions under surface water entitlements in each basin can be found in Part 2.

The bulk entitlement volumes for some basins have changed compared to the values reported in the 2011–12 accounts.

In 2012–13, high reliability water shares held by North East Water were converted to bulk entitlement to improve administrative efficiency for managing town water supplies. The water corporation's Murray bulk entitlement was increased by 442.1 ML to reflect the conversion of water shares to bulk entitlements.

North East Water's Kiewa bulk entitlement for supply to Yackandandah was also increased to by 31.3 ML in 2012–13 to formally recognise water entitlements purchased by the water corporation in 2005 and 2006 to supplement supplies to the town.

Multiple bulk entitlements held by Goulburn Valley Water and Coliban Water for supply to towns in the Goulburn system were consolidated into two bulk entitlements 2012–13. The new bulk entitlements cover the same town supplies, delivery locations and total entitlement volume as the original bulk entitlements. The change improves administrative efficiency for allocating town supplies.

However, the difference in bulk entitlement volumes to 2011–12 is mostly attributed to change in the way the total volume of water defined in bulk entitlements in each basin has been determined. Additional environmental entitlements were removed from the total as they are not considered to be consumptive entitlements.

The volume of water taken under bulk entitlements in 2012–13 was 65% of the total volume of bulk entitlements, and the volume of water taken under licences was 36% of the total volume of licences.

Not all small catchment dams are required to be licensed or registered under the Water Act (i.e. farm dams for domestic and stock use). The total entitlement volume is assumed to be equal to the estimate of total water taken by small catchment dams for the year.

Table 3-3 Volume allocated and taken under surface water entitlements in 2012–13

Basin	Bulk entitlements[1]			Licences[2]			Small catchment dams
	Entitlement volume (ML)	Volume taken (ML)	Proportion of entitlement volume taken (%)	Entitlement volume (ML)	Volume taken (ML)	Proportion of entitlement taken (%)	Volume taken (ML)
Murray	1,934,434	1,599,011	83%	17,141	1,578	9%	6,445
Kiewa	1,106	598	54%	15,814	6,124	39%	3,927
Ovens	50,241	12,459	25%	18,125	7,600	42%	15,888
Broken	25,279	10,753	43%	2,992	1,315	44%	15,738
Goulburn	1,902,244	1,145,792	60%	25,871	11,224	43%	47,513
Campaspe	129,266	41,805	32%	3,333	3,275	98%	28,776
Loddon	123,300	49,336	40%	23,175	16,610	72%	50,037
Avoca	278	97	35%	3,029	35	1%	12,693
Mallee	0	0	n/a	0	0	n/a	0
Wimmera	56,516	16,510	29%	2,582	454	18%	14,337
East Gippsland	622	135	22%	660	137	21%	1,100
Snowy	2,201	725	33%	3,992	732	18%	3,356
Tambo	342	31	9%	4,167	812	19%	3,971
Mitchell	9,208	4,957	54%	16,387	11,493	70%	4,558
Thomson	390,854	246,627	63%	17,244	7,647	44%	6,984
Latrobe	216,842	118,408	55%	19,188	8,320	43%	20,547
South Gippsland	168,815	7,688	5%	12,790	2,832	22%	24,256
Bunyip	36,595	10,033	27%	19,007	4,577	24%	15,525
Yarra	400,000	299,636	75%	42,986	9,137	21%	15,824
Maribyrnong	10,711	1,461	14%	2,098	441	21%	7,782
Werribee	37,617	21,859	58%	1,039	275	26%	9,347
Moorabool	40,600	13,849	34%	3,600	1,276	35%	22,197
Barwon	55,734	33,260	60%	5,639	1,370	24%	30,898
Corangamite	0	0	n/a	1,237	142	11%	12,366
Otway Coast	19,667	13,395	68%	6,740	845	13%	12,728
Hopkins	629	179	28%	11,423	3,484	30%	64,538
Portland Coast	0	0	n/a	1,081	73	7%	16,135
Glenelg	4,554	1,361	30%	1,068	348	33%	55,483
Millicent Coast	0	0	n/a	4	4	100%	0
Total	**5,617,655**	**3,649,963**	**65%**	**282,412**	**102,158**	**36%**	**522,949**

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 trade, caps that are climatically adjusted, or caps that are long-term rolling averages. Bulk entitlements and environmental entitlements held by the Victorian Environmental Water Holder are not included as water taken under these entitlements as they are not considered to be for consumptive purposes.

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

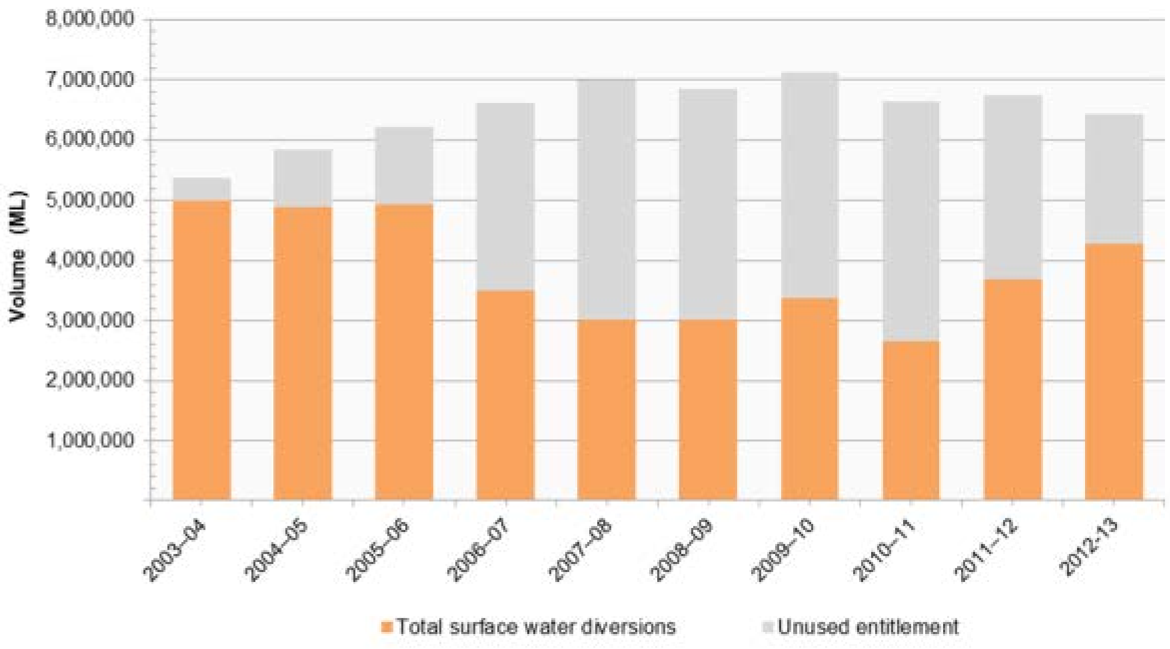
Water for consumptive use

Figure 3-2 shows the volume of water taken under surface water entitlements over the past ten years.

The low water use over the period 2006–07 to 2009–10 is a reflection of the low water availability during the recent 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 streams were widespread. In contrast, the low use seen in 2010–11 and 2011–12 is a reflection of supressed demand for water due to the wet conditions experienced during these years. The proportion of water taken to volume of entitlements was 65% in 2012–13, an increase from 53% in 2011–12.

The total volume of surface water entitlements generally increased over the years 2003–04 to 2009–10 due to continued conversion of water corporations' historic rights into bulk entitlements and the granting of new bulk entitlements and licences.

Figure 3-2 Surface water entitlements and associated diversions



Consumptive entitlements are used for many different purposes, however they can broadly be classified as either:

- irrigation
- domestic and stock
- urban and commercial or
- power generation (which has its own category due to the water-intensive nature of its operations).

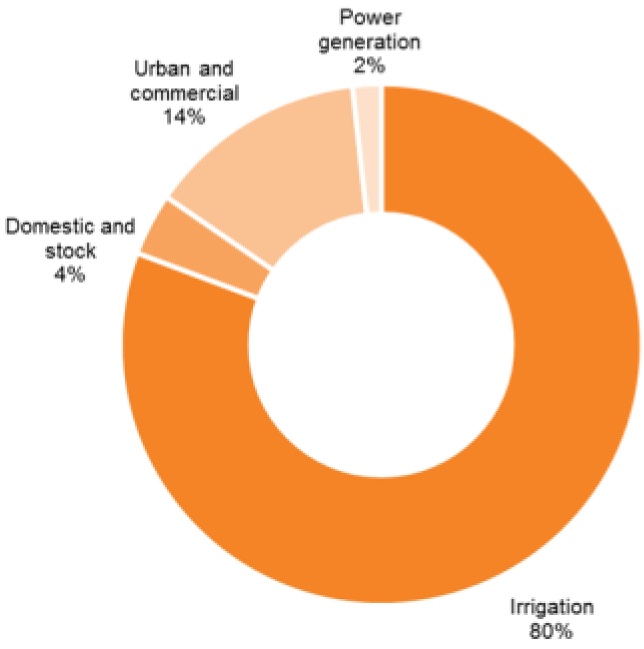
As shown in Table 3-4, the volume of water taken under consumptive entitlements in 2012–13 increased compared to 2011–12. The volume of water diverted for irrigation purposes in 2012–13 was around 720,000 ML greater than the amount diverted in 2011–12. In contrast, the volume of water diverted for urban and commercial purposes was slightly less than in 2011–12. The volume diverted for power generation purposes was similar in 2010–11 and 2011–12.

Irrigation continues to be the highest category of surface water use in the state, comprising 80% of all diversions. This portion increased in 2012–13 compared to 2011–12.

Table 3-4 End use of surface water diverted under consumptive entitlements

Consumptive end use	2012–13		2011–12	
	Volume diverted (ML)	Proportion of total consumptive diversions (%)	Volume diverted (ML)	Proportion of total consumptive diversions (%)
Irrigation	3,467,102	80%	2,746,202	75%
Domestic and stock	166,836	4%	166,752	5%
Urban and commercial	586,316	14%	662,211	18%
Power generation	75,422	2%	86,989	2%
Total	**4,295,676**	**100%**	**3,662,154**	**100%**

Figure 3-3 Total surface water diversions for consumptive purposes in Victoria, 2012–13



3.2 Groundwater entitlements and use

Groundwater in Victoria is managed through Groundwater Management Units (GMUs). There are two types of GMU: Water Supply Protection Areas (WSPAs) and Groundwater Management Areas (GMAs). Areas that do not fall into these units are referred to as unincorporated areas.

- **Groundwater Management Area (GMA)**: an area where groundwater has been intensively developed or has the potential to be. GMA boundaries are defined for the purposes of ongoing management.
- **Water Supply Protection Area (WSPA)**: an area declared under the *Water Act 1989* to protect groundwater or surface water resources through the development of a management plan.
- **Unincorporated area (UA)**: an area where limited development or use of groundwater has occurred. This is usually because the resource is low-yielding, its quality has limited its use, or there is limited information about resource availability. UAs are important for the supply of domestic and stock water.

Full details of water entitlements and use from each GMA and WSPA in 2012–13 are presented in Appendix B.

In 2012–13, total groundwater licensed entitlement was approximately 967,695 ML across the state. The total groundwater use across the state, including domestic and stock use, was approximately 369,569 ML, which was significantly more than the volume used in 2011–12 (316,322 ML).

In 2012–13, the total volume of licensed groundwater extracted from GMAs and WSPAs (not UAs) was approximately 293,538 ML, an increase of 37% compared to 2011–12 (214,633 ML).

Domestic and stock use (55,687 ML) was estimated to account for approximately 15% of total groundwater use (369,569 ML). In Victoria's GMAs, licensed groundwater entitlements totalled 305,069 ML, with total use of 130,678 ML consisting of 114,594 ML of metered extractions and an estimated domestic and stock use in these areas was 16,084 ML.

Licensed groundwater entitlements in WSPAs totalled 542,204 ML, with total use of 195,793 ML consisting of 178,944 ML of metered extractions and an estimated domestic and stock use in these areas was 16,849 ML.

Estimated groundwater entitlements in the unincorporated areas were approximately 120,422 ML, with 43,098 ML extracted. This was lower than 2011–12 when entitlement was approximately 133,257 ML and 64,564 ML was extracted.

The total volume of groundwater extracted for urban use in 2012–13 was 9,409 ML, which was approximately 3% of the total groundwater extracted.

Approximately 72 towns have a groundwater entitlement as either a supplementary or primary water supply. In 2012–13, only 52 of these towns recorded any extraction. The largest of these was Sale with extraction of 1,924 ML.

Figure 3-4 shows the location of towns where groundwater is used for urban water supply.

Figure 3-4 Location of towns where groundwater is extracted for urban supply

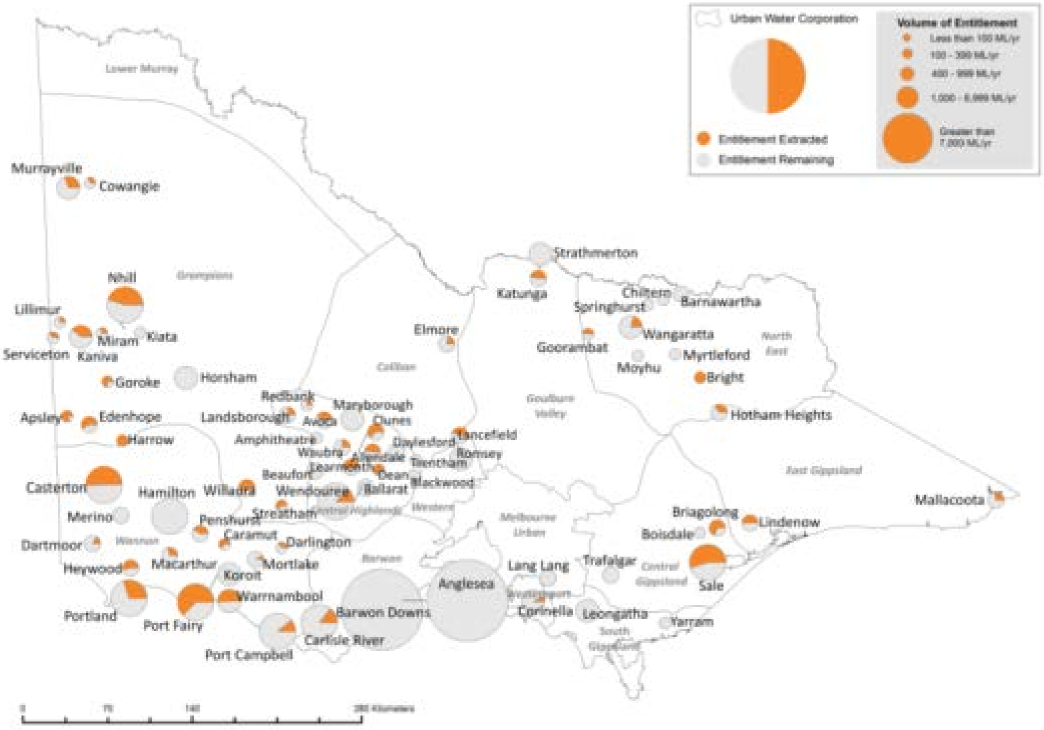
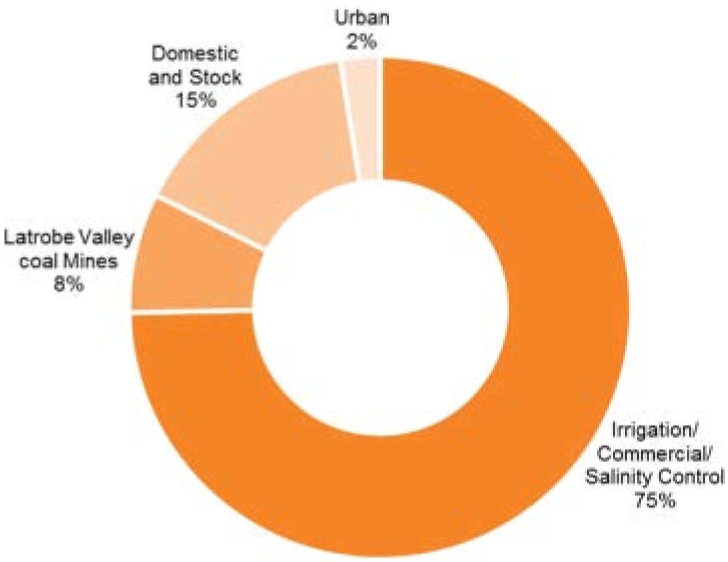


Table 3-5 and Figure 3-5 show the groundwater extraction by type of use in GMUs in 2012–13.

Table 3-5 Groundwater extraction by use in GMUs

Consumptive end use	Volume diverted (ML)	Proportion of total consumptive diversions (%)
Irrigation/commercial/salinity control	275,964	75
Domestic and stock	55,687	15
Urban	9,409	2
Power generation	28,510	8
Total consumptive diversions 2012–13	**369,570**	**100**
Total consumptive diversions 2011–12	316,322	100

Figure 3-5 Groundwater extraction by use in GMUs



3.3 Recycled water production

The total volume of 450,355 ML of wastewater produced in 2012–13 was lower than the 473,602 ML produced in 2011–12 (Table 3-6). The volume of water recycled by Victoria's water businesses for use external to treatment plants in 2012–13 increased compared to 2011–12. The recycled volume was 70,696 ML, which represents an increase of 3,566 ML compared to 2011–12. The volume recycled represents 16% of the total volume available for reuse at the end of the wastewater treatment process. An additional 20,631 ML was recycled for use within the wastewater treatment process which, when subtracted from the total, increases the proportion to 20% of wastewater available for reuse. The volumes and percentages used in the following paragraphs only refer to recycled water supplied for use external to the treatment plants.

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. In 2012–13, the volume of water recycled by the Eastern Treatment Plant was 21,352 ML, which was an increase on the 18,139 ML recycled in 2011–12. Under the Eastern Irrigation Scheme, Melbourne Water sells Class C recycled water to private sector operator TopAq, which further treats the water to Class A standard and delivers the water to horticultural, recreational and industrial users. The volume of water recycled by the Western Treatment Plant decreased from 30,617 ML in 2011–12 to 26,865 ML in 2012–13. This decrease is attributable largely to a reduction in the volume used in agriculture from 13,988 ML in 2011–12 to 8,438 ML in 2012–13.

The volume of water recycled in Melbourne, including at treatment plants operated by the Melbourne metropolitan retailers, was 37,490 ML or 11%. The percentage of recycled water was higher outside of 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 28%, or 33,206 ML, of the wastewater available for reuse. This was higher than in 2011–12, when it was 29,953 ML.

Table 3-6 Volume of wastewater recycled in 2012–13

Basin	Wastewater produced (ML)	Volume of wastewater recycled (ML)	Percentage of wastewater recycled (%)	End uses of recycled water					Volume discharged to the environment (ML)	Release to ocean/ Other[3] (ML)
				To retailers	Urban and industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Murray	10,295	4,470	43%	0	388	4,083	0	0	3,313	2,512
Kiewa	309	125	40%	0	0	125	0	0	184	0
Ovens	1,896	643	34%	0	92	551	0	0	1,253	0
Broken	341	341	100%	0	0	341	0	0	0	0
Goulburn	8,330	6,538	78%	0	291	6,247	0	0	1,792	0
Campaspe	2,147	1,572	73%	0	288	1,283	0	1	577	(2)
Loddon	7,746	2,776	36%	0	1,132	1,643	0	0	4,470	501
Avoca	158	224	142%	0	59	165	0	0	0	(66)
Mallee	0	0	0%	0	0	0	0	0	0	0
Wimmera	1,678	1,680	100%	0	482	1,198	0	0	0	(2)
East Gippsland	162	137	85%	0	0	137	0	0	25	0
Snowy	326	326	100%	0	0	326	0	0	0	0
Tambo	1,031	1,031	100%	0	0	1,031	0	0	0	0
Mitchell	1,387	1,387	100%	0	0	185	1,202	0	0	0
Thomson	508	292	57%	0	4	288	0	0	216	0
Latrobe	23,557	1,283	5%	0	700	28	555	0	4,120	18,154
South Gippsland	5,337	416	8%	0	73	331	0	12	4,994	(74)
Bunyip	158,399	24,524	6%	6,973	1,798	607	0	15,146	8,524	125,351
Yarra	10,447	2,687	9%	0	453	449	0	1,785	0	7,760
Maribyrnong	3,206	1,572	26%	0	335	499	0	739	2,121	(487)
Werribee	168,849	31,017	18%	2,643	1,049	11,124	15,784	417	4,507	133,325
Moorabool	204	204	100%	0	204	0	0	0	0	0

Basin	Wastewater produced (ML)	Volume of wastewater recycled (ML)	Percentage of wastewater recycled (%)	End uses of recycled water					Volume discharged to the environment (ML)	Release to ocean/ Other[3] (ML)
				To retailers	Urban and industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Barwon	31,873	5,843	11%	0	1,109	1,823	564	2,348	26,975	(945)
Corangamite	2,048	464	20%	0	15	392	0	58	1,691	(108)
Otway Coast	1,322	281	12%	0	0	163	0	118	991	50
Hopkins	5,470	672	12%	0	204	461	0	7	91	4,707
Portland Coast	2,412	158	7%	0	0	158	0	0	177	2,077
Glenelg	880	653	74%	0	153	500	0	0	295	(68)
Millicent Coast	37	11	30%	0	11	0	0	0	0	26
Total 2012–13	**450,355**	**91,327**	**16%**	**9,616**	**8,839**	**34,137**	**18,104**	**20,631**	**66,316**	**292,712**
Total 2011–12	**473,602**	**86,934**	**14%**	**3,969**	**6,798**	**37,618**	**18,745**	**19,804**	**87,560**	**299,108**

Notes:

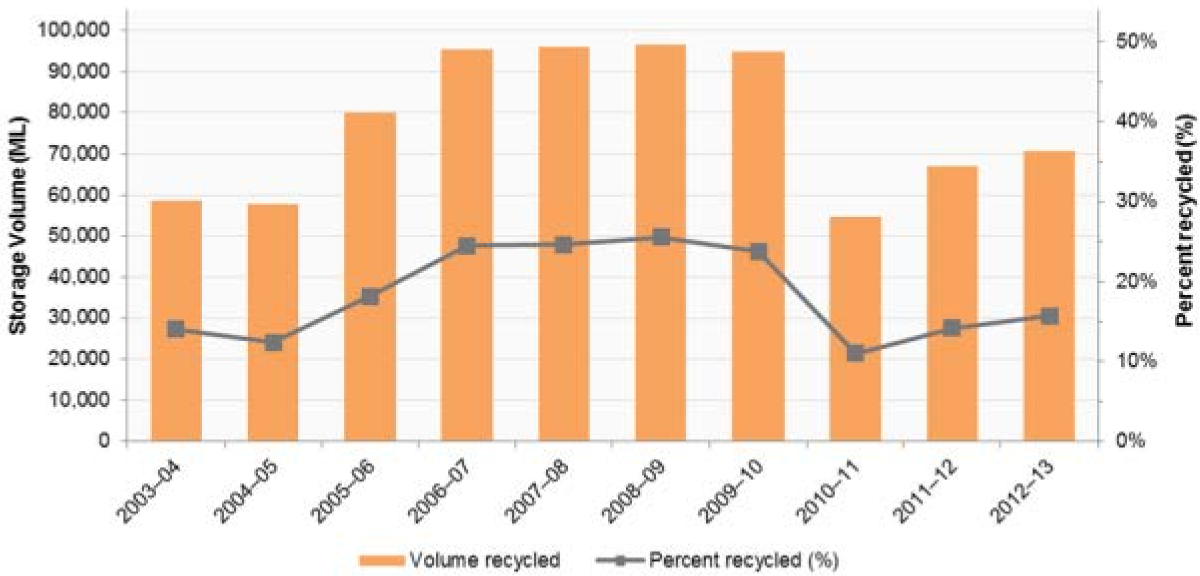
(1) Volume used to deliver specific environmental flow benefits.

(2) Water reused in wastewater treatment processes, for example backflushing of filters. This value is not included in the total percentage recycled.

(3) 'Other' refers to a change in on-site effluent storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

Figure 3-6 shows the trend in recycled water over the ten years to 2012–13. In 2003–04 and 2004–05, the volume recycled was slightly less than 60,000 ML. In the next two years, as demand for recycled water increased due to the drought and more recycling schemes came online, the volume of water recycled grew substantially, as did the percentage recycled. The volume and percentage recycled in 2011–12 and 2012–13 were less than in recent years, due to reduced demand for recycled water as a result of higher rainfall.

Figure 3-6 Recycled water volume and percentage, 2003–04 to 2012–13[1]



Note:

(1) This figure excludes recycled water used 'within process'.

3.4 Urban and commercial consumptive use

Consumption in urban areas is often measured by the metered volume of water delivered to customers. This figure differs from the bulk water diversion figures presented 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 discussed below are less than the urban diversion volumes in Table 3-4 and Figure 3-3. Detailed information about urban distribution systems can be found in Chapter 8.

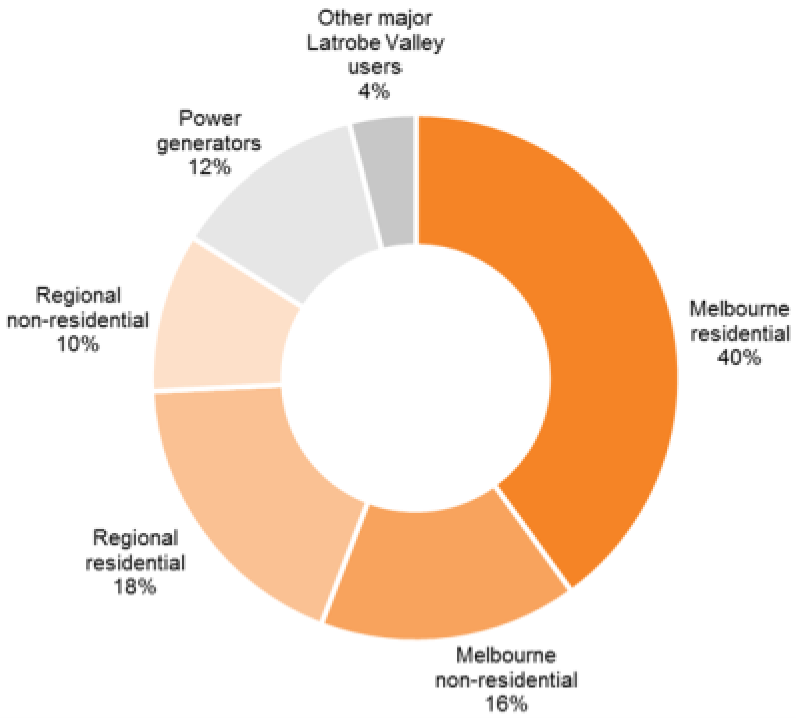
Metered urban water consumption in Victoria increased in 2012–13 compared to 2011–12. Total urban water consumption by residential users increased by 10% compared to 2011–12, and non-residential use increased by 9%

in 2012–13 compared to 2011–12. The largest increase was in regional Victoria, with regional residential customers increasing their water consumption by 14%. The 2012–13 data in Table 3-7 is represented as a pie chart in Figure 3-7.

Table 3-7 Urban metered water consumption in Victoria

Urban consumption category	2012–13 (ML)	2011–12 (ML)	Change (%)
Melbourne – residential	251,517	229,386	10%
Melbourne – non-residential	99,566	91,529	9%
Regional – residential	115,757	101,832	14%
Regional – non-residential	61,474	57,904	6%
Power generators	75,422	86,989	-13%
Other major Latrobe Valley industrial users	25,375	24,265	5%
Total urban consumption	**629,111**	**591,905**	**6%**

Figure 3-7 Consumptive uses of urban and commercial metered water in Victoria, 2012–13



4 Water for the environment

The Environmental Water Reserve (EWR) is water set aside through Victoria's water allocation framework to provide environmental benefits. The EWR is managed to preserve the environmental values and health of water ecosystems, including their biodiversity, ecological function and quality of water. Water in the EWR is provided in three ways:

- **Environmental water entitlements**: volumes of water held by the environmental water holders in perpetuity. In general, they are a share of the available resource in storages that can be released to meet specific environmental needs. They are the component of the EWR that can be actively managed.
- **Obligations on consumptive entitlements**: the volumes of water which water corporations or licensed diverters are obliged to provide out of storages or past diversion points (as passing flows) before water can be taken for consumptive use.
- **'Above cap' water**: the water available above the total volume allocated for consumptive use.

In regulated systems, where the flow of a river is regulated through the operation of dams or weirs, water for the environment is provided through environmental entitlements to water held in storages and by requiring water corporations to pass flows at dams, weirs and other extraction points under conditions placed on their bulk entitlements. More information on environmental water in regulated systems is provided in section 4.2.

In unregulated rivers, the EWR is provided primarily through management of licensed diversions, including licence conditions, rostering and restriction rules, and caps on licensed volume. In groundwater systems, the EWR is provided by limiting the volume of groundwater that can be extracted for consumptive use. More information on environmental water in unregulated rivers and groundwater systems is provided in section 4.3.

4.1 Overview of environmental water and seasonal conditions

The Victorian Environmental Water Holder (VEWH) is the independent statutory body responsible for deciding the most efficient and effective use of environmental water entitlements across the state. Information on the VEWH's planning processes for the use of the environmental water holdings and the outcomes of environmental watering undertaken in 2012–13 is available in the VEWH's annual report and annual watering booklet, available at **www.vewh.vic.gov.au.**

At the national level, the Commonwealth Environmental Water Holder (CEWH) was established under the Commonwealth *Water Act 2007* to recover water for the environment through water purchase and infrastructure investment throughout the Murray–Darling basin. Delivery of Commonwealth environmental water in Victoria is managed by the VEWH in partnership with the CEWH and catchment management authorities. To facilitate the use of Commonwealth water in Victorian rivers and wetlands, water is traded into Victorian environmental entitlements.

During 2012–13, winter rainfall in Victoria was close to long-term averages for most regions, while spring, summer and autumn had below-average rainfall. The relative accessibility of water in 2012–13 meant that, for the second year in a row, some environmental water was made available for trade. The VEWH sold a total of 14,000 ML from the Murray system in small parcels. Some of the proceeds from this trade were used to purchase 860 ML of water allocation in the Werribee system where there was a supply shortfall. The remaining revenue was held for future purchase of water in the event of shortfalls. If required, the money may also be used to improve water delivery, for example funding minor structural works to improve water use efficiency.

Of the 122 potential priority watering actions identified in the *Seasonal Watering Plan for 2012–13*, some 111 (91%) were fully or partially achieved through natural river flows, river operations, or as a direct result of managed environmental releases. The VEWH oversaw the delivery of more than 437,000 ML of water to 46 river reaches and 17 wetlands, providing significant benefit to a wide range of water-dependent plants and animals. The remainder, 382,564 ML of water, was carried over to 2013-14, providing a good start for early season watering actions in the following year.

In 2012–13, there was no change to the formal water management plans in effect in Victoria. Eight Stream Flow Management Plans are in place in the Yarra basin, and an integrated water management plan is in place in the Ovens basin. Local management plans have been recommended across most other basins (see section 4.3).

The below-average rainfall and lower river flows experienced across much of the state in 2012–13 meant that the total volume of water leaving Victoria's river basins was lower than the previous year (17,058 GL, compared to 26,668 GL in 2011–12). However, as a percentage of total inflow volume, the water reaching the basin outlets was similar, with 80% reaching the basin outlets in 2012–13 compared to 82% in 2011–12 (see section 4.5).

4.2 Environmental water in regulated systems

During 2012–13, water held by the VEWH increased from a long-term average of 590,300 ML to 630,800 ML. This increase was due to the creation of a new environmental entitlement (bringing the total to 21) and amendments to three more entitlements. Further Increases in long-term average water availability was driven by increases in the Northern Victoria Irrigation Renewal Program (NVIRP) Stage 1 environmental entitlement volumes in the Murray and

Goulburn systems. In total, 765,135 ML of water was available to the VEWH in 2012–13, including 251,466 ML made available from the CEWH.

4.2.1 Environmental water holdings in southern Victoria

There are currently eight environmental entitlements within southern Victoria (Table 4-1).

Under the environmental entitlements for the Werribee, Moorabool, Yarra, Thomson, Tarago and Bunyip rivers, a share of inflows to major storages on these rivers is available for environmental watering.

The entitlement for the Macalister River is specified as being equivalent to the high reliability and low reliability water shares in the Macalister system; water is allocated to the entitlement under the seasonal determination process for entitlements and water shares.

The *Barwon River Environmental Entitlement 2011* and the *Latrobe River Environmental Entitlement 2011* provide for unregulated flows to be diverted to floodplain wetlands. Use of these entitlements is dependent upon suitable river heights, as specified in the entitlements. Use of water under unregulated flow entitlements is difficult to quantify due to infrastructure and metering limitations. Substantial inflows into these wetlands also occur through overbank flows and catchment runoff. As such, no volumes have been reported for these entitlements in Table 4-1 below.

Table 4-1 Environmental entitlements in southern Victoria 2012–13 (ML)

Basin	Entitlement type	Entitlement volume at 30 June 2012	Allocation carried over from 2011–12	Allocation 2012–13	Share of available water 2012–13	Total water available 2012–13	Water use 2012–13	Carried over to 2013–14
			A	B	C	D = A + B + C	E	D – E
Latrobe	***Latrobe River Environmental Entitlement 2011***							
	Unregulated	–	-	-	-	-	-	-
Thomson	***Bulk Entitlement (Thomson River – Environment) Order 2005***							
	High reliability	10,000	749	10,000	-	10,749	10,936	-187
	Macalister River Environmental Entitlement 2010							
	High reliability	12,461	0	12,461	-	12,461	9,565	2,896
	Low reliability	6,230	0	1,246	-	1,246	1,246	1,246
Yarra	***Yarra River Environmental Entitlement 2006***[1]							
	High reliability	17,000	30,554	17,000	-	47,554	12,589	34,965
Bunyip	***Tarago and Bunyip Rivers Environmental Entitlement 2009***							
	Per cent share of inflows	10.9%	-[2]	-	3,000	3,000	2,176	1,808
Werribee	***Werribee River Environmental Entitlement 2011***							
	Per cent share of inflows	10%	-[2]	-	3,218	3,218	2,149	869
Barwon	***Barwon River Environmental Entitlement 2011***							
	Unregulated	–	-	-	-	-	-	-
Moorabool	***Moorabool River Environmental Entitlement 2010***							
	Per cent share of inflows	11.9%	5,126	-	1,696	6,822	2,399	4,423
Total			**36,429**	**40,707**	**7,914**	**85,050**	**41,060**	**46,020**

Notes:

(1) In addition to the volumetric entitlement, the entitlement also consists of access to up to 55 ML per annum in the Yarra River downstream of the confluence with Olinda Creek.

(2) Unused water available to carry over in this system is not calculated as available water minus used water, due to the allocation rules of these entitlements.

4.2.2 Environmental water holdings in western Victoria

Within western Victoria, one environmental entitlement supplies both the Wimmera and Glenelg rivers and wetlands connected to the Wimmera–Mallee pipeline. The entitlement is for water held in the Grampians headworks system, a highly connected system that harvests water from both the Glenelg and Wimmera basins.

Table 4-2 Environmental entitlements in western Victoria 2012–13 (ML)

Basin	Entitlement type	Entitlement volume at 30 June 2012	Allocation carried over from 2011–12(1)	Allocation 2012–13(2)	Total water available 2012–13	Water use 2012–13	Carried over to 2013–14
			A	B	C = A + B	D	C – D
Wimmera and Glenelg	*Wimmera Glenelg Rivers Environmental Entitlement 2010*						
	High reliability	41,560	43,217	39,079	82,296	50,277	32,019
Total			**43,217**	**39,079**	**82,296**	**50,277**	**32,019**

Notes:

(1) When spare capacity is available in certain storages, bulk and environmental entitlement holders and other bulk entitlement holders in the Grampians headworks system are able to carry over any unused allocations and hold carryover volumes greater than their entitlement volumes. This carryover is held in the spillable water account. If system storages physically spill, the volume of carryover lost to spill is deducted from the spillable water account.

(2) Water allocation under the *Wimmera Glenelg Rivers Environmental Entitlement* in 2012–13 includes a once-off repayment of 5,532 ML in accordance with the provisions of the entitlement.

4.2.3 Environmental water holdings in northern Victoria

In northern Victoria, the Murray, Goulburn, Campaspe and Loddon basins have environmental entitlements.

In 2012–13, use of environmental water recovered in the Campaspe was facilitated through an allocation bank account and water use registration until an environmental entitlement could be granted at the end of the period.

During 2012–13, the allocation of savings and mitigation water associated with Stage 1 of the Goulburn–Murray Water Connections Project was made under supply agreements with Goulburn–Murray Water. While the Goulburn–Murray Water Connections Project is active, the actual volume available to the environment each year is determined and allocated after an audit of water savings in July.

The VEWH holds environmental entitlements and water shares in the Murray, Goulburn and Loddon rivers in trust to provide improved environmental flows for the Snowy River. The water available and used for this purpose is detailed in Table 4-3, and more information on Snowy River increased flows is provided in section 4.2.4.

Table 4-3 Environmental entitlements in northern Victoria 2012–13 (ML)

Basin	Entitlement type	Entitlement volume at 30 June 2012	Allocation carried over from 2011–12	Carryover lost to spill[1]	Allocation 2012–13	Return flow re-credit[2]	Net transfers[3]	Net allocation trade VEWH[4]	Total water available 2012–13	Water use 2012–13	Carried over to 2013–14
			A	B	C	D	E	F	G = A – B + C + D + E + F	H	I = G – H
Murray	***Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999[5][6]***										
	High reliability	27,600	26,303	863	27,600	240,223	-244,893	-14,000	34,369	7,037	27,332
	Unregulated	40,000	0	0	6,346	0	0	0	6,346	6,346	n/a
	Environmental Entitlement (River Murray – NVIRP Stage 1) 2012[7]										
	-	5,711	1,521	0	9,260	0	46,134	0	56,915	28,195	28,720
	Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999 – Barmah–Millewa Environmental Water Allocation										
	High reliability	50,000	31,000	-	50,000	-	-	-	106,000	-	106,000
	Low reliability	25,000			25,000						
	Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999 – Living Murray										
	High reliability	5,710	1,510	50	5710	0	1,490	0	8,660	2,950	5,710
	Low reliability	101,850	0	0	0	50,778	-50,778	0	0	0	0
	Unregulated	34,300	0	0	5,452	0	0	0	5,452	5,452	0
	Bulk Entitlement (River Murray – Snowy Environmental Reserve) Conversion Order 2004										
	High reliability	29,794	0	0	29,794	0	-29,794	0	0	n/a	0
	Water shares – Snowy River Environmental Reserve										
	High reliability	11,392	0	0	13,996	0	-13,996	0	0	n/a	0
	Low reliability	6,415	0	0	0	0	0	0	0	n/a	0
Goulburn	***Environmental Entitlement (Goulburn System – NVIRP Stage 1) 2012[5]***										
	-	23,535	9,725	0	18,722	0	218,157	0	246,605	219,302	27,302
	Goulburn River Environmental Entitlement 2010										
	High reliability	1,432	996	543	1,432	0	0	0	1,886	1,886	0
	Environmental Entitlement (Goulburn System – Living Murray) 2007										
	High reliability	39,625	732	290	39,625	0	22,242	0	62,309	31,228	31,081
	Low reliability	156,980	32,321	9,781	0	0	12,356	0	34,896	19,116	15,780
	Bulk Entitlement (Snowy – Environment) Order 2005										
	High reliability	30,252	0	0	30,252	0	-30,252	0	0	n/a	0
	Low reliability	8,156	0	0	0	0	0	0	0	n/a	0
	Water shares – Snowy River Environmental Reserve										
	High reliability	6,401	0	0	7,853	0	-7,853	0	0	n/a	0
	Low reliability	17,852	0	0	0	0	0	0	0	n/a	0
Campaspe	**Campaspe Water Use Registration[8]**										
	-	n/a	0	0	8,020	0	6,821	0	14,841	13,481	n/a
	Environmental Entitlement (Campaspe River – Living Murray Initiative) 2005										
	High reliability	126	1	0	126	0	0	0	126	0	126
	Low reliability	5,048	0	0	5,048	0	0	0	5,048	3,406	1,642
Loddon	***Bulk Entitlement (Loddon River – Environmental Reserve) Order 2005***										
	High reliability	2,000	2,000	2,000	2,000	0	0	0	2,000	0	2,000
	Trigger based	7,490	2,101	0	7,490	0	0	0	9,591	4,759	4,831
	Low reliability	2,024	0	0	0	0	2,746	0	2,746	2,746	0
	Water shares – Snowy River Environmental Reserve										
	High reliability	470	0	0	470	0	-470	0	0	n/a	0
	Environmental Entitlement (Birch Creek – Bullarook System) 2009										
	High reliability	100	51	51	0	0	0	0	0	0	0
Total		**639,263**	**108,260**	**13,578**	**294,197**	**291,001**	**-68,091**	**-14,000**	**597,789**	**345,904**	**250,525**

Notes:

(1) When spare capacity is available in certain systems in northern Victoria, entitlement holders are able to carry over unused water above their entitlement volume. If system storages spill, some or all of that carryover may be deemed to be 'lost' through that spill.

(2) Return flows provisions in entitlements allow environmental water to be delivered to achieve outcomes in multiple systems. For example, these rules allow water to be delivered through the Goulburn or Campaspe systems and then be re-credited for delivery in the Murray system (minus losses) to meet the environmental objectives in downstream sites such as the Lower Lakes in South Australia.

(3) Administrative transfers between allocation bank accounts are required to facilitate the use of water across river and wetland systems, and to enable the use of water made available by CEWH and the Living Murray program in Victoria. A positive transfer value indicates there has been a net transfer of allocation into the specified entitlement. A negative value indicates a net transfer of allocation out of the specified entitlement. Net transfers by the VEWH represent transfers of water to the Snowy River entitlements and transfers of water to South Australia to facilitate delivery to the Murray River.

(4) Negative net trades indicate net sale of water allocation, while positive net trades indicate net purchase of water allocation.

(5) Volume carried over to 2013-14 includes some Living Murray water carried over in a VEWH account.

(6) Volume of allocation carried over from 2011–12 includes 427.5 ML of CEWH carryover.

(7) Total entitlement volume and allocation includes mitigation water allocated for the purposes of water specific environmental sites that have been identified through Goulburn–Murray Water Connection Project environmental approvals process.

(8) Use of environmental water recovered in the Campaspe under the Goulburn–Murray Water Connections Project in 2012–13 was facilitated through an allocation bank account and water use registration until an environmental entitlement could be granted at the end of 2012–13

4.2.4 Snowy River increased flows

Victoria continues to meet its obligations to provide improved environmental flows in the Snowy River. Allocation to water entitlements held in trust for the Snowy River is traded out of VEWH environmental accounts to supply consumptive users who would otherwise have been supplied through water diverted from the Snowy system. By reducing the demand to supply consumptive users from the Snowy system, this water can be used to maximise environmental flows in both the Snowy and Murray rivers.

Under the Snowy Water Inquiry Outcomes Implementation Deed, increased flows to the rivers each year are derived from allocations against entitlements in the preceding year. In practice, to provide adequate notice for the planning of releases, the volume for release in the coming year is derived from allocations as at 15 January, and also includes any late-season improvement to allocations from the previous year. Water is apportioned for release from the Snowy system on the basis of one-third to the Murray River and two-thirds to the Snowy River (until the Murray River reaches a maximum of 70,000 ML, after which all remaining water is apportioned to the Snowy River).

The information on the Snowy River entitlements in Table 4-4 was sourced from the New South Wales Office of Water.

Table 4-4 Snowy River entitlements 2012–13 (ML)

Entitlement source	Entitlement at 1 March 2013 (ML)	Volume available for release in 2012–13 (ML)
Victoria(1)	115,504	65,822
New South Wales(2)	169,238	158,402
Total	**284,742**	**224,224**
Volume apportioned to Snowy River increased flows		*154,224*
Volume apportioned to Murray River increased flows		*70,000*

Notes:

(1) Primarily high reliability entitlements.

(2) Primarily high security entitlements.

4.3 Environmental water in unregulated systems

In priority unregulated systems that are flow-stressed in summer, formal management plans may be developed. These plans are used to set out arrangements for sustainably managing available water resources in an unregulated system to balance the needs of all users, including the environment. The types of management plans are:

- **Stream Flow Management Plans** – statutory plans for managing water resources of priority unregulated waterways that are under stress, or where there is a demand for more development.
- **integrated water management plans** – recognise the connections between groundwater and surface water in systems with highly-connected groundwater and surface water.
- **local management plans** – capture and formalise existing rules in unregulated systems where there are no statutory management plans.

A precursor to the establishment of a statutory water management plan is the declaration by the Minister for Water of a Water Supply Protection Area (WSPA) under section 27 of the *Water Act 1989*. A WSPA protects the area's water resources through the development of a statutory management plan that aims for equitable management and long-term sustainability of the resource. No surface water WSPAs were declared in 2012–13.

Stream Flow Management Plans (SFMPs) determine how river water will be shared between consumptive users and the environment in declared surface water WSPAs in unregulated systems.

In 2012–13, eight SFMPs were in effect in Victoria, all within the Yarra basin. In addition, one integrated management plan is in effect in the Upper Ovens River where there is a high degree of connectivity between groundwater and surface water. Table 4-5 lists each basin where SFMPs are in place and gives the status of each plan as reported by rural water corporations. No additional SFMPs are planned. Twenty-one priority systems were initially identified in 2004 for development of SFMPs. Since then, technical studies and resource appraisals have been completed, resulting in a reassessment of priorities throughout Victoria. These reassessments have occurred through the development of sustainable water strategies. Where SFMPs would have been developed, local management plans will be used instead. Local management 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.

As stated in the Northern Region Sustainable Water Strategy (released in November 2009), SFMPs are no longer being developed for the Kiewa River, King Parrot Creek, Yea River and Seven Creeks. Instead local management rules have been prepared for these systems.

Compliance with each approved SFMP is reported annually by the relevant water corporation to the Minister for Water and the relevant catchment management authority. Melbourne Water Corporation is responsible for the management and implementation of the eight SFMPs that are in effect, hence information regarding its compliance with the SFMPs is available from its 2012–13 annual report. In addition, annual reports for each of the SFMPs are posted on the Melbourne Water website.

Goulburn–Murray Water is responsible for the management and implementation of the Upper Ovens River Water Management Plan (WMP). Information regarding compliance with the plan is reported in the Upper Ovens River WMP annual report, which is available on the Goulburn–Murray Water website.

Table 4-5 Status of Stream Flow Management Plans and integrated water management plans

Basin	Stream(s)	Work undertaken in 2012–13
Kiewa	Kiewa River	Local management plan in place as recommended under the Northern Region Sustainable Water Strategy
Ovens	Ovens River above Myrtleford	Integrated water management plan approved and operational
Goulburn	King Parrot Creek, Yea River, Seven Creeks	Local management plan in place as recommended under the Northern Region Sustainable Water Strategy
Thomson	Avon River	Reviewed under the Gippsland Region Sustainable Water Strategy: a local management plan is to be prepared in 2014
Latrobe	Latrobe River (upper)	Reviewed under the Gippsland Region Sustainable Water Strategy: a local management plan was recommended
South Gippsland	Tarra River	Reviewed under the Gippsland Region Sustainable Water Strategy: a local management plan was recommended
Yarra	Diamond Creek, Hoddles Creek, Plenty River, Pauls / Steels / Dixons creeks, Olinda Creek, Stringybark Creek, Woori Yallock Creek and Little Yarra and Don Rivers	All Stream Flow Management Plans approved and operational.
Maribyrnong	Upper Maribyrnong River (Deep Creek)	Continuing work.
Barwon	Barwon River main stem and tributaries to the south including Leigh River	Continuing work.
Otway Coast	Gellibrand River	Reviewed under the Western Region Sustainable Water Strategy: a local management plan was recommended.
Hopkins	Merri River	Reviewed under the Western Region Sustainable Water Strategy: a local management plan was recommended.
Wimmera	Upper Wimmera River	Reviewed under the Western Region Sustainable Water Strategy: a local management plan was recommended.

4.4 Compliance with passing flow requirements

Each water business is required to report on whether it has complied with its obligations to pass flows at dams, weirs and other extraction points specified in bulk entitlements and environmental entitlements.

No major breach of passing flow compliance was reported by water corporations in 2012–13.

4.5 Proportion of total streamflow that reaches basin outlets

Figure 4-1 compares the total flows throughout the state with the total volume leaving the state's basins since 2003–04. Table 4-6 shows 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. This is expressed as a proportion of the annual flow of water that would have left the basin if there were no diversions.

Given the highly variable and seasonal nature of flows in Victorian rivers and the complex demands made of them by water diversions for consumption, the proportion of annual flow of water leaving a basin (i.e. the proportion of annual flow not diverted for consumption) is not in itself a reliable indicator of river health or other environmental benefits. While this water is likely to have environmental benefits, it is not the entirety of water protected under the EWR. It also includes water not used under consumptive entitlements and, in some cases, water traded out of a system.

In 2012–13, the proportion of total flow leaving the basin decreased in most basins when compared to the previous year (Table 4-6). The basins that experienced the lowest proportions of water leaving the basin as a percentage of total flow in 2012–13 were the Campaspe (49%), Wimmera (40%), Loddon (30%) and Avoca (0%) basins. The proportion of annual flow leaving the basin was above 90% in 11 basins, predominantly in the south of the state, compared to 13 basins in 2011–12. The Snowy and East Gippsland basins recorded the highest proportion of total flow leaving the basin in 2012–13; consumptive use in these basins is generally very low compared to water availability, and almost all inflows are passed to Bass Strait.

Across Victoria as a whole, the total volume of water leaving the river basins in 2012–13 was 17,058 GL compared to 26,668 GL in 2011–12 (Figure 4-1), which reflected the substantially lower basin inflows. However, as a percentage of total flow, the proportion of water that reached the basin outlets was similar to the previous year, with 80% in 2012–13 compared to 82% in 2011–12 (Table 4-6).

Figure 4-1 Volume leaving Victorian surface water basins, as proportion of total flow, 2003–04 to 2012–13

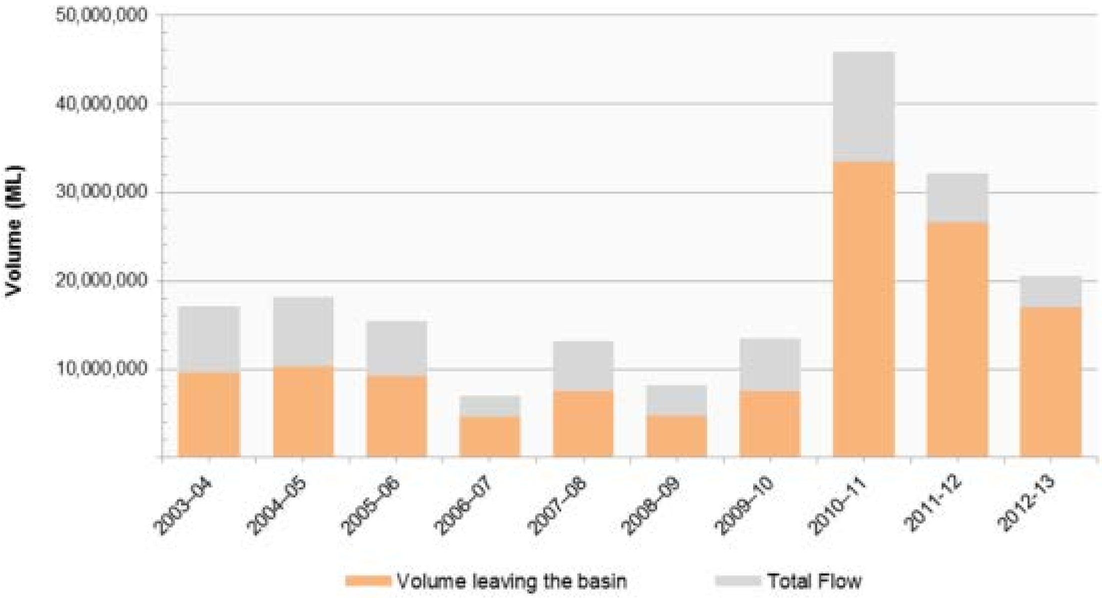


Table 4-6 Volume leaving Victorian surface water basins 2012–13

Basin	Outflow to	2012–13			2011–12		
		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	6,143,993	4,015,600	65%	9,195,297	5,521,400	60%
Kiewa(2)	Murray River	612,663	560,841	92%	850,533	791,718	93%
Ovens	Murray River	1,234,059	1,181,616	96%	1,747,302	1,700,280	97%
Broken	Murray River	201,296	171,518	85%	472,217	421,384	89%
Goulburn	Murray River	2,530,962	1,723,620	68%	3,187,532	1,889,211	59%
Campaspe	Murray River	165,079	81,278	49%	155,699	91,165	59%
Loddon	Murray River	194,784	59,020	30%	195,230	73,607	38%
Avoca(3)	Lake Bael Bael and the Marshes	23,942	28	0%	26,975	586	2%
Mallee(4)	Murray River	n/a	n/a	n/a	n/a	n/a	n/a
Wimmera(3)	Lakes Hindmarsh and Albacutya	71,509	28,834	40%	145,567	47,355	33%
East Gippsland	Bass Strait	953,355	951,942	100%	1,647,803	1,646,426	100%
Snowy (Vic. only)(5)	Bass Strait	1,441,377	1,820,329	126%	2,796,999	3,735,696	134%
Tambo	Gippsland Lakes	309,242	302,443	98%	839,137	832,631	99%
Mitchell	Gippsland Lakes	722,170	699,601	97%	1,264,868	1,250,550	99%
Thomson	Gippsland Lakes	876,174	562,825	64%	1,788,987	1,390,741	78%
Latrobe	Gippsland Lakes	900,762	801,824	89%	1,338,357	1,237,780	92%
South Gippsland	Bass Strait, Western Port	1,017,893	983,554	97%	1,854,567	1,820,697	98%
Bunyip	Bass Strait, Western Port, Port Phillip Bay	641,644	612,847	96%	1,033,964	1,013,685	98%
Yarra(6)	Port Phillip Bay	914,537	650,795	71%	1,200,267	833,073	69%
Maribyrnong	Port Phillip Bay	81,471	63,658	78%	60,885	46,132	76%
Werribee	Port Phillip Bay	79,770	49,963	63%	64,557	26,670	41%
Moorabool	Port Phillip Bay	94,386	50,779	54%	109,037	57,763	53%
Barwon	Port Phillip Bay, Bass Strait	155,726	142,120	91%	191,647	155,376	81%
Corangamite(3)	Corangamite lakes	145,591	128,241	88%	164,247	147,277	90%
Otway Coast	Bass Strait	668,930	639,420	96%	780,800	749,379	96%
Hopkins	Bass Strait	235,182	136,907	58%	303,486	211,246	70%
Portland Coast	Bass Strait	338,902	318,387	94%	437,172	419,224	96%
Glenelg	Bass Strait	426,508	290,509	68%	648,620	557,131	86%
Millicent Coast(4)	South Australia	4	n/a	n/a	4	n/a	n/a
Total		**21,181,913**	**17,028,500**	**80%**	**32,501,756**	**26,668,183**	**82%**

Notes:

(1) This table includes only the Victorian component of Murray basin streamflow and Victoria's contribution to the environment's share of total flow. In this case, the environment's share is taken to be Victoria's contribution to flow at the Victorian-South Australian border.

(2) Includes the NSW share of Kiewa River flows under the Murray–Darling Basin Agreement.

(3) For the purpose of this table, flow leaving the basin is taken as flow entering the terminal lakes.

(4) There are no significant streams in this basin.

(5) The total flow volume relates to the flows from the Victorian tributaries of the Snowy River only. Volume leaving the basin relates to all water flowing from the Snowy River into Bass Strait, which includes water originating from the NSW portion of the Snowy River.

(6) Transfers of water into this basin are not included in the total flow.

5 Water trade

Water trade has long been used as a tool in Victoria to facilitate 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 2012–13 water year, taking into consideration the volume of water traded and the geographical movements of water in those trades.

5.1 Victoria's water trade framework

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 there is entitlement volume trade and change of ownership. 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.

5.1.1 Allocation trade

Allocation trade involves transferring a volume of water allocation from a seller to a buyer. Water allocation is water allocated each season against water entitlements, for example water shares. Water is allocated based on the available resource in any given year. (Discussion about seasonal allocations in 2012–13 can be found in Chapter 2). The allocation made against a water entitlement may be traded separately from the entitlement and from land according to trading rules for declared water systems, which are governed by the Minister. Allocation trade can either occur within a trading zone, between trading zones or in line with the trading rules.

Allocation trade only occurs in declared water systems. In northern Victoria these are the Broken, Bullarook, Campaspe, Goulburn, Loddon, Murray and Ovens systems; and in southern Victoria, the Thomson–Macalister and Werribee systems.

5.1.2 Trade of water shares

Trade of water shares can mean a transfer of ownership, a change of location, or both. In this report trade is taken to mean a change in location, as the purpose of including trade here is to show the movement of water into or out of different water delivery areas in Victoria.

A transfer of ownership occurs when a water share is sold from one person to another. A change of location may occur during a transfer of ownership or following an application to vary or associate a water share. A water share can be associated with a new water use licence without a transfer of ownership; in this situation a change of location occurs without a change of owner. The source of water for a water share cannot change during this transaction, however the point of use can change. For instance, when a water user located in the Murray system purchases a Goulburn water share, the water share source remains in the Goulburn, but it is tagged for use in the Murray. In order to analyse the movement of water shares, the direction of trade must be assessed by considering the point of use rather than the source of the water share as this never changes. In summary, 'movement' can either be considered to occur with:

- a change of ownership (the new owner wishes the water share to be used at a new location), or
- an association or variation of the water share (an existing owner wishes to shift the water share to another location).

In this report, a change of location is presented as the movement of water shares between delivery systems.

5.1.3 Trade of take and use licences

Outside declared water systems, take and use licences can be traded in Victoria. A take and use licence can either be sourced from unregulated surface water systems or from groundwater. Trade of take and use licences can either be an entitlement volume trade or a change of ownership. 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. These generally include a change in location. The other type of transfer is 'change of ownership', which changes the ownership of a licence without affecting its volume and location. Approval of bundled entitlement trades are subject to the constraints of the Water Act, the ministerial policies for managing take and use licences and any approved local management rules or plans.

For the purposes of this chapter, trades of bundled entitlements are presented as either unregulated surface water trades or groundwater trades.

5.2 Overview of trade in 2012–13

In this report, northern Victoria is defined as the area north of the Great Dividing Range falling under the management of Goulburn–Murray Water (G-MW), Lower Murray Water (LMW) and Coliban Water (CW). Southern Victoria includes areas south of the divide under Southern Rural Water (SRW) and Melbourne Water (MW). Western Victoria is the area under Grampians Wimmera Mallee Water (GWMWater).

Total allocation trade in northern Victoria amounted to 2,342 GL in 2012–13, up from 1,604 GL in the previous year. In southern Victoria, allocation trade increased to around 24 GL in 2012–13 from about 8 GL in the previous year.

There was a decrease in water share movement (i.e. transfers of ownership and variations) in northern Victoria falling from 887 GL in 2011–12 to 603 GL in 2012–13. In southern Victoria, the level of water share movement increased from about 17 GL in 2011–12 to 30 GL in 2012–13.

In northern Victoria, the Commonwealth purchased about 31 GL of high reliability water shares in 2012–13, down from 174 GL in 2011–12.

For take and use licences in northern Victoria, there was 28.1 GL of groundwater trade and 5.6 GL of surface water trade. Southern Victoria had 23.6 GL of take and use licence groundwater trade and 16.4 GL of take and use licence surface water trade. Western Victoria had 7.6 GL of trade in groundwater take and use licences and 0.9 GL of surface water trade in various unregulated entitlement types (take and use licences, water allowances and bulk entitlements).

Further information about water trading in Victoria is provided in the *Victorian Water Trading 2012–13 Annual Report*, available at http://waterregister.vic.gov.au.

5.3 Northern Victoria

5.3.1 Allocation trade

Total trade of allocation in northern Victoria amounted to 2,342 GL in 2012–13 (Table 5-2), significantly more than the 1,604 GL traded in 2011–12. The number of trades increased from 5,189 in 2011–12 to 11,330 in 2012–13. The large increase in trading activity likely resulted from a combination of factors, including high allocations and drier conditions with the majority of Victoria experiencing below-average rainfall during the year. Like 2011–12, environmental trades made up a significant portion of the volume traded in 2012–13; 1,008 GL was traded by environmental parties which equates to 43% of the total volume traded. Due to the large influence of environmental trades on the total volume traded, this chapter for the first time separates the volume of water traded by non-environmental parties (Table 5-3Table 5-15) to the amount traded by environmental parties (Table 5-4). For a discussion regarding the assumptions made to distinguish between environmental and non-environmental trading, see the *2012–13 Victorian Water Trading Report*. Table 5-1 provides a summary of the volume traded and number of trades by type in 2012–13.

Table 5-1 Summary of trade of allocation in northern Victoria (ML)

Trade type	Number of trades	Volume (ML)
Environmental allocation trade	126	1,008,646
Non-environmental allocation trade	11,204	1,333,794
Total	**11,330**	**2,342,440**

Victoria continued to be an exporter of water in 2012–13, exporting a net volume of 645 GL in 2012–13, an increase from the previous year when Victoria exported a net volume of 231 GL. This change was largely due to an increase in the volume of environmental allocation trades from Victoria to South Australia (about 533 GL this year compared to 227 GL in 2011–12.

Table 5-2 shows the volume of allocation traded between each trading zone in northern Victoria in 2012–13. In summary:

- Intrazone trade was again highest in 1A Greater Goulburn with about 408 GL total volume traded, of which 237 GL was non-environmental allocation trade.
- Including environmental trades, only one Victorian trading zone, 1A Greater Goulburn, was a net buyer of allocation with net trade in of about 46 GL.
- Excluding environmental trades, only trading zone 1B – Boort was a net buyer of allocation with a net trade in of about 12 GL.
- South Australia was the largest buyer of allocation in 2012–13, with a net purchase of 537 GL. This was dominated by environmental trades of about 532 GL.
- In 2012–13 Victoria sold a net volume of 108 GL, including environmental allocation trades, to New South Wales, up from 51 GL in 2011–12.

Table 5-2 Trade of allocation in northern Victoria (ML)

Trading zone		Buyer																			
		Victoria															NSW	SA			
	Seller	1A Greater Goulburn	1B Boort	2A Broken – Nillahcootie to Caseys Weir	2B Broken – Caseys Weir to Goulburn River	3 Lower Goulburn	4A Campaspe	4C Lower Campaspe	5A Loddon	5B Bullarook	6 Vic Murray – Dartmouth to Barmah	6B Lower Broken Creek	7 Vic Murray – Barmah to SA	9A Ovens	9B King	20 Snowy	NSW	12 South Australian Murray	Total sold	Number of trades	Net sold
Victoria	1A Greater Goulburn	407,981	7,964			3,301	121	124	457		23,017	3,699	105,981			33,228	17,544	8,077	**611,494**	**4,502**	**-45,897**
	1B Boort	30,716	8,513			127	475		20		475		8,426			1,852	13,249	847	**64,700**	**221**	**8,328**
	2A Broken – Nillahcootie to Caseys Weir			88															**88**	**1**	**0**
	2B Broken – Caseys Weir to Goulburn River				123														**123**	**7**	**0**
	3 Lower Goulburn	11,821	100			1,640	550				762	120	2,701			3,025	2,102	1,539	**24,359**	**140**	**17,206**
	4A Campaspe	11,023	2,306			900	18,543				730		9,128				770	1,638	**45,038**	**181**	**24,771**
	4C Lower Campaspe	403					540	9					21						**973**	**14**	**840**
	5A Loddon	1,548	306						5,807		250	48	1,714			470	125	50	**10,318**	**93**	**3,089**
	5B Bullarook									354									**354**	**19**	**0**
	6 Vic Murray – Dartmouth to Barmah	64,603	2,209			120					83,070	1,589	56,366			32,514	16,868	59,448	**316,787**	**1,512**	**146,463**
	6B Lower Broken Creek	6,297	180								8,464	1,994	3,899			81	2,362	3,587	**26,864**	**232**	**18,155**
	7 Vic Murray – Barmah to SA	112,054	28,008			1,065	38		746		43,931	1,260	314,684			11,195	106,601	515,670	**1,135,250**	**4,169**	**554,691**
	9A Ovens													321					**321**	**8**	**0**
	9B King														576				**576**	**11**	**0**
	20 Snowy																		**0**	**0**	**-82,365**
NSW	NSW	1,579	2,947						200		7,775		38,868						**51,368**	**85**	**-108,252**
SA	12 South Australian Murray	9,368	3,838								1,850		38,772						**53,828**	**135**	**-537,028**
Total purchased		**657,392**	**56,372**	**88**	**123**	**7,153**	**20,267**	**133**	**7,229**	**354**	**170,325**	**8,709**	**580,559**	**321**	**576**	**82,365**	**159,620**	**590,856**	**2,342,440**		
Number of trades		**4,867**	**290**	**1**	**7**	**64**	**51**	**5**	**54**	**19**	**1,237**	**120**	**3,896**	**8**	**11**	**13**	**472**	**215**		**11,330**	

Table 5-3 Non-environmental trade of allocation in northern Victoria (ML)

Trading zone		Buyer																		
		Victoria														NSW	SA			
Seller		1A Greater Goulburn	1B Boort	2A Broken – Nillahcootie to Caseys Weir	2B Broken – Caseys Weir to Goulburn River	3 Lower Goulburn	4A Campaspe	4C Lower Campaspe	5A Loddon	5B Bullarook	6 Vic Murray – Dartmouth to Barmah	6B Lower Broken Creek	7 Vic Murray – Barmah to SA	9A Ovens	9B King	NSW	12 South Australian Murray	Total sold	Number of trades	Net sold
Victoria	1A Greater Goulburn	238,692	7,964			3,301	121	124	457		21,246	3,699	96,341			17,544	8,077	**397,567**	**4,482**	**4,309**
	1B Boort	11,556	8,513			127	475		20		475		8,426			13,249	847	**43,687**	**216**	**-12,685**
	2A Broken – Nillahcootie to Caseys Weir			88														**88**	**1**	**0**
	2B Broken – Caseys Weir to Goulburn River				123													**123**	**7**	**0**
	3 Lower Goulburn	9,387	100			1,640	550				762	120	2,701			2,102	1,539	**18,899**	**135**	**11,747**
	4A Campaspe	11,023	2,306			900	12,263				730		9,128			770	1,638	**38,757**	**176**	**25,311**
	4C Lower Campaspe	403						9					21					**433**	**12**	**300**
	5A Loddon	1,548	306						3,062		250	48	1,714			125	50	**7,102**	**90**	**2,619**
	5B Bullarook									354								**354**	**19**	**0**
	6 Vic Murray – Dartmouth to Barmah	35,803	2,209			120					65,748	1,589	47,089			16,868	12,484	**181,910**	**1,484**	**69,340**
	6B Lower Broken Creek	6,297	180								7,255	1,994	3,899			2,362	965	**22,952**	**229**	**14,243**
	7 Vic Murray – Barmah to SA	67,604	28,008			1,065	38		746		13,976	1,260	303,798			100,201	32,414	**549,109**	**4,120**	**24,135**
	9A Ovens													321				**321**	**8**	**0**
	9B King														576			**576**	**11**	**0**
NSW	NSW	1,579	2,947						200		278		13,085					**18,088**	**79**	**-135,132**
SA	12 South Australian Murray	9,368	3,838								1,850		38,772					**53,828**	**135**	**-4,186**
Total purchased		**393,258**	**56,372**	**88**	**123**	**7,153**	**13,446**	**133**	**4,484**	**354**	**112,569**	**8,709**	**524,974**	**321**	**576**	**153,220**	**58,014**	**1,333,794**		
Number of trades		**4,830**	**290**	**1**	**7**	**64**	**44**	**5**	**52**	**19**	**1,222**	**120**	**3,874**	**8**	**11**	**468**	**189**		**11,204**	

Table 5-4 Environmental trade of allocation in northern Victoria (ML)

Trading zone		Buyer														
		Victoria										NSW	SA			
Seller		1A Greater Goulburn	1B Boort	3 Lower Goulburn	4A Campaspe	4C Lower Campaspe	5A Loddon	6 Vic Murray – Dartmouth to Barmah	6B Lower Broken Creek	7 Vic Murray – Barmah to SA	20 Snowy	New South Wales	South Australia	Total sold	Number of trades	Net sold
Victoria	1A Greater Goulburn	169,289						1,771		9,640	33,228			**213,927**	**20**	**-50,206**
	1B Boort	19,160									1,852			**21,013**	**5**	**21,013**
	3 Lower Goulburn	2,434									3,025			**5,459**	**5**	**5,459**
	4A Campaspe				6,281									**6,281**	**5**	**-540**
	4C Lower Campaspe				540									**540**	**2**	**540**
	5A Loddon						2,746				470			**3,216**	**3**	**470**
	6 Vic Murray – Dartmouth to Barmah	28,800						17,322		9,277	32,514		46,964	**134,878**	**28**	**77,122**
	6B Lower Broken Creek							1,210			81		2,622	**3,912**	**3**	**3,912**
	7 Vic Murray – Barmah to SA	44,450						29,955		10,886	11,195	6,400	483,256	**586,142**	**49**	**530,556**
	20 Snowy													**0**	**0**	**-82,365**
NSW	New South Wales							7,497		25,783				**33,280**	**6**	**26,880**
SA	South Australia													**0**	**0**	**-532,842**
Total purchased		**264,133**	**0**	**0**	**6,821**	**0**	**2,746**	**57,755**	**0**	**55,585**	**82,365**	**6,400**	**532,842**	**1,008,647**		
Number of trades		**37**	**0**	**0**	**7**	**0**	**2**	**15**	**0**	**22**	**13**	**4**	**26**		**126**	

5.3.2 Water share transfers

Table 5-5 and Table 5-6 summarise the transfer and variations of high and low reliability water shares in northern Victoria during 2012–13 by grouped delivery system. While not all transfers involved a change in location (i.e. water share purchases within a delivery system), the movement of water shares between delivery systems can be observed in these tables. In summary:

- Approximately 603 GL of high reliability and low reliability water shares were transferred or varied.
- 3,815 transfers or variations of high reliability water shares occurred, totalling around 457 GL.
- 1,609 transfers or variations of low reliability water shares occurred, totalling around 146 GL.
- The majority of transfers and variations occurred within delivery system groups
- About 101 GL of high reliability water shares moved between delivery system groups; this included 80 GL of water share dissociation from land to the non-water users.
- About 27 GL of low reliability water shares moved between delivery system groups. This included 10 GL of water share dissociated from land and transferred to non-water users.

Table 5-5 Transfer and variation of high reliability water shares in northern Victoria (ML)

	Delivery system	Destination																			
		Broken River	Bullarook	Campaspe Irrigation Area	Campaspe River	Central Goulburn Irrigation Area	Goulburn River	Loddon River	Loddon Valley Irrigation Area	Murray River	Murray Valley Irrigation Area	Nyah, Tresco and Woorinen	Ovens River	Robinvale, Red Cliffs, Merbein, FMID	Rochester Irrigation Area	Shepparton Irrigation Area	Torrumbarry Irrigation Area	Non-water users	**Total trades**	**Number of trades**	**Net out/(Net in)**
Source	Broken River	344																94	**438**	**20**	**94**
	Bullarook		2																**2**	**1**	**0**
	Campaspe Irrigation Area				20										100			141	**261**	**4**	**161**
	Campaspe River				915													26	**941**	**29**	**(200)**
	Central Goulburn Irrigation Area					29,140	5		213	643	7				44	30	404	14,242	**44,726**	**655**	**13,833**
	Goulburn River					2	1,827								120		197	1,840	**3,986**	**75**	**2,119**
	Loddon River							1,042									50	14	**1,106**	**21**	**64**
	Loddon Valley Irrigation Area								12,766	89					16	25	70	9,465	**22,430**	**232**	**7,589**
	Murray River					2				42,271	383			24		8	227	8,285	**51,201**	**362**	**3,996**
	Murray Valley Irrigation Area									237	23,788							14,238	**38,263**	**382**	**12,912**
	Nyah, Tresco and Woorinen									25		2,189					162	624	**2,999**	**58**	**665**
	Ovens River												522					50	**572**	**27**	**0**
	Robinvale, Red Cliffs, Merbein, FMID									556		84		11,243			17	4,982	**16,882**	**521**	**5,161**
	Rochester Irrigation Area					152									22,783	239	80	7,244	**30,497**	**296**	**5,084**
	Shepparton Irrigation Area					423			186		4				307	8,287	174	5,058	**14,438**	**253**	**5,777**
	Torrumbarry Irrigation Area								20	1,696		10		10			36,613	13,209	**51,557**	**524**	**7,763**
	Non-water users			100	206	1,174	36		1,658	1,689	1,168	52	50	444	2,044	72	5,801	162,613	**177,107**	**355**	**(65,018)**
	Total trades	**344**	**2**	**100**	**1,141**	**30,892**	**1,867**	**1,042**	**14,842**	**47,205**	**25,350**	**2,334**	**572**	**11,721**	**25,413**	**8,662**	**43,795**	**242,125**	**457,407**		
	Number of trades	**18**	**1**	**1**	**31**	**519**	**60**	**18**	**169**	**349**	**261**	**45**	**27**	**407**	**258**	**187**	**387**	**1,077**		**3,815**	

Table 5-6 Transfer and variation of low reliability water shares in northern Victoria (ML)

	Delivery system	Destination: Broken River	Bullarook	Campaspe Irrigation Area	Campaspe River	Central Goulburn Irrigation Area	Goulburn River	Loddon River	Loddon Valley Irrigation Area	Murray River	Murray Valley Irrigation Area	Nyah, Tresco and Woorinen	Ovens River	Robinvale, Red Cliffs, Merbein, FMID	Rochester Irrigation Area	Shepparton Irrigation Area	Torrumbarry Irrigation Area	Non-water users	**Total trades**	**Number of trades**	**Net out / (Net in)**
Source	Broken River	66																19	**85**	**7**	**19**
	Bullarook																		**0**	**0**	**0**
	Campaspe Irrigation Area				11													22	**34**	**2**	**21**
	Campaspe River				234													24	**258**	**8**	**-43**
	Central Goulburn Irrigation Area					17,711			595	649	40				724	746	243	937	**21,645**	**366**	**1,788**
	Goulburn River					35	592								32			114	**773**	**23**	**181**
	Loddon River					49		209	39										**297**	**9**	**88**
	Loddon Valley Irrigation Area					320			21,951	620				91			526	1,448	**24,955**	**159**	**1,778**
	Murray River									2,455	232							400	**3,087**	**48**	**-4,124**
	Murray Valley Irrigation Area								52		15,468							3,079	**18,599**	**233**	**989**
	Nyah, Tresco and Woorinen									10		462						12	**484**	**10**	**2**
	Ovens River												274					25	**299**	**16**	**0**
	Robinvale, Red Cliffs, Merbein, FMID									151				154					**304**	**2**	**-91**
	Rochester Irrigation Area			13		360			187						10,688	81	175	115	**11,619**	**132**	**1**
	Shepparton Irrigation Area					260			130	101					146	7,158	79	538	**8,412**	**155**	**-144**
	Torrumbarry Irrigation Area								10	2,056				151			36,716	3,512	**42,445**	**345**	**2,173**
	Non-water users				56	1,122			214	1,168	1,870	19	25		28	572	2,534	5,116	**12,724**	**94**	**-2,638**
	Total trades	**66**	**0**	**13**	**301**	**19,857**	**592**	**209**	**23,177**	**7,210**	**17,610**	**482**	**299**	**396**	**11,618**	**8,556**	**40,272**	**15,361**	**146,017**		
	Number of trades	**6**	**0**	**1**	**10**	**345**	**17**	**7**	**153**	**77**	**219**	**9**	**16**	**3**	**132**	**148**	**301**	**165**		**1,609**	

5.3.3 Unregulated surface water

As shown in Table 5-7, trade in surface water take and use licences is much lower than the trade in groundwater take and use licences (Table 5-8). Trades as part of land transfers (take and use licence change of ownership) are the dominant trade type (by volume) in surface water trades.

Table 5-7 Trade of surface water take and use licences in northern Victoria

River basin	Permanent trade		Temporary trade		Trade as part of land transfer	
	Number	Volume (ML)	Number	Volume (ML)	Number	Volume (ML)
Broken	0	0	1	25	6	92
Campaspe	177	1,724	39	324	60	541
Goulburn	10	161	3	106	41	333
Kiewa	1	2	9	486	22	591
Loddon	1	6	1	10	6	238
Murray	0	0	4	153	18	245
Ovens	4	132	8	266	23	166
Total	**193**	**2,025**	**65**	**1,370**	**176**	**2,205**

5.3.4 Groundwater

Table 5-8 shows that in 2012–13, trades of groundwater take and use licences were mostly part of land transfers (take and use licence 'change of ownership') with 129 trades amounting to about 17 GL. Temporary and permanent entitlement volume trades had 22 transfers (about 2 GL) and 98 transfers (about 9 GL), respectively.

Table 5-8 Trade of groundwater take and use licences in northern Victorian GMUs

Groundwater Management Unit	Permanent trade		Temporary trade		Trade as part of land transfer	
	Number	Volume (ML)	Number	Volume (ML)	Number	Volume (ML)
Alexandra GMA	0	0	0	0	1	5
Katunga WSPA	2	20	26	1,419	18	2,111
Kinglake GMA	0	0	1	10	4	111
Loddon Highlands WSPA	5	525	24	1,891	3	339
Lower Campaspe Valley WSPA	4	1,457	25	4,171	3	897
Lower Ovens GMA	7	93	12	495	11	1,679
Mid-Goulburn GMA	0	0	2	126	1	76
Mid-Loddon GMA	3	300	3	609	4	509
Mullindolingong GMA	0	0	0	0	1	60
Shepparton Irrigation Region WSPA	0	0	0	0	54	10,069
Upper Ovens WSPA	1	2	5	364	2	42
Unincorporated areas	0	0	0	0	27	770
Total	**22**	**2,397**	**98**	**9,085**	**129**	**16,668**

5.4 Southern Victoria

5.4.1 Allocation trade

The total volume of allocation traded within southern Victoria during 2012–13 was about 24 GL, comprising 557 trades. This was a large increase in trade over the 7.5 GL (152 trades) reported in 2011–12. The increase in trade may have been due to the impact of lower-than-average rainfalls and higher-than-average maximum temperatures in Victoria during the year.

Table 5-9 shows the number and volume of allocation trades by trading zone in southern water systems during 2012–13. In summary:

- 88% of the allocation trade occurred within trading zones, with only about 3 GL of interzone trade.
- Both the volume and proportion of trade in the Thomson–Macalister system increased. In 2012–13, about 86% of the 24,090 ML of allocation trade in Southern Victoria was within the Thomson–Macalister system compared to 77% of the 7,547 ML of trade in 2011–12.

- Only 3,374 ML was traded within the Werribee and Bacchus Marsh trading zones. This was still an increase in allocation trade from 1,735 ML in 2011–12. Trade within Werribee District continued to be the major contributor to the volume of allocation trade in this area.

Table 5-9 Trade of allocation in southern Victoria (ML)

	Trading zone	Buyer								
		31AD Bacchus Marsh District	31AR Upper Werribee Diverters	31BD Werribee District	31BR Lower Werribee Diverters	41 Macalister	42B Mid-Thomson	**Total sold**	**Number of trades**	**Net sold**
Seller	31AD Bacchus Marsh District	384	18	16	4			**422**	**21**	**38**
	31AR Upper Werribee Diverters							**0**	**0**	**-18**
	31BD Werribee District			1,944	859			**2,803**	**78**	**695**
	31BR Lower Werribee Diverters			148				**148**	**4**	**-715**
	41 Macalister					18,314	289	**18,603**	**409**	**-1,255**
	42B Mid-Thomson					1,544	570	**2,114**	**45**	**1,255**
	Total purchased	**384**	**18**	**2,108**	**863**	**19,857**	**859**	**24,090**		
	Number of trades	**16**	**2**	**83**	**2**	**433**	**21**		**557**	

5.4.2 Water share transfers

The transfers and variations of high reliability and low reliability water shares during 2011–12 in southern Victoria are presented in Table 5-10 and Table 5-11. While not all transfers involved a change in location (i.e. water share purchases within a delivery system), the movement of water shares between delivery systems can be observed in these tables. The tables show that:

- 387 transfers and variations of low reliability and high reliability water shares (totalling 30,272 ML) were recorded for southern Victoria. This is an increase from 261 transfers (amounting to 17,159 ML) in 2011–12
- the largest volume of transfers was within the Macalister Irrigation District (about 25 GL). A much lower volume of transfers occurred within the Werribee and Bacchus Marsh irrigation districts and the Thomson River
- the net movement of high reliability water shares into the non-water user category increased from 1 ML in 2011–12 to 97 ML in 2012–13.

Table 5-10 Transfer and variation of high reliability water shares in southern Victoria (ML)

	Delivery system	Destination									
		Bacchus Marsh Irrigation District	Werribee Irrigation District	Werribee River	Macalister Irrigation District	Macalister River	Thomson River	Non-water user	**Total trades**	**Number of trades**	**Net out / (Net in)**
Source	Bacchus Marsh Irrigation District	32						3	**35**	**4**	**3**
	Werribee Irrigation District		649						**649**	**17**	**0**
	Werribee River							4	**4**	**2**	**4**
	Macalister Irrigation District				16,802	235	73	3	**17,113**	**147**	**147**
	Macalister River				99	170		11	**280**	**7**	**(125)**
	Thomson River				50		2,330	90	**2,470**	**27**	**67**
	Non-water user				15		0		**15**	**2**	**(97)**
	Total trades	**32**	**649**	**0**	**16,966**	**405**	**2,403**	**112**	**20,566**		
	Number of trades	**3**	**17**	**0**	**145**	**9**	**26**	**6**		**206**	

Water trade

Table 5-11 Transfer and variation of low reliability water shares in southern Victoria (ML)

	Delivery system	Destination									
		Bacchus Marsh Irrigation District	Werribee Irrigation District	Werribee River	Macalister Irrigation District	Macalister River	Thomson River	Non-water user	**Total trades**	**Number of trades**	**Net out / (Net in)**
Source	Bacchus Marsh Irrigation District	14						1	**16**	**4**	**1**
	Werribee Irrigation District		314						**314**	**17**	**0**
	Werribee River								**0**	**0**	**0**
	Macalister Irrigation District				7,909	79	36		**8,024**	**132**	**56**
	Macalister River				50	84		5	**139**	**6**	**(25)**
	Thomson River						1,160	45	**1,205**	**21**	**9**
	Non-water user				10				**10**	**1**	**(41)**
	Total trades	**14**	**314**	**0**	**7,968**	**163**	**1,196**	**51**	**9,706**		
	Number of trades	**3**	**17**	**0**	**130**	**7**	**21**	**3**		**181**	

5.4.3 Unregulated surface water

Trading of permanent and temporary entitlement volume was more common in 2012–13 than in previous years – about 12 GL compared to 1.5 GL in 2011–12. Trade as part of a land transfer decreased slightly from 2011–12, with less than 5 GL of change of ownership transfers compared with just over 5 GL in 2011–12 (Table 5-12).

Table 5-12 Trade of surface water take and use licences in southern Victoria (ML)

River basin	Permanent trade		Temporary trade		Trade as part of land transfer	
	Number	Volume (ML)	Number	Volume (ML)	Number	Volume (ML)
Barwon	0	0	6	263	11	133
Bunyip	7	196	10	345	24	606
East Gippsland	0	0		0	1	3
Glenelg	0	0	1	3	4	44
Hopkins	0	0	7	480	3	164
Latrobe	3	16	29	909	23	681
Maribyrnong	4	41		0	12	251
Mitchell	0	0	4	238	8	235
Moorabool	2	33		0	5	97
Otway Coast	0	0	1	5	8	156
Portland Coast	0	0		0	1	30
Snowy	0	0	3	129	0	0
South Gippsland	2	51	3	100	19	348
Tambo	0	0		0	5	123
Thomson–Macalister	2	3	4	208	12	1,077
Werribee	0	0		0	1	4
Yarra	5	8,530	24	272	46	606
Total	**25**	**8,870**	**92**	**2,951**	**183**	**4,559**

5.4.4 Groundwater

Table 5-13 shows that in 2012–13, trades of take and use licences were dominated by trades as part of land transfers (take and use licence change of ownership) with 114 trades amounting to about 15 GL. About 7 GL and 2 GL of temporary and permanent entitlement volume respectively were transferred.

Table 5-13 Trade of groundwater take and use licences in southern Victorian GMUs

Groundwater Management Unit	Permanent trade		Temporary trade		Trade as part of land transfer	
	Number	Volume (ML)	Number	Volume (ML)	Number	Volume (ML)
Bungaree WSPA	0	0	13	212	4	234
Cardigan GMA	1	22	1	3	0	0
Colongulac GMA	0	0	0	0	2	15
Condah WSPA	0	0	0	0	4	367
Cut Paw Paw GMA	0	0	0	0	0	0
Denison WSPA	0	0	14	1,325	6	349
Deutgam WSPA	0	0	4	111	1	51
Frankston GMA	1	5	0	0	0	0
Giffard GMA	1	200	1	50	2	1,140
Glenelg WSPA	0	0	1	200	4	1,914
Glenormiston GMA	1	1		0	1	3
Hawkesdale GMA	3	83	7	730	4	1,477
Heywood GMA	0	0	0	0	3	9
Koo Wee Rup WSPA	5	27	11	427	13	744
Merrimu GMA	0	0	0	0	0	0
Moe GMA	1	4	0	0		0
Moorabbin GMA	0	0	0	0	0	0
Nepean GMA	1	10	8	346	2	218
Nullawarre WSPA	6	677	13	738	8	990
Orbost GMA	0	0	0	0	1	277
Rosedale GMA	1	83	1	120	3	3,186
Sale WSPA	4	270	6	445	1	10
Tarwin GMA	0	0	0	0	1	35
Unincorporated areas	1	5	5	178	34	1,828
Wa De Lock GMA	1	1	2	600	7	395
Wandin Yallock WSPA	0	0	4	38	0	0
Warrion WSPA	3	96	1	150	5	452
Wy Yung WSPA	0	0	2	70	1	60
Yangery WSPA	1	180	3	166	4	374
Yarram WSPA	1	120	4	1,110	3	638
Total	**32**	**1,784**	**101**	**7,019**	**114**	**14,766**

5.5 Western Victoria

5.5.1 Allocation trade

In 2012–13, no allocation trades were completed in western Victoria.

5.5.2 Unregulated surface water

Table 5-14 shows that trade in surface water take and use licences was much lower than the trade in groundwater take and use licences. In 2012–13 there was 850 ML of surface water trade in various unregulated entitlement types (take and use licences, water allowances and bulk entitlements), compared with only 380 ML in 2011–12.

Water trade

Table 5-14 Trade of surface water take and use licences

River basin	Permanent trade		Temporary trade		Trade as part of land transfer	
	Number	Volume (ML)	Number	Volume (ML)	Number	Volume (ML)
Avoca	1	12	0	0	2	141
Glenelg	0	0	0	0	1	2
Murray	4	2	0	0	0	0
Wimmera	441	587	0	0	9	106
Total	**446**	**601**	**0**	**0**	**12**	**249**

5.5.3 Groundwater

In 2012–13 the volume of groundwater trading increased with about 7.7 GL in groundwater take and use licences traded (Table 5-15) compared with 1.2 GL in 2011–12.

Table 5-15 Trade of groundwater take and use licences

Groundwater Management Area	Permanent trade		Temporary trade		Trade as part of land transfer	
	Number	Volume (ML)	Number	Volume (ML)	Number	Volume (ML)
Murrayville WSPA	0	0	4	635	1	600
West Wimmera GMA	2	330	10	1,749	8	4,360
Total	**2**	**330**	**14**	**2,384**	**9**	**4,960**

Part 2: Water Accounts 2012–13

Part 2 of the 2012–13 Victorian Water Accounts presents an account of surface water, groundwater and distribution systems in Victoria for 2012–13.

Chapter 6 provides the water accounts for each of Victoria's 29 river basins and includes:

- a map of each river basin
- a basin overview, including summaries of information presented in each basin, management responsibilities in the basin and, where applicable, information about the environmental water reserve
- the total water resources in each basin
- detailed information about 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 inflow to a waterway to the time it is diverted from the surface streams of the basin, or flows from them to another basin or to the sea.

Chapter 7 provides the water accounts for each of Victoria's 20 groundwater catchments and includes:

- a map of each groundwater catchment
- an overview of groundwater resources in each catchment
- detailed information about licences and 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.

Chapter 8 provides the accounts for distribution systems. These accounts track the water from the time it moves from a waterway, an aquifer or other source to the time it is delivered to a customer, or to another destination. Such accounting is important because distribution systems are part of the water cycle that people can control, and because with these systems delivery efficiency improvements can most readily be made. These accounts have the potential over time to address a number of questions such as:

- how do the many urban systems compare to each other? Urban systems range from large and well-resourced (such as those operated by Melbourne retailers), to very small and possibly less well-resourced systems in small towns throughout the state
- how do piped urban systems compare to piped irrigation systems and to large gravity irrigation systems that are currently being modernised
- what potential is there to recover water to meet rising demand by upgrading maintenance standards in the numerous systems apart from the few large irrigation systems?

6 Basin water accounts

6.1 Overview of methodology

6.1.1 Introduction

This section outlines the basis for the information presented in the basin water 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 basin water accounts are compiled from information obtained from:

- responses to requests for data to water businesses, catchment management authorities, Victorian Environmental Water Holder (VEWH), Department of Environment and Primary Industries (DEPI), major users of water and the Murray–Darling Basin Authority (MDBA)
- water consumption and recycled water data collected from water businesses by the Essential Services Commission (ESC)
- hydrologic information from selected streamflow monitoring sites
- climate information from selected rainfall and evaporation monitoring sites provided by the Australian Bureau of Meteorology and water businesses
- estimated relationships between water use and climate or hydrologic data, which is produced by water supply system modelling
- water businesses' annual reports and related documents.
- The basin water accounts report information on surface water and recycled water in 2012–13 for the 29 river basins within Victoria. The basin definitions are based on the river basin boundaries designated by the former Australian Water Resources Council (AWRC). The exception is the Murray basin which, for the purposes of the Victorian Water Accounts, includes the Upper Murray basin as defined by the AWRC and areas in Victoria supplied from the Murray River downstream of Lake Hume. Groundwater has historically been presented together with surface water in the Victorian Water Accounts, according to river basin boundaries. The 2012–13 Victorian Water Accounts presents groundwater information in its own section for the first time, reported by groundwater catchment according to changes to Victoria's groundwater management framework. Chapter 7 presents an introduction, methodology and catchment accounts for Victoria's groundwater resources.

6.1.2 Surface water data

Surface water data generally aligns well with river basin boundaries. The only instances where this does not occur is 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 the point of use. For example, information on diversions to supply the Rochester Irrigation Area, located at the downstream end of the Campaspe basin, is accounted for in the Goulburn basin where its source of supply is located.

6.1.3 Recycled water

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.

All information for each of the 29 basins is provided for the period 1 July 2012 to 30 June 2013. Responsibilities for water management are reported in the accounts as they were during 2012–13. Any changes to responsibilities since the end of June 2013 will be reported in future water accounts.

6.1.4 Surface water resources section

Information on surface water in 2012–13 is presented in this section for each of the 29 river basins. There are three sub-sections: water balance, storages and flows and entitlement volumes and diversions.

6.1.5 Surface water balance sub-section

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 (i.e. water in storages).

A surface water balance is presented for all of the 29 basins except the Mallee basin and Millicent Coast basin. Owing to the lack of significant surface water resources in these basins, there is insufficient data available to prepare a water balance.

The three components of the water balance (storages, inflows, outflows) are explained below.

6.1.5.1 Major on-stream storages

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 the end of the year. In general, only on-stream storages with a total capacity larger than 1,000 ML are included in this component of the water balance. While storages that are less than 1,000 ML are important locally, they are generally an insignificant proportion of total storage at a river 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 the double counting of water that has been diverted from rivers or extracted from groundwater.

6.1.5.2 Inflows

Inflows contribute to the volume of streamflow in waterways within a basin. An overview of the inflow components included in the water balance is provided below.

- Catchment inflow: This item represents the total volume of surface runoff from rainfall that becomes streamflow or is captured by small catchment dams. This is generally the unaccounted-for item in each water balance and is used as the balancing item. Catchment inflow is determined to be the difference between the total outflows, and the known inflows and 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 other Victorian basins (Ovens, Goulburn, Broken, Campaspe and Loddon) into the Murray River. It also includes estimated inflows to small catchment dams in the Murray basin to match the estimated impacts of small catchment dams.
- Internal spills from New South Wales's share of storage: This item only applies in the Murray basin. When New South Wales's share of storage capacity is full, New South Wales's share of incoming inflows are credited to Victoria's share of capacity. This is referred to as an 'internal spill'.
- Ceding from New South Wales's share of storage: This item only applies in the Murray basin. This item represents an accounting adjustment to the River Murray Water Accounts maintained by the MDBA under the Murray–Darling Basin Agreement.
- Rainfall on major storages: This represents inflows from rain falling directly on major on-stream storages. Estimates are based on rainfall data and the surface area of storages.
- Transfers from other basins: Transfers from other basins are included in a basin's water balance only where these transfers are known to affect streamflows in the receiving basin. These transfers (e.g. 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 (e.g. urban diversions, irrigation district diversions) and is not accounted for as a transfer in the water balance.
- Return flow from irrigation: Return flows 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 component represents the volume of water discharged from wastewater treatment plants back into waterways. Refer to section 6.1.9 for more information.

6.1.5.3 Outflows

This term represents water that has left a waterway, whether by natural processes (such evaporation and seepage) or through being diverted by water businesses and individuals. An overview of the outflow components included in the water balance is provided below.

Diversions

Diversions are considered to be water that is deliberately diverted from a waterway to meet a specific use.

- Urban diversions: This item represents the total volume of water diverted from waterways by water corporations to supply urban customers.
- Irrigation district diversions: This component represents the bulk volume of water diverted from waterways by rural water businesses to supply customers within irrigation districts.
- Licensed diversions from regulated or unregulated streams: Licensed diversions occur where the extraction and delivery of water to a property from a watercourse is the responsibility of the licence holder. Information on 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 businesses). The water balance excludes diversions under domestic and stock rights which do not require a licence. The volume associated with these rights is relatively small.
- Transfers to other basins: Transfers to other basins represent the transfer of water to another basin where it is either used or contributes to the in-stream loss in the other basin. The corresponding transaction is reported as an inflow 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, however, 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. More information on how the volume of extractions is determined is provided in section 6.1.8.1.

Losses

Losses refer to 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 flow at a basin outlet.

- Evaporation losses from major storages: This represents direct evaporation from major on-stream storages. It is estimated based on evaporation rates and the surface area of the storage.
- Evaporation losses from small catchment dams: This item represents the estimated volume of evaporation losses from small catchment dams within a basin. More information on how the evaporation loss is determined is provided in section 6.1.8.1.
- 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 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 the balancing items. In this instance, in-stream losses are determined to be the difference between the known outflows, and the total inflows and 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 documents in Table 6.1. In-stream losses have not been estimated for the following basins where a suitable model is not available: East Gippsland, Snowy, Tambo, Latrobe, South Gippsland, Yarra, Corangamite, Otway Coast, Hopkins and Portland Coast.

Water passed at outlet of basin

Generally, this item represents the total volume of flow that passes the outlet of the basin. The outlets vary from basin to basin and include:

- 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 don't outflow to the ocean or to other rivers, but to lakes that are referred to 'terminal lakes'
- outflows to another state: the outlet of the Murray River is considered to be the boundary with South Australia for accounting purposes. Flow across the boundary into South Australia from Victoria's share of the Murray River resources is considered to be water passed at the outlet of the basin.

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

In the Murray basin, the total volume of water deducted from Victoria's share of the resource, in line with interstate accounting under the Murray–Darling Basin Agreement, is represented as water passed at the basin outlet. These volumes include:

- internal spills to New South Wales's share of storage: This item only applies in the Murray basin. When Victoria's share of storage capacity is full, Victoria's share of incoming inflows is credited to New South Wales's share of capacity. This is referred to as an 'internal spill'
- ceding to New South Wales's share of storage: This item only applies in the Murray basin. This item represents Victoria's 'ceding' obligations to provide water in storage to New South Wales under the Murray–Darling Basin Agreement.

Table 6.1 Models used to derive in-stream losses for 2012–13

Basin(s)	Model(s)
Kiewa	Kiewa River REALM
Ovens	Ovens River REALM (the volume derived using the model represents the average annual in-stream loss over the period 1891–2006)
Broken, Goulburn, Campaspe, Loddon	Goulburn Simulation Model (this model covers the Goulburn, Broken, Campaspe and Loddon systems)
Avoca	Avon River REALM
Wimmera	Wimmera–Glenelg 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

6.1.6 Storages and flows sub-section

This section provides an overview of inflows and volumes in storage within each basin. A chart is presented that plots catchment inflow from the water balance 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 eight years. Information on storages in each basin is presented, including the capacity, starting and ending volume in store, rainfall and evaporation. It also provides an amount representing catchment inflow less regulated releases; this volume is the balancing item for each storage and represents the flow of water in or out of the storage that is not shown as rainfall or evaporation, and may include other minor components influencing the change in storage during the year.

6.1.7 Entitlement volumes and diversions sub-section

This section presents information on diversions used in the surface water balance. It provides an overview of the entitlements granted to individuals or corporations in the basin. It also reports the diversions by water corporations under bulk entitlements, diversions to off-stream wetlands under environmental entitlements, licensed diversions from unregulated streams by private diverters, and diversions and losses from small catchment dams.

6.1.7.1 Entitlement volumes

Details of all entitlements to water in each basin are reported in this section. Entitlements can include rights granted to individuals (for example water shares and take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the VEWH). 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 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 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 is an entitlement to be supplied 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.

This is a different approach to previously published versions of the Victorian Water Accounts. This is the first year that entitlement volumes are presented separately to the discussion of water allocation and use for each entitlement type (see 6.1.8). Bulk entitlement holders are no longer presented against entitlements in the basin chapters’ tables. Appendix D lists all Victoria’s bulk entitlements and their entitlement holders.

6.1.8 Allocation account balances

Allocation available under bulk entitlements and licences is presented in this section. Allocation represents the actual water that is available for use and trade in the 2012–13 water year. Individuals or authorities that hold water entitlements in Victoria are allocated water based on the size of their entitlement and the available resource. For example, in 2012–13 entitlement holders with low reliability water shares in the Werribee system were allocated 40% of their entitlement. That is, for every 100 ML of entitlement they owned, they were allocated 40 ML of water that could be used or traded. The tables in this section summarise the water transactions for each river basin by entitlement holder or by entitlement holder type (i.e. the total water transactions for all water share holders in a particular basin). 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 that are specified in the bulk entitlement. Where there is a difference between the total diversion from the waterway and the amount supplied to primary entitlement holders, an amount is allocated to an operating provision line item. This allows for any known or unknown loss and any unaccounted-for gain in the system.

6.1.8.1 Estimated small catchment dam impacts

Small catchment dams (also known as catchment farm dams) are dams that are not located on a defined watercourse but harvest water from their local catchment. The presence of small catchment dams changes the hydrology in a basin due to their effects on the rate of overland flow (surface runoff), evaporation and groundwater seepage. Small catchment dams reduce the volume of surface runoff that might otherwise become streamflow in a basin.

The total volume of water harvested by small catchment dams has been determined based on estimates of the total volume of small catchment dams in a basin obtained from DEPI's Sustainable Diversions Limits project in 2002 and Flow Stressed Ranking Procedure project in 2005, and computer-based simulation modelling of the impact of small catchment dams on mean annual streamflow.

The estimated total water harvested by (or total impact of) small catchment dams in a basin is represented in the water balance as two separate components:

- The estimated volume that owners extract from dams to supply their needs is accounted for as a diversion in the surface water balance. The volume extracted is determined based on the estimated total capacity and the assumed use of small catchment dams in a basin. (Dams are categorised as being for either domestic and stock purposes or commercial and irrigation purposes based on their estimated size).
- The estimated volume of evaporation from small catchment dams is accounted for as a loss in the surface water balance. This volume is determined to be the difference between the estimated total water harvested (or total impact of) small catchment dams and the estimated volume extracted for use.

All volumes presented for small catchment dams are annual average figures. In extremely dry years, these annual average figures are factored down to reflect the reduced water availability from lower rainfall. The 2012–13 year was not considered to be an extremely dry year for any of Victoria's 29 basins, therefore the average annual volumes have been applied.

6.1.9 Recycled water section

Recycled water from towns with wastewater treatment plants has been assigned to river 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 within the river basin where the plant is located.

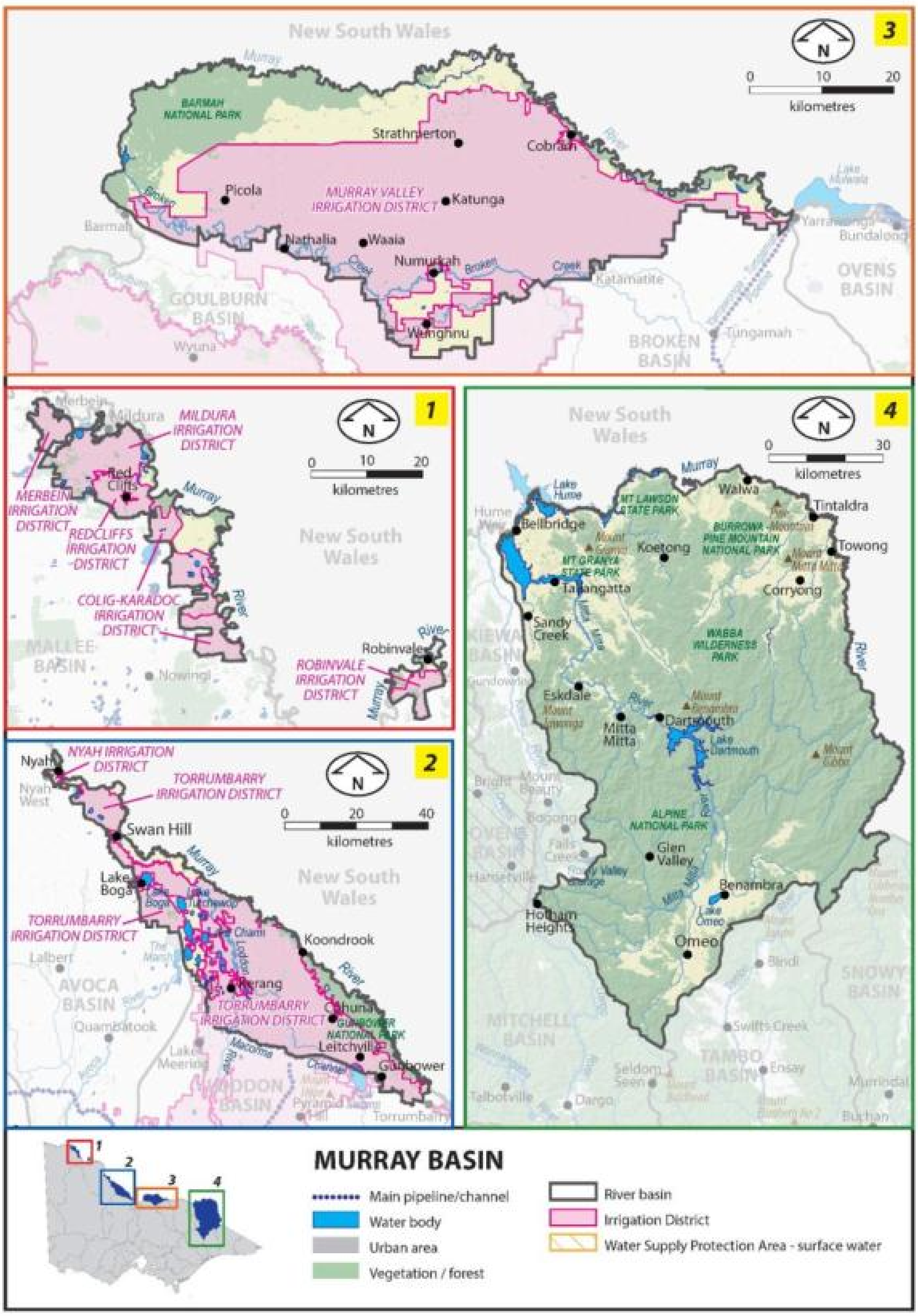
A table in each basin chapter provides the following information:

- the volume of wastewater produced (excluding evaporation)
- the total volume recycled, and a breakdown into the following end-use categories:
- volume recycled for urban and industrial uses
- volume recycled for agricultural uses
- volume recycled for beneficial allocations (for example, environmental flows)
- volume recycled within process
- the volume discharged to the environment (ocean outfalls or inland water discharges).

6.2 Murray basin (Victoria)

The Murray River forms the border with New South Wales. Victoria shares the volume of water held in the Murray–Darling basin's 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 6.2-1).

Figure 6.2-1 Map of the Murray basin (Victoria)



6.2.1 Water resources overview

Rainfall across the Murray basin in 2012–13 was between 80% and 100% of the long-term average over the large majority of the basin, with only small areas receiving higher or lower rainfall. While catchment inflows to the Murray basin in 2012–13 were 81% of the long-term average, they were much lower compared to 2011–12 when inflows were 120% of the long-term average.

The volume held in Victoria's share of the major Murray system storages started at 90% of capacity at the beginning of July and was at 83% of capacity at the end of June 2013.

Allocations in the regulated Murray system began the year at 26%. The allocation for high reliability water shares reached 100% by mid-November 2012. This was the fourth consecutive year that the allocation for high reliability entitlements reached 100%.

There were no urban water use restrictions imposed in the Murray basin in 2012–13. Irrigation bans were put in place for licensed surface water diversions on the Indigo Creek and upper Black Dog Creek from January to June 2013.

The Murray–Darling Basin Authority (MDBA) is responsible under the *Water Act 2007* (Commonwealth) for the planning and management of Murray–Darling basin water resources on behalf of Victoria, New South Wales, Queensland, the Australian Capital Territory and South Australia. Under the Murray–Darling Basin 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 (i.e. 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 and Campaspe rivers. Victoria is also required under the agreement to supply half of South Australia's monthly entitlement flow from the water available to it.

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

Table 6.2-1 shows the responsibilities of the authorities within the Victorian-controlled parts of the Murray basin in 2012–13.

Table 6.2-1 Responsibilities for water resources management within the Murray basin (Victoria)

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Murray–Darling Basin Authority				Jointly coordinates waterway management along the Murray River and operates the Murray River supply system
Department of Environment and Primary Industries				Coordinates Victoria's input to resource management associated with the Murray River
State Water New South Wales				Operates Lake Hume, Euston Weir and the Menindee Lakes on behalf of the MDBA
South Australian Water Corporation				Operates Lake Victoria and several locks on behalf of the MDBA
Goulburn–Murray Water	Supplies Murray Valley, Torrumbarry, Woorinen, Tresco and Nyah irrigation areas	Manages private diversions on the Victorian side of the Murray basin upstream of Nyah		Operates Lake Dartmouth, Yarrawonga Weir (Lake Mulwala), Torrumbarry Weir and Mildura Weir on behalf of the MDBA
Lower Murray Water	Supplies Red Cliffs, Robinvale, Merbein and the First Mildura irrigation districts	Manages private diversions in the Sunraysia region	Supplies towns along the Murray River from Swan Hill to the South Australian border	
North East Water			Supplies towns upstream of Lake Mulwala	Obliged to meet passing flow requirements
Goulburn Valley Water			Supplies towns in the Murray Valley Irrigation Area	
Coliban Water			Supplies towns in the Torrumbarry Irrigation Area	
East Gippsland Water			Supplies Omeo and Dinner Plain	

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
GWMWater			Supplies domestic and stock water to towns and farms in the Northern Mallee area	
Victorian Environmental Water Holder				Holds and manages environmental entitlements in the basin
North East Catchment Management Authority				Manages waterways within the North East CMA area
Mallee Catchment Management Authority				Manages waterways within the Mallee CMA area

Environmental Water Reserve

Important environmental assets depend on the Environmental Water Reserve (EWR) in the Murray basin. The Barmah–Millewa Forest, Gunbower Forest, Hattah Lakes and Kerang Wetlands are located along the Murray River and are all internationally significant wetlands listed under the Ramsar convention and Living Murray Icon sites. The Lindsay, Wallpolla and Mulcra Islands Living Murray Icon sites also depend on the EWR in the Murray basin. These sites rely on the freshwater inputs from the Murray River to function ecologically.

In 2012–13 the Murray basin (Victoria) EWR comprised the following components:

- the Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999, comprising 27,600 ML of high reliability and 40,000 ML unregulated entitlements held by the Victorian Environmental Water Holder (VEWH)
- the Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999 – Living Murray, comprising 5,710 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
- the Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999 – Barmah–Millewa Environmental Water Allocation – a significant operational rule embedded in consumptive entitlements, comprising 50,000 ML of high reliability and 25,000 ML of low reliability entitlement held by the VEWH
- the *Environmental Entitlement (River Murray – NVIRP Stage 1) 2012* of 5,711 ML held by the VEWH, which includes mitigation water allocated for the purposes of watering specific environmental sites that have been identified through the Goulburn–Murray Water Connections Project environmental approvals processes
- the Bulk Entitlement (River Murray – Snowy Environmental Reserve) Conversion Order 2004, comprising 29,274 ML of high reliability entitlement
- water shares – Snowy River Environmental Reserve comprising 11,392 ML of high reliability and 6,415 ML of low reliability entitlement held by the VEWH
- water set aside for the environment through the operation of passing flows released by 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 bulk entitlements from unregulated rivers
- all other water in the basin not allocated for consumptive use.

6.2.2 Surface water resources

6.2.2.1 Water balance

The total surface water resource includes: Victoria's share of inflows to Lake Dartmouth, Lake Hume, Lake Victoria and the Menindee Lakes; Victoria's share of inflows from the Kiewa River; and outflows from other Victorian rivers (Ovens, Goulburn, Campaspe and Loddon) and Broken Creek into the Murray River.

A surface water balance for the Murray basin (Victoria) is shown in Table 6.2-2.

Murray basin (Victoria)

Table 6.2-2 Balance of surface water in the Murray basin (Victoria)

Water account component	2012–13 (ML)[4]	2011–12 (ML)[4]
Major on-stream storage		
Volume in storage at start of year	4,090,380	3,679,480
Volume in storage at end of year	3,782,415	4,090,380
Change in storage	**(307,965)**	**410,900**
Inflows		
Catchment inflow[1]	6,143,993	9,195,297
Rainfall on major storages[2]	150,443	205,683
Internal spills from NSW share of storage	200	5,620
Ceding from NSW share of storage	0	1,150
Return flow from irrigation	203,826	90,408
Treated wastewater discharged back to river	3,313	3,653
Total inflows	**6,501,775**	**9,501,811**
Outflows		
Diversions		
Urban diversions	38,227	31,625
Irrigation district diversions	1,134,371	932,861
Licensed diversions from regulated streams	426,413	321,433
Licensed diversions from unregulated streams	1,578	6,989
Environmental water diversions	7,768	40,377
Small catchment dams	6,445	6,445
Total diversions	***1,614,802***	***1,339,730***
Losses		
Evaporation losses from major storages[2]	690,799	655,225
Evaporation from small catchment dams	1,164	1,164
In-stream infiltration to groundwater, flows to floodplain and evaporation[3]	270,325	1,171,582
Total losses	***962,288***	***1,827,971***
Water passed at outlet of basin		
Murray River flow to South Australia from Victoria's allocation	4,015,600	5,521,400
Internal spills to NSW share of storages	100,250	281,260
Ceding to NSW storages per Murray–Darling Basin Agreement	116,800	120,550
Total water passed at outlet of basin	***4,232,650***	***5,923,210***
Total outflows	**6,809,740**	**9,090,911**

Notes:

(1) Inflows calculated based on estimates of inflows to major storages, plus inflows from tributaries.

(2) The 2011–12 values in these line items have been revised from the 2011–12 published report. These revisions required a re-calculation of catchment inflow and thus this is also reported differently to the 2011–12 published number.

(3) This is the balancing item in this water balance. It is the difference between Victoria's share of the total outflows, total inflows and net change in storage volume.

(4) The volumes in this table may not be consistent with the MDBA's Water Audit Monitoring Report due to different accounting entities and methods.

6.2.2.2 Storages and flows

The volume held in major storages in the Murray basin began 2012–13 at 4,090,380 ML (90% of capacity) and ended the year at 3,782,415 ML (83% of capacity) (Table 6.2-3). This includes Victoria's share of Lake Cullulleraine, Lake Dartmouth, Lake Hume, Lake Victoria and the Menindee Lakes. The volume reported in the 'catchment inflow less regulated releases' column of Table 6.2-3 is the balancing item for each storage. It represents the flow of water in or out of the storage that is not shown as rainfall or evaporation, and may include other minor components influencing the change in storage during the year. that is not shown as rainfall or evaporation and may include other minor components influencing the change in storage during the year.

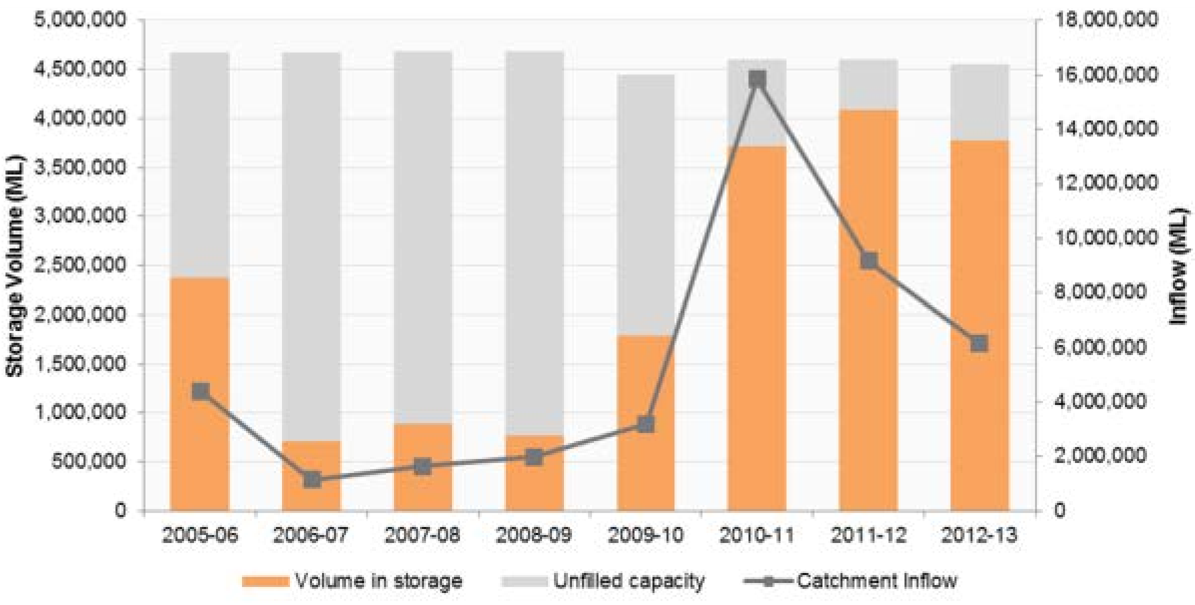
Table 6.2-3 Storage volumes in the Murray basin (Victoria)

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Lake Culluleraine	5,270	4,370	347	4,366	4,434	4,785
Lake Dartmouth (Vic. share)	1,928,116	1,691,560	26,579	30,354	191,365	1,879,150
Lake Hume (Vic. share)	1,502,579	1,434,450	59,196	96,916	(284,250)	1,112,480
Lake Victoria (Vic. share)	338,500	241,000	11,000	85,600	78,500	244,900
Menindee Lakes (Vic. share)	785,000	719,000	53,321	421,168	189,947	541,100
Total storages	**4,559,465**	**4,090,380**	**150,443**	**638,404**	**179,996**	**3,782,415**

Victoria's share of catchment inflows were 81% of the long-term average (of 7,618,000ML), considerably lower than the volume for 2011–12, which was 120% of the long-term average (Figure 6.2-2).

The Victorian component of water flowing from the Murray basin to South Australia was 4,015,600 ML in 2012–13. This represented 65% of the catchment inflows into the basin, compared to 60% in 2011–12.

Figure 6.2-2 All major storages and catchment inflows in the Murray basin (Victoria)



6.2.2.3 Entitlement volumes and diversions

East Gippsland Water, Coliban Water, Goulburn Valley Water, North East Water, GWMWater, Goulburn–Murray Water, and Lower Murray Water all hold bulk entitlements in the Murray basin. Surface water is also diverted by licensed diverters, and is also harvested in small catchment dams.

The bulk entitlement for Bundalong was amalgamated into the River Murray – North East Water entitlement during 2012–13.

Entitlements in the Murray basin include rights granted to individuals (for example water shares and take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the VEWH). Rights to water in the Murray basin are outlined in Table 6.2-4.

Murray basin (Victoria)

Table 6.2-4 Entitlement volumes in the Murray basin (Victoria)

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (River Murray – Goulburn Murray Water) Conversion Order 1999	
High reliability water shares	831,811
Low reliability water shares	295,720
High reliability supply by agreements	1,459
Low reliability supply by agreements	597
Loss provisions(1)	297,990
Mid Murray storages – loss provision	47,371
Sub-total: Bulk Entitlement (River Murray – Goulburn Murray Water) Conversion Order 1999	**1,474,947**
Bulk Entitlement (River Murray – Lower Murray Urban and Rural Water – Irrigation) Conversion Order 1999	
High reliability water shares	299,402
Low reliability water shares	5,774
High reliability supply by agreements	524
Loss provisions(1)	13,080
Sub-total: Bulk Entitlement (River Murray – Lower Murray Urban and Rural Water – Irrigation) Conversion Order 1999	**318,780**
Bulk Entitlement (River Murray – First Mildura Irrigation Trust) Conversion Order 1999	
High reliability water shares	54,167
Low reliability water shares	154
High reliability supply by agreements	788
Loss provisions(1)	12,000
Sub-total: Bulk Entitlement (River Murray – First Mildura Irrigation Trust) Conversion Order 1999	**67,109**
Bulk Entitlement (River Murray – Lower Murray Urban and Rural Water – Urban) Conversion Order 1999	**30,971**
Bulk Entitlement (River Murray – Grampians Wimmera Mallee Water) Conversion Order 1999	**3,492**
Bulk Entitlement (River Murray – North East Water) Conversion Order 1999	**13,236**
Bulk Entitlement (River Murray – Goulburn Valley Water) Conversion Order 1999	**5,593**
Bulk Entitlement (River Murray – Coliban Water) Conversion Order 1999	**6,285**
Bulk Entitlement (River Murray – South East Water) Order 2012(2)	**4,372**
Bulk Entitlement (River Murray – City West Water) Order 2012(2)	**4,372**
Bulk Entitlement (River Murray – Yarra Valley Water) Order 2012(2)	**4,372**
Bulk Entitlement (Corryong) Conversion Order 2000	**680**
Bulk Entitlement (Cudgewa) Conversion Order 2000	**29**
Bulk Entitlement (Dartmouth) Conversion Order 2000	**60**
Bulk Entitlement (Omeo) Conversion Order 2008	**77**
Bulk Entitlement (Walwa) Conversion Order 2000	**61**
Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999	
High reliability entitlement	33,310
Low reliability entitlement	101,850
Unregulated entitlement	74,300
Sub-total: Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999	**209,460**
Environmental Entitlement (River Murray – NVIRP Stage 1) 2012	**13,560**
Bulk Entitlement (River Murray – Snowy Environmental Reserve) Conversion Order 2004	**29,794**
Take and use licences – unregulated surface water	**17,141**
Total volume of water entitlements in the Murray basin	**2,204,388**

Notes:

(1) The volume specified is the loss entitlement volume recorded in the Victorian Water Register.

(2) South East Water, City West Water and Yarra Valley Water were granted a bulk entitlement conversion order in July 2013.

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.2-5. Entitlements to water in regulated systems in the Murray basin provide for 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;

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; 38,693 ML was written-off due to actual spill events in 2012–13. Water corporations' diversions under bulk entitlements for 2012–13 are presented in Table 6.2-5. Diversions under these bulk entitlements are assessed against the Murray–Darling basin annual cap target for the Murray–Kiewa–Ovens valley. Details of this assessment are published annually in the MDBA's Water Audit Monitoring Report.

The VEWH diverted 7,768 ML to off-stream wetlands from water available under Victorian environmental entitlements and water traded in from the Commonwealth Environmental Water Holder. Further information on environmental entitlements held by the VEWH is provided in Chapter 4.

Table 6.2-5 Allocation account balance summary for the Murray basin (Victoria)

Water entitlement	Opening carryover	Allocation issued	Net trade In/(Out)	Water use	Write-off due to spill	End of season forfeitures	Carried forward to 2013–14
River Murray – Goulburn Murray Water							
Water shares	721,131	723,403	(219,152)	(768,238)	(16,184)	(47,876)	393,084
Supply by agreements	1,921	1,459	(86)	(1,552)	(58)	(96)	1,587
Loss provisions	-	-	-	(224,171)	-	-	-
Mid Murray Storages – Loss provision	-	-	-	(54,519)	-	-	-
Net diversion: River Murray – Goulburn Murray Water(1)				**(1,048,480)**			
River Murray – Lower Murray Urban and Rural Water – Irrigation (2)							
Water shares	608,940	462,701	(123,016)	(494,933)	(19,911)	(79,565)	354,217
Supply by agreements	2,100	1,312	(918)	(1,148)	(69)	(72)	1,206
Loss provisions	-	-	-	(12,360)	-	-	-
Diversion: River Murray – Lower Murray Water(3)				**(508,441)**	**-**	**-**	**-**
River Murray – Lower Murray Water – Urban	19,272	31,791	(20,559)	(20,050)	(633)	(1,378)	8,443
River Murray – Wimmera Mallee Water	1,727	3,492	(1,530)	(3,863)	(57)	0	(231)
River Murray – North East Water(4)	15,804	14,183	(17,379)	(8,543)	(519)	(107)	3,439
River Murray – Goulburn Valley Water	2,708	5,593	(2,120)	(4,892)	(89)	(88)	1,111
River Murray – Coliban Water	7,964	6,285	0	(4,395)	(261)	(480)	9,113
River Murray – Melbourne Retailers(5)	0	8,943	4,372	0	0	(666)	12,649
Corryong	-	680	0	(256)	-	(424)	-
Cudgewa	-	29	0	0	-	(29)	-
Dartmouth	-	60	0	(28)	-	(32)	-
Omeo	-	77	0	(43)	-	(34)	-
Walwa	-	61	0	(19)	-	(42)	-
River Murray – Flora and Fauna							
High reliability(6)(7)	27,813	273,533	(257,404)	(9,987)	(913)	(1,367)	31,675
Low reliability(8)	0	50,778	(50,778)	0	0	0	0
Unregulated(9)	-	11,799	0	(11,799)	-	0	-
Sub-total: River Murray – Flora and Fauna				**(21,786)**			
River Murray – NVIRP Stage 1(10)	1,521	9,260	46,134	(28,195)	0	(1,436)	27,284
River Murray – Snowy Environmental Reserve	-	29,794	(29,794)	0	-	0	-
Take and use licences – unregulated surface water	-	17,141	0	(1,578)	-	(15,563)	-

Notes:

(1) 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.

(2) The allocation summary provided for River Murray – Lower Murray Water includes a summary of Lower Murray Water's two bulk entitlements (First Mildura Irrigation District and Lower Murray Urban and Rural Water – Irrigation).

(3) 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.

(4) Allocation issued includes return flows of 1,389 ML credited to North East Water for return flows from the West Wodonga Treatment Plant.

(5) Melbourne retailers transactions are held in one account as they each own equal shares of the available allocation.

(6) Allocation includes return flows of 240,223 ML credited to the VEWH from deliveries of environmental water.

(7) Water use here represents both in-stream use and actual diversions from the waterway. Of the 9,987 ML reported, 7,303 ML represents an actual diversion from the waterway.
(8) Allocation issued includes return flows of 50,778 ML credited to the VEWH from deliveries of environmental water.
(9) Water use here represents both in-stream use and actual diversions from the waterway. Of the 11,799 ML reported, 45 ML represents an actual diversion from the waterway.
(10) Water use here represents both in-stream use and actual diversions from the waterway. Of the 28,195 ML reported, 420 ML represents an actual diversion from the waterway.

The estimated total capacity of, and total water harvested from, small catchment dams within the Murray basin is small compared to other basins (Table 6.2-6).

Table 6.2-6 Estimated small catchment dam information for the Murray basin (Victoria)

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	7,154	3,577	n/a
Registered commercial and irrigation	3,414	2,868	n/a
Total	**10,568**	**6,445**	**7,609**

n/a: No information available.

6.2.3 Recycled water

Around 43% of the volume of wastewater passing through treatment plants in the basin was recycled for consumptive use (Table 6.2-7), mostly for agricultural purposes. This is similar to the proportion recycled and water consumption rates in 2011–12.

Table 6.2-7 Volume of recycled water in the Murray basin

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process(2))	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ other(3) (ML)
				Urban and industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Bellbridge	41	41	100%	0	41	0	0	0	0
Bundalong	0	0	0%	0	0	0	0	0	0
Cobram	502	502	100%	0	502	0	0	0	0
Cohuna	0	0	0%	0	0	0	0	0	0
Corryong	156	156	100%	0	156	0	0	0	0
Dartmouth	8	0	0%	0	0	0	0	8	0
Gunbower/ Leitchville	0	0	0%	0	0	0	0	0	0
Koondrook	74	0	0%	0	0	0	0	0	74
Koorlong	2,163	1,864	86%	0	1,864	0	0	0	299
Lake Boga	45	0	0%	0	0	0	0	0	45
Merbein	155	2	1%	0	2	0	0	0	153
Mildura	975	518	53%	0	518	0	0	0	458
Murrabit	10	0	0%	0	0	0	0	0	10
Nathalia	68	68	100%	0	68	0	0	0	0
Numurkah	237	237	100%	0	237	0	0	0	0
Nyah/Nyah West	79	0	0%	0	0	0	0	0	79
Omeo	26	26	100%	0	26	0	0	0	0
Robinvale	231	108	47%	0	108	0	0	0	123
Strathmerton	0	0	0%	0	0	0	0	0	0
Swan Hill	1,271	0	0%	0	0	0	0	0	1,271
Tallangatta	120	120	100%	0	120	0	0	0	0
Wodonga	3,693	388	11%	388	0	0	0	3,305	0
Yarrawonga	442	442	100%	0	442	0	0	0	0
Total 2012–13	**10,295**	**4,470**	**43%**	**388**	**4,083**	**0**	**0**	**3,313**	**2,512**
Total 2011–12	10,364	3,980	38%	94	3,886	0	0	3,653	2,731

Notes:
(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.
(2) 'Within process' refers to water reused in wastewater treatment processes, for example to maintain biological processes. This value is not included in the total percent recycled, consistent with its treatment in the ESC's performance report.
(3) 'Other' refers to a change in onsite wastewater storage or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.3 Kiewa basin

The Kiewa basin (Figure 6.3-1) is located in northern Victoria and drains to the Murray River. The Kiewa River is approximately 100 kilometres long, extending from the Bogong High Plains, draining northward to the Murray River.

Figure 6.3-1 Map of the Kiewa basin

6.3.1 Water resources overview

In 2012–13, rainfall in the Kiewa basin was 60% to 80% of the long-term average in its north-west and 80% to 100% in its south-east. Catchment inflows were 89% of the long-term average, compared to 123% in 2011–12. The volume of water flowing out of the Kiewa River into the Murray basin represented 91% of the Kiewa basin's total inflows.

The major water storages in the Kiewa basin finished the year at 71% of capacity, compared with 68% of capacity at the start of the year.

Only one unregulated stream in the Kiewa basin was subject to diversion restrictions during 2012–13: Stage 5 restrictions were imposed for Bight Creek in January 2013 and remained in place through to the end of June. Diversions from all other streams in the basin were unrestricted throughout the year. There were no urban water restrictions imposed during 2012–13, with all towns remaining on permanent water saving rules throughout the year.

Table 6.3-1 shows the responsibilities of the authorities within the Kiewa basin.

Table 6.3-1 Responsibilities for water resources management in the Kiewa basin

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Goulburn–Murray Water	Manages private diversions		
North East Water		Supplies towns across the basin, including Wodonga and Mount Beauty	Obliged to meet passing flow requirements
AGL Hydro			Operates reservoirs in the upper parts of the Kiewa basin for hydropower generation Obliged to meet passing flow requirements
North East Catchment Management Authority			Manages waterways for the whole of the Kiewa basin

Environmental Water Reserve

Important environmental assets, such as threatened remnant vegetation and the Murray Cod, exist in the reaches of the West Kiewa and Lower Kiewa rivers and depend on water from the Environmental Water Reserve (EWR) in the Kiewa basin. Water from the Kiewa basin also flows into the Murray River, helping to protect environmental assets within the Murray basin.

In 2012–13, the EWR in the Kiewa basin comprised the following components:

- water set aside for the environment through flow-sharing arrangements, and the operation of passing flows released as a condition of bulk entitlements held by North East Water and AGL Hydro Ltd
- 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.

6.3.2 Surface water resources

6.3.2.1 Water balance

In 2012–13 the total volumes of water available and supplied from water resources in the Kiewa basin are shown in Table 6.3-2 Balance of surface water in the Kiewa basin. Inflows to the Kiewa basin, which are shared between New South Wales and Victoria, are reported as a consolidated volume. Outflows from the Kiewa basin are shared on a fifty-fifty basis between Victoria and New South Wales in the Murray system.

Outflows from the Kiewa basin were lower in 2012–13 (Table 6.3-2) than those reported in the 2011–12 Victorian Water Accounts. Only a small proportion of the surface water resources in the Kiewa basin (1.7%) was extracted for consumptive use.

Table 6.3-2 Balance of surface water in the Kiewa basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	20,213	18,920
Volume in storage at end of year	21,045	20,213
Change in storage	**832**	**1,293**
Inflows		
Catchment inflow(1)	612,663	850,533
Rainfall on major storages	3,598	4,918

Water account component	2012–13 (ML)	2011–12 (ML)
Treated wastewater discharged back to river	321	328
Total inflows	**616,583**	**855,779**
Outflows		
Diversions		
Urban diversions	598	481
Licensed diversions from unregulated streams	6,124	2,290
Small catchment dams	3,927	3,927
Total diversions	***10,649***	***6,699***
Losses		
Evaporation losses from major storages	2,763	2,432
Evaporation from small catchment dams	1,099	1,099
In-stream infiltration to groundwater, flows to floodplain and evaporation	40,398	52,538
Total losses	***44,260***	***56,069***
Water passed at outlet of basin		
Kiewa basin outflow to Murray River – Victoria share	280,421	395,859
Kiewa basin outflow to Murray River – NSW share	280,421	395,859
Total water passed at outlet of basin	***560,841***	***791,718***
Total outflows	**615,751**	**854,486**

Note:

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

6.3.2.2 Storages and flows

Storage levels for all major on-stream and off-stream storages in the basin were 21,303 ML (71% of capacity) by the end of June 2013 compared to 20,349 ML (68% of capacity) at the start of July 2012 (Table 6.3-3). The volume reported in the 'catchment inflow less regulated releases' column is the balancing item for each storage. It represents the flow of water in or out of the storage that is not shown as rainfall or evaporation, and may include other minor components influencing the change in storage during the year.

Table 6.3-3 Storage volumes in the Kiewa basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Lake Guy	1,416	261	194	149	72	378
Rocky Valley	28,294	19,952	3,404	2,614	(75)	20,667
Total on-stream storages	***29,710***	***20,213***	***3,598***	***2,763***	***(3)***	***21,045***
Off-stream storages						
Clover Pondage	255	136	n/a	n/a	122	258
Pretty Valley Basin	500	500	n/a	n/a	0	500
Total off-stream storages	***755***	***636***	***n/a***	***n/a***	***122***	***758***
Total storages	**30,465**	**20,849**	**3,598**	**2,763**	**119**	**21,803**

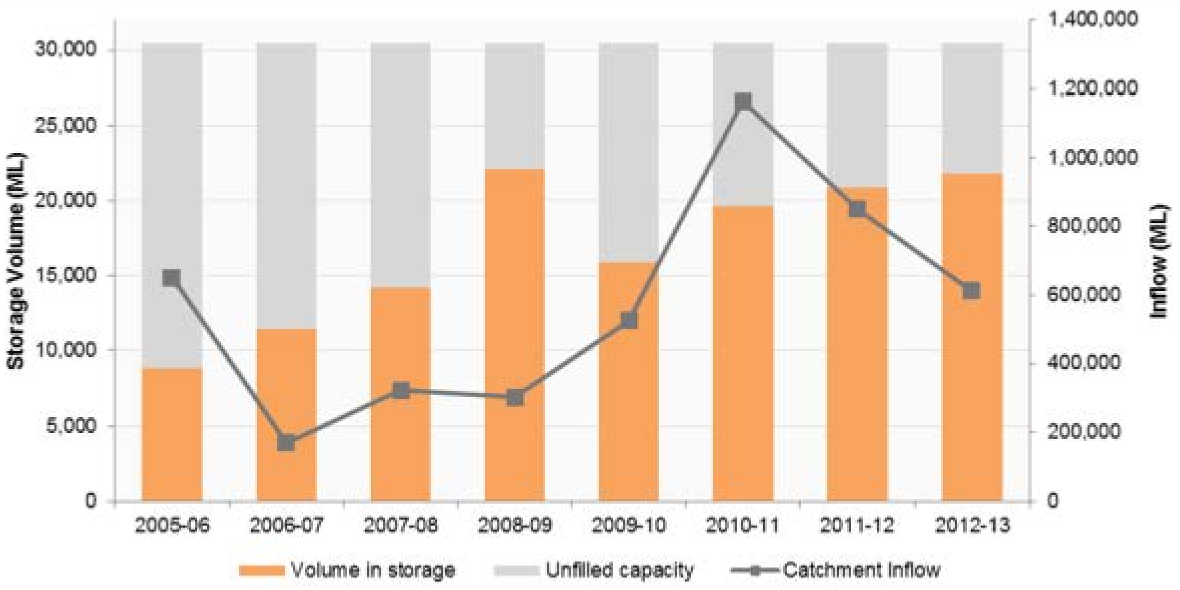
n/a: Information not available.

The catchment inflow volume for 2012–13 was 612,663 ML, representing 89% of the long-term average of 689,000 ML. The volume of water flowing from the Kiewa basin into the Murray River decreased to 560,841 ML in 2012–13 (including the New South Wales share of Kiewa River flows under the Murray–Darling Basin Agreement). This volume was approximately 230,000 ML less than the 2011–12 outflow volume of 791,718 ML. The volume of water flowing from the Kiewa basin into the Murray River in 2012–13 represented 91% of the total inflows into the Kiewa basin, which is similar to the percentage of inflows in the previous year.

Figure 6.3-2 illustrates total storage volume and catchment inflows for 2012–13 compared to the previous seven years.

Kiewa basin

Figure 6.3-2 All major storages and catchment inflows



6.3.2.3 Entitlement volumes and diversions

In the Kiewa basin, surface water is diverted by North East Water and licensed diverters, and water is harvested in small catchment dams.

Entitlements include rights granted to individuals (for example water shares and take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the Victorian Environmental Water Holder). Rights to water in the Kiewa basin are outlined in Table 6.3-4.

Table 6.3-4 Entitlement volumes in the Kiewa basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Kiewa – Hydro) Conversion Order 1997[(1)]	0
Bulk Entitlement (Kiewa – Tangambalanga) Conversion Order 2000	179
Bulk Entitlement (Mount Beauty – Tawonga) Conversion Order 1997	718
Bulk Entitlement (Yackandandah) Conversion Order 2001[(2)]	209
Take and use licences – unregulated surface water	15,814
Total volume of water entitlements in the Kiewa basin	**16,921**

Note:
(1) This bulk entitlement held by AGL Hydro Ltd is for non-consumptive purposes. All water diverted under this entitlement must be returned to the waterway.
(2) The volume of the Yackandandah bulk entitlement was increased by 31.3 ML to 209.3 ML to formally recognise North East Water's purchase of entitlement in 2005 and 2006 to supplement Yackandandah's water supply.

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.3-5. Diversions under these bulk entitlements are assessed against the Murray–Darling basin annual cap target for the Murray–Kiewa–Ovens valley. Details of this assessment are published annually in the Murray–Darling Basin Authority's *Water Audit Monitoring Report.*

Table 6.3-5 Allocation account balance summary for the Kiewa basin

Water entitlement	Allocation issued	Net trade In / (Out)	Water use	End of season forfeitures
Kiewa – Hydro[(1)]	0	0	0	0
Kiewa – Tangambalanga	179	0	0	(179)
Mount Beauty – Tawonga	718	0	(390)	(328)
Yackandandah	209	0	(208)	(1)
Take and use licences – unregulated surface water	15,814	0	(6,124)	(9,690)

Note:
(1) This bulk entitlement held by AGL Hydro Ltd is for non-consumptive purposes. 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.

The estimated volume of water harvested from small catchment dams in the Kiewa basin is provided in Table 6.3-6.

Table 6.3-6 Estimated small catchment dam information for the Kiewa basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	3,972	1,986	n/a
Registered commercial and irrigation	2,311	1,941	n/a
Total	**6,283**	**3,927**	**5,026**

n/a: Information not available.

6.3.3 Recycled water

There are four wastewater treatment plants in the Kiewa basin: three are operated by North East Water and the Dinner Plain Treatment Plant is operated by East Gippsland Water. The volume of water recycled and an indication of its end use purpose is provided in Table 6.3-7. In addition to the recycled water reported in below, 137 ML was returned from the Falls Creek Alpine Resort to Rocky Valley Creek during the water year.

Table 6.3-7 shows the volumes of water recycled in the Kiewa basin in 2012–13.

Table 6.3-7 Volume of recycled water in the Kiewa basin

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process(2))	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other(3) (ML)
				Urban and industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Baranduda	0	0	0%	0	0	0	0	0	0
Dinner Plain	53	53	100%	0	53	0	0	0	0
Mount Beauty	184	0	0%	0	0	0	0	184	0
Yackandandah	72	72	100%	0	72	0	0	0	0
Total 2012–13	**309**	**125**	**40%**	**0**	**125**	**0**	**0**	**184**	**0**
Total 2011–12	331	126	38%	0	126	0	0	205	0

Notes:

(1) 'Beneficial allocation' refers to volume used to deliver specific environmental flow benefits.

(2) 'Within process' refers to water reused in sewage treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site effluent storage or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.4 Ovens basin

The Ovens basin (Figure 6.4-1) is located in north-east Victoria and covers an area of 7,985 square kilometres. Its area extends from the Murray River in the north to the Great Dividing Range in the south, and is bordered by the Broken basin in the west and the Kiewa basin in the east.

Figure 6.4-1 Map of the Ovens basin

6.4.1 Water resources overview

In 2012–13, rainfall across the Ovens basin was generally between 60% and 80% of the long-term average, with the lower catchment receiving 80%-100%. Catchment inflows in 2012–13 were 70% of the long-term average annual volume, after being close to average in 2011–12 and almost double the average in 2010–11. The volume of water flowing out of the Ovens basin into the Murray River represented 95% of the Ovens basin's total inflows.

The total volume of water held in major storages in the Ovens basin finished the year at 70% capacity, marginally lower than the 76% at the start of the year. No urban water restrictions were applied in 2012–13.

Licensed diversions on unregulated streams were unrestricted in late 2012. The exceptionally hot, dry summer led to restrictions in several unregulated systems between January and June 2013. These were largely Stage 1 roster restrictions, with Reedy Creek being subject to Stage 5 suspension between March and June 2013.

Table 6.4-1 shows the responsibilities of the authorities within the Ovens basin.

Table 6.4-1 Responsibilities for water resources management

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Goulburn–Murray Water	Supplies primary entitlements on the regulated Ovens and King system	Manages licensed diversions		Operates Lake Buffalo and Lake William Hovell Obliged to meet passing flow requirements
North East Water			Supplies towns including Wangaratta, Bright, Myrtleford, Beechworth and Chiltern	Obliged to meet passing flow requirements
North East Catchment Management Authority				Manages waterways for the whole of the Ovens basin

Environmental Water Reserve

The Lower Ovens River, which contains heritage and iconic reaches, is an important environmental asset that depends on the Environmental Water Reserve (EWR) in the Ovens basin. Water from the Ovens basin also feeds into the Murray basin, helping to maintain the Murray basin's environmental assets.

In 2012–13 the Ovens basin EWR comprised:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Goulburn–Murray Water on the regulated rivers
- water set aside for the environment through flow-sharing arrangements set out in North East Water's bulk entitlements in the unregulated rivers
- water set aside for the environment through the operation of passing flow conditions on licensed diversions, including those set out in the Upper Ovens River Water Management Plan
- all other water in the basin not allocated for consumptive use.

There is also 70 ML of Commonwealth environmental water entitlement held in Lake Buffalo and Lake William Hovell in the Ovens system.

6.4.2 Surface water resources

6.4.2.1 Water balance

The total volumes of water available and supplied from water resources in the Ovens basin are shown in Table 6.4-2. The volume of surface water resources in 2012–13 decreased to 1,238,231 ML, compared to 1,754,256 ML in 2011–12. Total water use increased from the previous year, with total use of 35,947 ML in 2012–13 compared with 26,233 ML in 2011–12.

A surface water balance for the Ovens basin is shown in Table 6.4-2.

Ovens basin

Table 6.4-2 Balance of surface water in the Ovens basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	28,475	27,646
Volume in storage at end of year	26,342	28,475
Change in storage	**(2,133)**	**829**
Inflows		
Catchment inflow[(1)]	1,234,059	1,747,302
Rainfall on major storages	3,009	4,753
Treated effluent discharged back to river	1,253	2,201
Total inflows	**1,238,321**	**1,754,256**
Outflows		
Diversions		
Urban diversions	5,508	5,183
Licensed diversions from regulated streams	6,951	2,812
Licensed diversions from unregulated streams	7,600	2,350
Small catchment dams	15,888	15,888
Total diversions	***35,947***	***26,233***
Losses		
Evaporation losses from major storages	3,441	3,184
Evaporation from small catchment dams	4,514	4,514
In-stream infiltration to groundwater, flows to floodplain and evaporation	14,936	19,216
Total losses	***22,890***	***26,914***
Water passed at outlet of basin		
Ovens basin outflow to Murray River	1,181,616	1,700,280
Total water passed at outlet of basin	***1,181,616***	***1,700,280***
Total outflows	**1,240,454**	**1,753,427**

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

6.4.2.2 Storages and flows

The total volume of water held in major storages in the Ovens basin was 28,475 ML at 1 July 2012 and 26,342 ML or 70% of capacity by end June 2013 (Table 6.4-3). The volume reported in the 'catchment inflow less regulated releases' column in Table 6.4-3 is the balancing item for each storage. It represents the flow of water in or out of the storage that is not shown as rainfall or evaporation, and may include other minor components influencing the change in storage during the year.

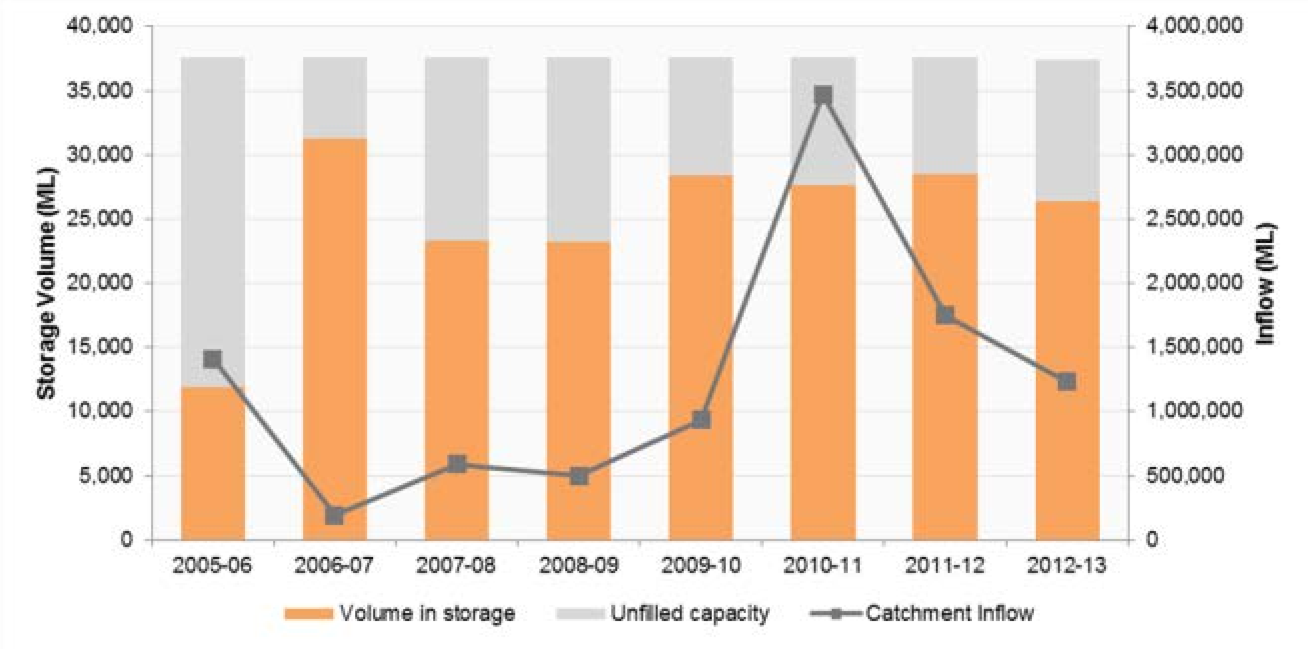
Table 6.4-3 Storage volumes

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Lake Buffalo	23,900	14,586	2,140	2,654	(1,299)	12,773
Lake William Hovell	13,500	13,889	869	787	(402)	13,569
Total storages	**37,400**	**28,475**	**3,009**	**3,441**	**(1,701)**	**26,342**

Catchment inflows in 2012–13 were 70% of the long-term annual average (1,758,000 ML), compared to 99% in 2011–12. The volume of water flowing from the Ovens basin into the Murray River was 1,181,161 ML in 2012–13. This represented 95% of the total inflows into the basin, compared to 97% in 2011–12.

Figure 6.4-2 shows the storage levels and inflow volumes in the Ovens basin from 2005–06 to 2012–13.

Figure 6.4-2 All major storages and catchment inflows



6.4.2.3 Entitlement volumes and diversions

In the Ovens basin, water is diverted by Goulburn–Murray Water, North East Water and licensed diverters, and water is harvested in small catchment dams.

Entitlements in the Ovens basin include rights granted to individuals (for example water shares and take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the Victorian Environmental Water Holder). Rights to water in the Ovens basin are outlined in Table 6.4-4.

Table 6.4-4 Bulk entitlement volumes and diversions

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Ovens System – Goulburn Murray Water) Conversion Order 2004[(1)]	
High reliability water shares	26,261
Spill reliability water shares	12,535
Bulk Entitlement (Ovens System – Moyhu, Oxley and Wangaratta – North East Water) Conversion Order 2004	7,832
Sub-total: Bulk Entitlement (Ovens System – Goulburn Murray Water) Conversion Order 2004	**46,628**
Bulk Entitlement (Beechworth) Conversion Order 2001	**1,100**
Bulk Entitlement (Bright) Conversion Order 2000	**704**
Bulk Entitlement (Chiltern) Conversion Order 2000	**180**
Bulk Entitlement (Glenrowan) Conversion Order 1999	**90**
Bulk Entitlement (Harrietville) Conversion Order 1999	**91**
Bulk Entitlement (Myrtleford) Conversion Order 2001	**1,212**
Bulk Entitlement (Porepunkah) Conversion Order 1999	**166**
Bulk Entitlement (Springhurst) Conversion Order 1999	**36**
Bulk Entitlement (Whitfield) Conversion Order 1999	**34**
Take and use licences – unregulated surface water	**18,125**
Total volume of water entitlements in the Ovens basin	**68,366**

Note:

(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 the townships of Wangaratta, Oxley and Moyhu.

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.4-5. Diversions under these bulk entitlements are assessed against the Murray–Darling basin annual cap target for the Murray–Kiewa–

Ovens valley. Details of this assessment are published annually in the Murray–Darling Basin Authority's *Water Audit Monitoring Report.*

Table 6.4-5 Allocation account balance summary for the Ovens basin

Water entitlement	Allocation issued	Net trade In / (Out)	Water use	End of season forfeitures
Ovens system – Goulburn Murray Water				
Water shares(1)	27,529	0	(6,972)	20,557
Ovens System – Moyhu, Oxley and Wangaratta – North East Water	7,832	0	(3,732)	(4,100)
Diversion: Ovens system – Goulburn Murray Water(2)			**(10,683)**	
Beechworth	1,100	0	(513)	(587)
Bright	704	0	(583)	(121)
Chiltern(3)	180	0	0	(180)
Glenrowan(4)	90	0	0	(90)
Harrietville	91	0	(46)	(45)
Myrtleford	1,212	0	(624)	(588)
Porepunkah(5)	166	0	0	(166)
Springhurst	36	0	0	(36)
Whitfield	34	0	(9)	(25)
Take and use licences – unregulated surface water(6)	18,125	134	(7,600)	(10,659)

Notes:

(1) Water use reported includes 21 ML of environmental in-stream use. This amount is not reflected in the water balance in Table 6.4-2 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 does not include water delivered in-stream for environmental purposes.

(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) North East Water is no longer diverting any water under this bulk entitlement since the connection of Glenrowan to the Wangaratta supply system.

(5) North East Water has not diverted any water under this bulk entitlement since January 2009 when Porepunkah was connected to the Bright supply system.

(6) Net trade encompasses temporary and permanent trades in and out of the Ovens basin, the net value of 133.9 ML represents water traded in from the Upper Ovens GMU.

The estimated volume of water harvested from small catchment dams represents the largest diversion of surface water in the Ovens basin (Table 6.4-6).

Table 6.4-6 Estimated small catchment dam information

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	14,739	7,370	n/a
Registered commercial and irrigation	10,141	8,518	n/a
Total	**24,880**	**15,888**	**20,401**

n/a: Information not available.

6.4.3 Recycled water

North East Water operates all wastewater treatment plants in the Ovens basin. Approximately 34% of the wastewater passing through treatment plants in the basin in 2012–13 was recycled, more than the estimated 25% in 2011–12.

Table 6.4-7 shows the volumes of water recycled in the Ovens basin in 2012–13.

Table 6.4-7 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process[2])	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other[3] (ML)
				Urban and industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Barnawartha	16	16	100%	-	16	-	-	-	-
Beechworth	255	88	34%	-	88	-	-	167	-
Bright / Porepunkah	155	27	17%	27	-	-	-	128	-
Chiltern	40	40	100%	-	40	-	-	-	-
Myrtleford	206	-	0%	-	-	-	-	206	-
Rutherglen / Wahgunyah	125	125	100%	60	66	-	-	-	-
Wangaratta	1,097	346	32%	6	341	-	-	751	-
Total 2012–13	**1,896**	**643**	**34%**	**92**	**551**	**-**	**-**	**1,253**	**-**
Total 2011–12	2,935	734	25%	70	664	-	-	2,201	-

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

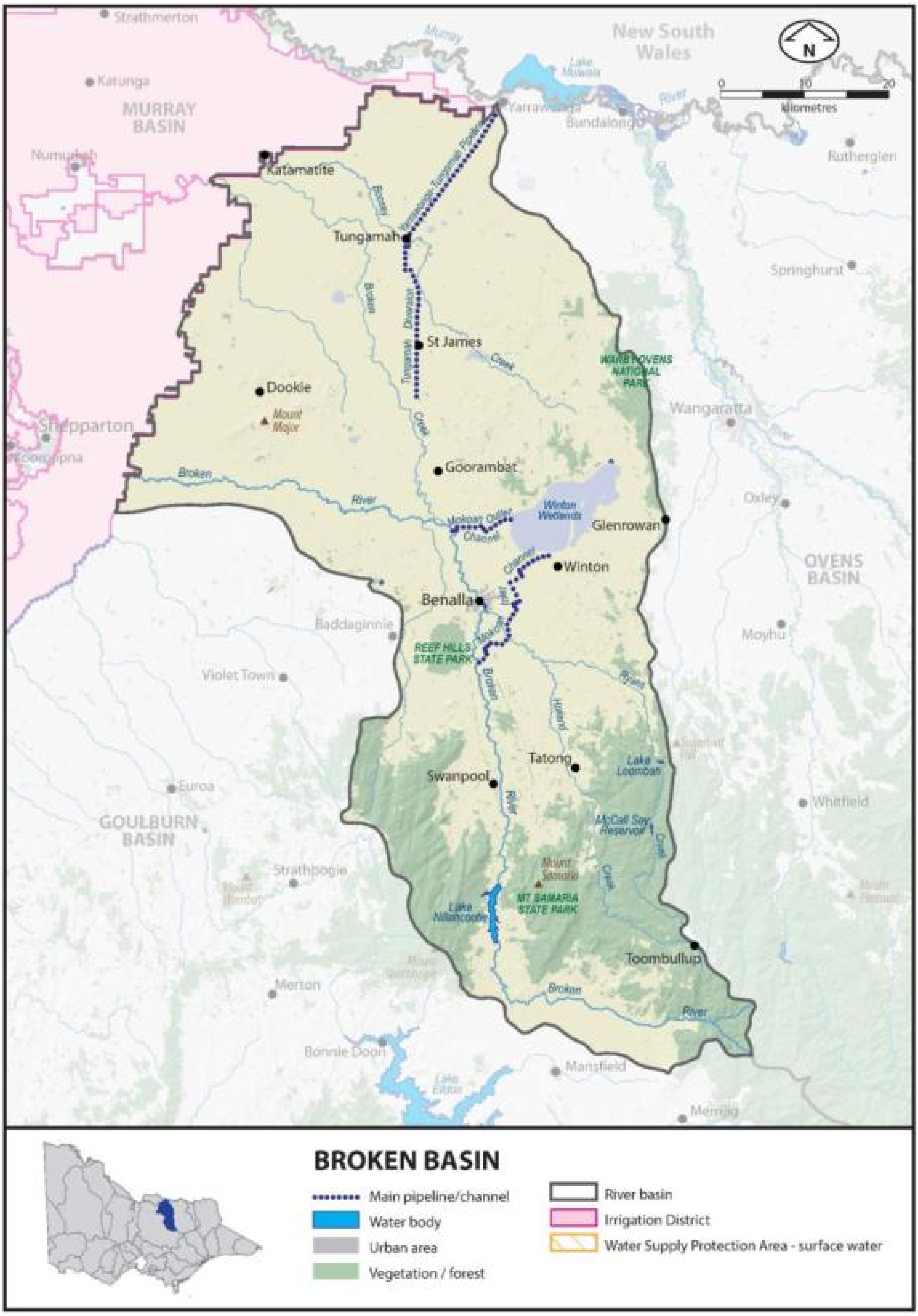
(2) 'Within process' refers to water reused in sewage treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site effluent storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.5 Broken basin

The Broken basin (Figure 6.5-1) is located 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 the water accounts, the Broken basin excludes the Murray Valley Irrigation Area.

Figure 6.5-1 Map of the Broken basin



6.5.1 Water resources overview

In 2012–13, rainfall across the Broken basin was 60% to 80% of its long-term average. Total catchment inflows were 65% of the long-term average and were a marked decrease from the previous year. The amount of water flowing from the Broken basin into the Murray River represented 84% of the total inflows into the basin in 2012–13.

Major storages in the Broken basin were at 62% of capacity at the end of the year, after being at full capacity at the start.

The year began with an 18% allocation for high reliability water shares for Broken system irrigators. By mid-October, high reliability water shares had increased to 100% allocation. Low reliability water shares also reached 100% by the middle of December.

A ban was in place for private diverters on Boosey Creek from November 2012 through to the end of June 2013. A ban was also imposed for Hollands Creek and Ryans Creek in February 2013, which was lifted in early June. Other streams in the Broken basin were unrestricted. There were no restrictions on urban water use in the Broken basin during 2012–13.

Table 6.5-1 shows the responsibilities of the authorities within the Broken basin.

Table 6.5-1 Responsibilities for water resources management in the Broken basin

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Goulburn–Murray Water	Supplies the Tungamah domestic and stock supply system	Manages licensed diversions	Provides bulk water supplies to Goulburn Valley Water(1) and North East Water	Operates Lake Nillahcootie and weirs on Broken River Obliged to meet passing flow requirements
North East Water			Supplies towns across most of the Broken basin, including Benalla	Operates Loombah-McCall Say Reservoir Obliged to meet passing flow requirements
Goulburn Valley Water			Supplies towns in the west of the basin, including Dookie(1)	
Goulburn Broken Catchment Management Authority				Manages waterways for the whole of the Broken basin

Note:

(1) Urban water systems managed by Goulburn Valley Water in the Broken basin are supplied water from the Goulburn and Murray systems.

Environmental Water Reserve

Important environmental assets, such as the Murray Cod, the Trout Cod and significant areas of intact riparian and floodplain vegetation, depend on the Broken basin Environmental Water Reserve (EWR). Similarly dependent are sites in Broken Creek and Lower Broken Creek, which contain native fish habitat and a wetland of national significance. Water from the Broken basin also feeds into the Murray basin, helping to maintain internationally significant environmental assets within that basin.

In 2012–13, the EWR in the Broken basin comprised:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by North East Water and Goulburn–Murray Water
- 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.

Commonwealth environmental water was traded into the Broken basin in 2012–13. A total of 41,179 ML was delivered to Broken Creek to provide elevated baseflows to support native fish habitat and movement in the lower Broken Creek, and 51 ML was delivered to the Broken River to supplement natural fresh flows.

6.5.2 Surface water resources

6.5.2.1 Water balance

A surface water balance for the Broken basin is shown in Table 6.5-2.

Table 6.5-2 Balance of surface water in the Broken basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	42,245	42,423
Volume in storage at end of year	26,220	42,245
Change in storage	**(16,025)**	**(178)**
Inflows		
Catchment inflow(1)	201,296	472,217
Rainfall on major storages	3,042	5,600
Total inflows	**204,338**	**477,817**
Outflows		
Diversions		
Urban diversions	1,478	1,206
Licensed diversions from regulated streams(2)	9,275	5,684
Licensed diversions from unregulated streams	1,315	323
Small catchment dams	15,738	15,738
Total diversions	***27,806***	***22,951***
Losses		
Evaporation losses from major storages	4,203	4,600
Evaporation from small catchment dams	7,227	7,227
In-stream infiltration to groundwater, flows to floodplain and evaporation	9,609	21,833
Total losses	***21,039***	***33,660***
Water passed at outlet of basin		
Broken River at Gowangardie to Goulburn basin	168,572	279,712
Boosey Creek at Tungamah to Murray basin	1,787	89,324
Broken Creek at Katamatite to Murray basin	1,159	52,348
Total water passed at outlet of basin	***171,518***	***421,384***
Total outflows	**220,363**	**477,995**

Notes:

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

(2) The value reported for 2011–12 has been revised from the 2011–12 published report. This value represents the bulk diversion for the supply of licences from the waterway, rather than the final supply to customers. This revision required a recalculation of catchment inflow and thus this is also reported differently to the 2011–12 published number.

6.5.2.2 Storages and flows

The volume of water held in major storages in the Broken basin was 26,220 ML at the end of June 2013, representing a net drawdown of the storage from the start of the year (Table 6.5-3). Table 6.5.3 shows detailed information for Lake Nillahcootie and Loombah-McCall Say Reservoir. The volume reported in the 'catchment inflow less regulated releases' column in Table 6.5-3 is the balancing item for each storage. It represents the flow of water in or out of the storage that is not shown as rainfall or evaporation, and may include other minor components influencing the change in storage during the year.

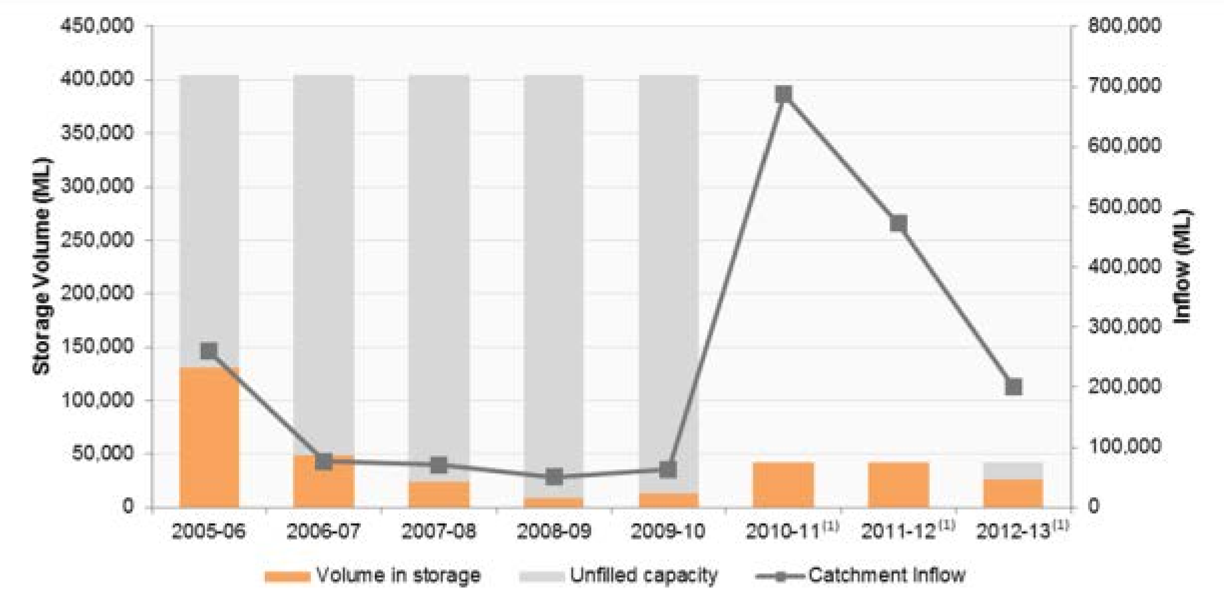
Table 6.5-3 Storage volumes in the Broken basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Lake Nillahcootie	40,400	40,801	2,800	3,375	(15,172)	25,054
Loombah-McCall Say	1,747	1,444	242	828	308	1,166
Total storages	**42,147**	**42,245**	**3,042**	**4,203**	**(14,864)**	**26,220**

Catchment inflows were 65% of the long-term average of 308,000 ML, a decrease compared to the volume of inflows in 2011–12 (Figure 6.5-2).

The amount of water flowing from the Broken basin into the Murray River decreased to 171,518 ML in 2012–13. This represented 84% of the Broken basin's total inflows, compared to 90% in 2011–12.

Figure 6.5-2 All major storages and catchment inflows



Note:

(1) Prior to 2010–11, Lake Mokoan was included as a storage within the Broken basin. Lake Mokoan was decommissioned in 2010 and water supply from this storage ceased, therefore it is no longer included in the total storage capacity for Broken basin.

6.5.2.3 Entitlement volumes and diversions

In the Broken basin, surface water is diverted by Goulburn–Murray Water, North East Water and licensed diverters, and water is harvested in small catchment dams.

Entitlements in the Broken basin include rights granted to individuals (for example water shares and take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the Victorian Environmental Water Holder). Rights to water in the Broken basin are outlined in Table 6.5-4 Entitlement volumes for the Broken basin.

Table 6.5-4 Entitlement volumes for the Broken basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Broken System Goulburn Murray Water) Conversion Order 2004[1]	
High reliability water shares	17,625
Low reliability water shares	3,345
Bulk Entitlement (Broken System – Tungamah Devenish and St James – North East Water) Conversion Order 2004	135
Loss provision	1,850
Sub-total: Bulk Entitlement (Broken System Goulburn Murray Water) Conversion Order 2004	**22,955**
Bulk Entitlement (Loombah McCall-Say) Conversion Order 2001	**2,324**
Take and use licences – unregulated surface water	**2,992**
Total volume of water entitlements in the Broken basin	**28,271**

Note:

(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 the townships of Tungamah, Devenish and St James.

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.5-5 Allocation account balance summary for the Broken basin. Entitlements to water in regulated systems in the Broken basin provide for the right to carry over unused allocation to the next season. In the Broken basin these entitlement holders can carry over unused water up to fifty percent of their entitlement volume; any unused water above this amount is written-off (end of season forfeiture).

Broken basin

Diversions under bulk entitlements in the Broken basin are assessed against the Murray–Darling basin annual cap target for the Goulburn–Broken–Loddon valley. Details of this assessment are published annually in the Murray–Darling Basin Authority's *Water Audit Monitoring Report.*

Table 6.5-5 Allocation account balance summary for the Broken basin

Water entitlement	Opening carryover	Allocation issued	Net trade In / (Out)	Water use	End of season forfeitures	Carried forward to 2013–14
Broken System – Goulburn Murray Water						
Water shares[1]	9,688	11,282	0	(6,291)	(6,075)	8,604
Tungamah, Devenish and St. James	64	68	0	0	(68)	64
Loss provision	-	-	-	(3,035)	-	-
Diversion: Broken system – Goulburn Murray Water[2]				**(9,275)**		
Loombah-McCall Say (Benalla)[3]	-	2,324	0	(1,478)	(846)	-
Take and use licences – unregulated surface water	-	2,992	10	(1,315)	(1,687)	-

Notes:

(1) Water use reported includes 51 ML of environmental in-stream use. This amount is not reflected in the water balance in Table 6.5-2 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 Broken system source bulk entitlement, it does not include water delivered in-stream for environmental purposes.

(3) North East Water transferred its offtake for this bulk entitlement to upstream of Benalla Weir in October 2009, but as yet does not have infrastructure in place to supply water under this entitlement. In 2012–13 these towns continued to be supplied water via a pipeline from Yarrawonga in the Murray system.

The estimated volume of water harvested from small catchment dams represented the largest diversion of surface water in the Broken basin (Table 6.5-6 Estimated small catchment dam information for the Broken basin).

Table 6.5-6 Estimated small catchment dam information for the Broken basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	15,382	7,691	n/a
Registered commercial and irrigation	9,580	8,047	n/a
Total	**24,962**	**15,738**	**22,965**

6.5.3 Recycled water

North East Water operates the sole wastewater treatment plant in the Broken basin at Benalla. The volume of wastewater produced from the Benalla Treatment Plant increased from 318 ML in 2011–12 to 341 ML in 2012–13. As in 2011–12, 100% of the wastewater produced in 2012–13 was recycled. Table 6.5-7 Volume of recycled water in the Broken basin below details the recycling undertaken at Benalla in 2012–13.

Table 6.5-7 Volume of recycled water in the Broken basin

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process[2])	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other[3] (ML)
				Urban and industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Benalla	341	341	100%	0	341	0	0	0	0
Total 2012–13	**341**	**341**	**100%**	**0**	**341**	**0**	**0**	**0**	**0**
Total 2011–12	318	318	100%	0	318	0	0	0	0

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

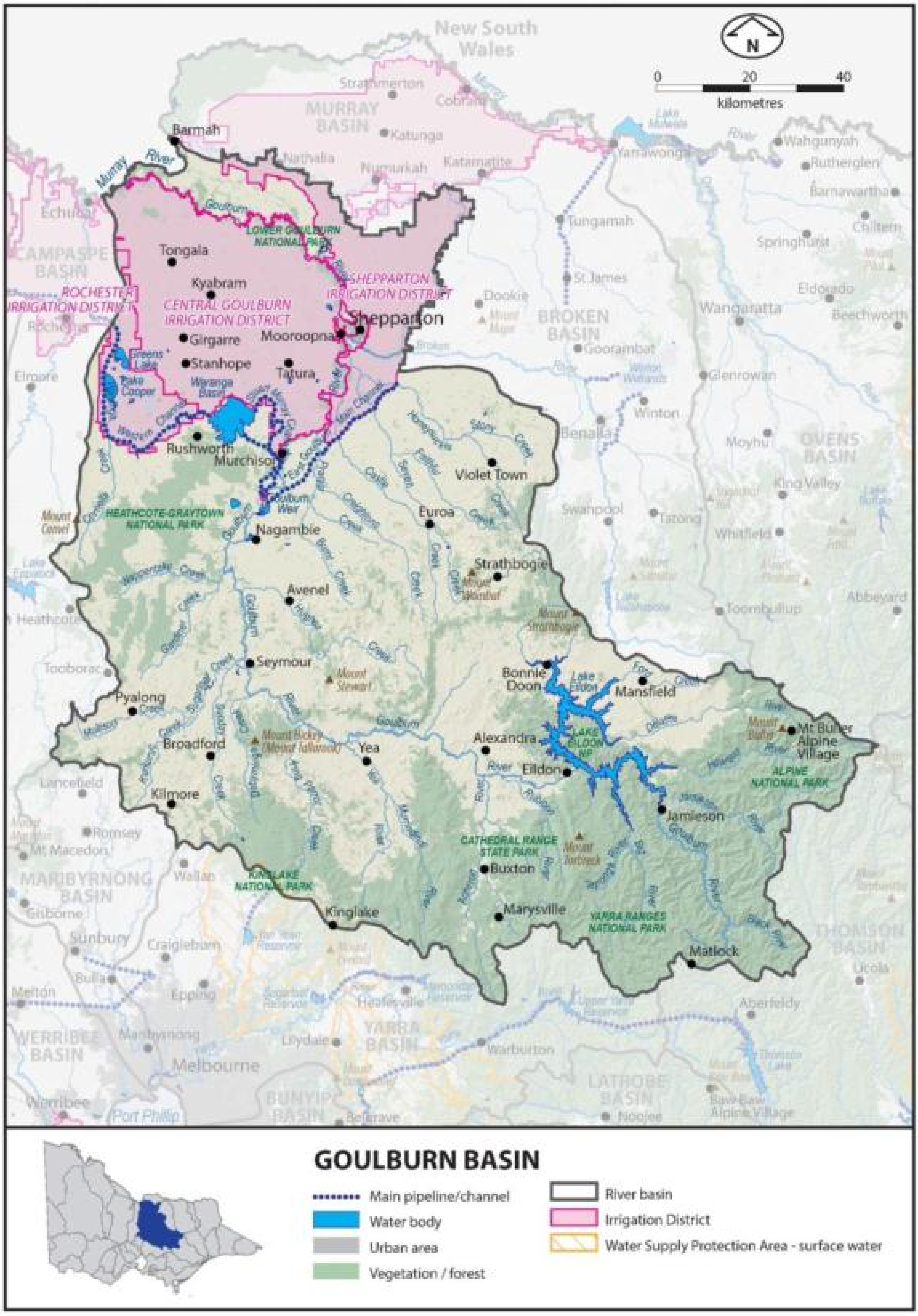
(2) 'Within process' refers to water reused in sewage treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site effluent storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.6 Goulburn basin

The Goulburn basin (Figure 6.6-1) is located in northern Victoria and extends from the Great Dividing Range near Woods Point to the Murray River near Echuca in the north-west.

Figure 6.6-1 Map of the Goulburn basin



6.6.1 Water resources overview

In 2012–13, rainfall across the Goulburn basin was largely between 60% and 80% of the long-term average, with isolated areas receiving 40% to 60%. This was some of the lowest rainfall in the state relative to the long-term average. Catchment inflows were 70% of the long-term average, lower than 2012–13 when inflows were 86% of the average. The amount of water flowing from the Goulburn basin into the Murray River represented 72% of the total inflows into the basin.

The volume of water in major storages in the Goulburn basin started the year at 89% of capacity and ended the year at 66% of capacity.

The seasonal allocation for high reliability water shares started at 61% and reached 100% in October. There was no allocation for low reliability water shares in 2012–13.

The only urban water restrictions during the year were in Pyalong, which was subject to Stage 2 restrictions between March and June 2013. A number of irrigation bans were put in place during 2012–13, peaking in March 2013 with bans on Faithfulls Creek, Seven Creek, Sunday Creek and Hughs Creek. Faithfulls Creek had the longest irrigation ban, lasting from November 2012 to June 2013.

Table 6.6-1 shows the responsibilities of various authorities within the Goulburn basin.

Table 6.6-1 Responsibilities for water resources management in the Goulburn basin

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Goulburn–Murray Water	Supplies Central Goulburn Irrigation District, Rochester Irrigation Area, 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 Obliged to meet passing flow requirements
Goulburn Valley Water			Supplies towns located in the Goulburn basin, including Shepparton, Alexandra and Seymour	Obliged to meet passing flow requirements for towns with supply from unregulated streams
Coliban Water			Supplies towns located in the Loddon and Campaspe basins from the Goulburn basin, including Bendigo	
Melbourne Water			Operates the Silver-Wallaby diversion system to Melbourne	Obliged to meet passing flow requirements
Victorian Environmental Water Holder				Holds and manages environmental entitlements in the basin
Goulburn Broken Catchment Management Authority				Manages waterways for the whole of the Goulburn basin

Environmental Water Reserve

Important environmental assets, such as wetlands of national significance, significant areas of intact riparian and floodplains vegetation, and endangered flora and fauna species (including Trout Cod and Murray Cod), depend on the Environmental Water Reserve (EWR) in the Goulburn basin. Water from the Goulburn basin also feeds into the Murray basin, helping to maintain internationally significant environmental assets such as Gunbower Forest and the Kerang Wetlands within that basin. Sites in the Goulburn basin that rely on the EWR include:

- Lower Goulburn River (downstream of Goulburn Weir) which contains a wetland of national significance, native fish habitat and floodplain national park
- Reedy Swamp, a regionally significant wetland that is part of Lower Goulburn National Park and contains drought refuge and significant habitat for colonial nesting birds
- Barmah Forest, the largest river red gum forest in the world, a Ramsar and Living Murray Icon site, a national park and a site where native fish breed.

In 2012–13, the Goulburn basin EWR comprised:

- the *Environmental Entitlement (Goulburn System – Living Murray 2007*, comprising of 39,625 ML of high reliability water and 156,980 ML of low reliability water held by the Victorian Environmental Water Holder (VEWH)
- the Goulburn River Environmental Entitlement 2010 of 1,432 ML held by the VEWH

- the *Environmental Entitlement (Goulburn System – NVIRP Stage 1) 2012* of 23,535 ML held by the VEWH, which includes mitigation water allocated for the purposes of watering specific environmental sites that have been identified through the Goulburn–Murray Water Connections Project environmental approvals processes
- the *Bulk Entitlement (Snowy – Environment) Order 2005* comprising 30,252 ML of high reliability and 8,156 ML of low reliability entitlement
- water shares – *Snowy River Environmental Reserve* comprising 6,401 ML of high reliability and 17,852 ML of low reliability entitlement held by the VEWH
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements (regulated and unregulated systems) held by Goulburn Valley Water and Goulburn–Murray Water
- water set aside for the environment through the operation of passing flow conditions 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 use.

Commonwealth environmental water was traded into the Goulburn basin in 2012–13. A total of 201,097 ML was delivered to complement natural flows and to improve habitat, migration and breeding opportunities for fish, to provide habitat for macroinvertebrates, and to encourage the recovery of bank vegetation. Parks Victoria also donated 33 ML of water to contribute to flows in late 2012–13.

6.6.2 Surface water resources

6.6.2.1 Water balance

A surface water balance for the Goulburn basin is shown in Table 6.6-2.

Table 6.6-2 Balance of surface water in the Goulburn basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	3,024,175	2,938,806
Volume in storage at end of year	2,366,591	3,024,175
Change in storage	**(657,584)**	**85,369**
Inflows		
Catchment inflow(1)	2,362,390	2,907,820
Rainfall on major storages	74,708	130,180
Inflow from Broken River at Gowangardie	168,572	279,712
Inflow from Loddon via the Goulburn supplement	32,362	0
Return flow from irrigation	0	0
Transfer from Campaspe via Waranga Western Channel	2,796	1,101
Treated wastewater discharged back to river	1,944	1,905
Total inflows	**2,642,772**	**3,320,718**
Outflows		
Diversions		
Urban diversions	25,704	22,495
Irrigation district diversions	1,104,295	965,842
Licensed diversions from regulated streams(2)	49,880	32,407
Licensed diversions from unregulated streams	11,224	9,818
Transfer from Silver and Wallaby creeks to Yarra basin	1,071	1,100
Transfers to Melbourne via North-South pipeline(3)	0	0
Environmental water diversions	0	0
Small catchment dams	47,513	47,513
Total diversions	***1,239,687***	***1,079,175***
Losses		
Evaporation losses from major storages	118,524	109,178

Water account component	2012–13 (ML)	2011–12 (ML)
Losses from small catchment dams	10,065	10,065
In-stream infiltration to groundwater, flows to floodplain and evaporation	208,460	147,720
Total losses	***337,049***	***266,963***
Water passed at outlet of basin		
Goulburn River to Campaspe River via Waranga Western Channel	0	945
Goulburn River outflow to Murray River	1,711,882	1,876,930
Goulburn River outflow to Murray River via Broken Creek	11,738	11,336
Total water passed at outlet of basin	***1,723,620***	***1,889,211***
Total outflows	**3,300,356**	**3,235,349**

Notes:

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

(2) The value reported for 2011–12 has been revised from the 2011–12 published report. This revision required a recalculation of catchment inflow and thus this is also reported differently to the 2011–12 published number.

(3) There were no transfers to the Yarra basin via the North-South pipeline in the 2011–12 water year.

6.6.2.2 Storages and flows

Levels for all major storages in the basin were 2,542,166 ML at the end June 2013, or 66% of the total storage capacity, compared to 3,409,117 ML at the start of July 2012 (Table 6.6-3). The volume reported in the ‘catchment inflow less regulated releases’ column in Table 6.6-3 is the balancing item for each storage. It represents the flow of water in or out of the storage that is that is not shown as rainfall or evaporation, and may include other minor components influencing the change in storage during the year.

Only volumes for major on-stream storages have been included in the water balance; major off-stream storages such as Waranga Basin and Greens Lake have not been included.

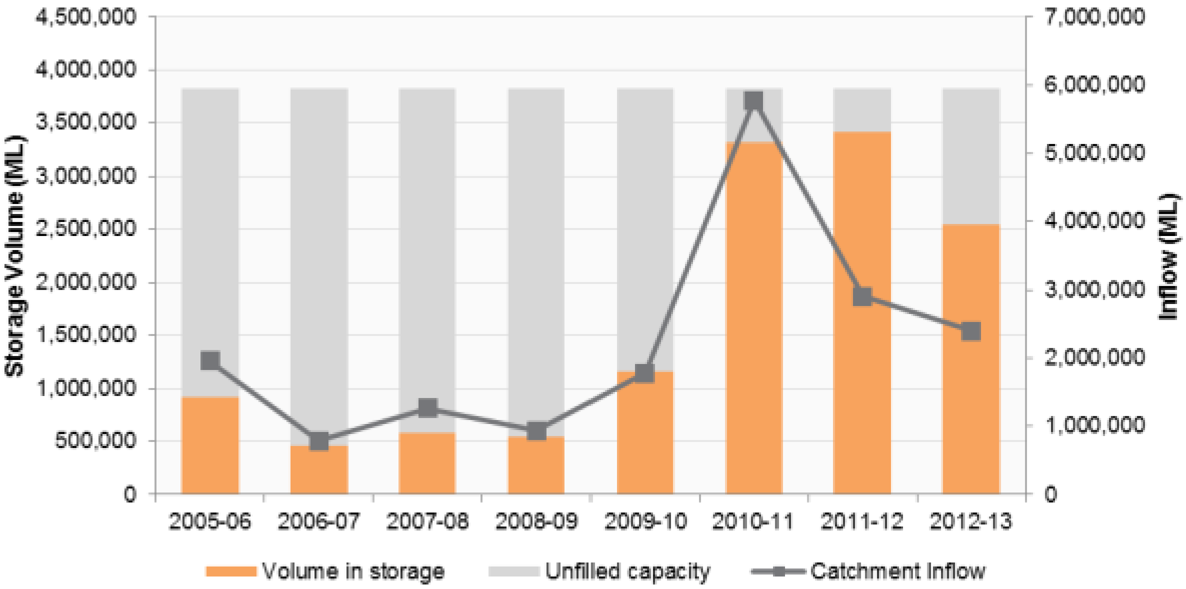
Table 6.6-3 Storage volumes in the Goulburn basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Goulburn Weir	25,500	25,177	3,845	13,289	9,232	24,965
Lake Eildon	3,334,158	2,997,348	70,798	105,046	(623,124)	2,339,976
Sunday Creek Reservoir	1,700	1,650	65	189	124	1,650
Total on-stream storages	***3,361,358***	***3,024,175***	***74,708***	***118,524***	***(613,768)***	***2,366,591***
Off-stream storages						
Greens Lake	32,440	17,329	1,112	5,381	(2,623)	10,436
Waranga Basin	432,362	367,613	14,389	52,998	(163,865)	165,139
Total off-stream storages	***464,802***	***384,942***	***15,501***	***58,379***	***(166,488)***	***175,575***
Total storages	**3,826,160**	**3,409,117**	**90,209**	**176,903**	**(780,256)**	**2,542,166**

Catchment inflows to the Goulburn basin in 2012–13 were 70% of the long-term average, lower than the 86% of long-term average in 2011–12 (Figure 6.6-2).

The amount of water flowing from the Goulburn basin into the Murray River decreased to 1,723,620 ML in 2012–13. This represented 72% of the total inflows into the Goulburn basin, an increase from 64% in 2011–12.

Figure 6.6-2 All major storages and catchment inflows in the Goulburn basin



6.6.2.3 Entitlement volumes and diversions

Goulburn–Murray Water, Coliban Water, Goulburn Valley Water, Grampians Wimmera Mallee Water, the Melbourne metropolitan retailers (City West Water, South East Water and Yarra Valley Water) and AGL Hydro Ltd all hold bulk entitlements in the Goulburn basin. Surface water is also diverted by licensed diverters and is harvested in small catchment dams.

Entitlements in the Goulburn basin include rights granted to individuals (for example water shares and take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the VEWH). Rights to water in the Goulburn basin are outlined in Table 6.6-4.

Table 6.6-4 Entitlement volumes in the Goulburn basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Eildon – Goulburn Weir) Conversion Order 1995[(1)]	
High reliability water shares	995,606
Low reliability water shares	439,483
High reliability supply by agreements	4,484
Low reliability supply by agreements	1,851
Water allowances – Water works districts	1,912
BE (Goulburn Channel System – CW) Order 2012[(2)]	2,420
BE (Goulburn River – GVW) Order 2012[(3)]	26,299
BE (Goulburn Channel System – GVW) Order 2012[(4)]	7,191
Bulk Entitlement (Quambatook – Grampians Wimmera Mallee Water) Order 2006	100
Goulburn System – Melbourne Metropolitan Retailers	
Bulk Entitlement (Goulburn System – City West Water) Order 2012[(5)]	n/a
Bulk Entitlement (Goulburn System – South East Water) Order 2012[(5)]	n/a
Bulk Entitlement (Goulburn System – Yarra Valley Water) Order 2012[(5)]	n/a
Sub-total: Goulburn System – Melbourne Metropolitan Retailers	0
Environmental Entitlement (Goulburn System – Living Murray) 2007	196,605
Bulk Entitlement (Goulburn System – Snowy Environmental Reserve) Order 2004	38,408
Goulburn River Environmental Entitlement 2010	1,432
Loss provision[(6)]	393,100
Sub-total: Bulk Entitlement (Eildon – Goulburn Weir) Conversion Order 1995	**2,108,891**
Bulk Entitlement (Broadford, Kilmore and Wallan) Conversion and Augmentation Order 2003[(7)]	**2,875**
Bulk Entitlement (Buxton) Conversion Order 1995	**110**
Bulk Entitlement (Euroa System) Conversion Order 2001	**1,990**
Bulk Entitlement (Longwood) Conversion Order 1995	**120**

Goulburn basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Mansfield) Conversion Order 1995	**1,300**
Bulk Entitlement (Marysville) Conversion Order 1995	**462**
Bulk Entitlement (Pyalong) Conversion Order 1997	**75**
Silver and Wallaby Creeks – Melbourne Metropolitan Retailers	
Bulk Entitlement (Silver & Wallaby Creeks – Melbourne Water for City West Water Limited) Conversion Order 2006(8)	n/a
Bulk Entitlement (Silver & Wallaby Creeks – Melbourne Water for South East Water Limited) Conversion Order 2006(8)	n/a
Bulk Entitlement (Silver & Wallaby Creeks – Melbourne Water for Yarra Valley Water Limited) Conversion Order 2006(8)	n/a
Sub-total: Silver and Wallaby Creeks – Melbourne Metropolitan Retailers	**22,000**
Bulk Entitlement (Strathbogie) Conversion Order 2012	**23**
Bulk Entitlement (Thornton) Conversion Order 1995	**120**
Bulk Entitlement (Upper Delatite) Conversion Order 1995	**235**
Bulk Entitlement (Violet Town) Conversion Order 1997	**20**
Bulk Entitlement (Woods Point) Conversion Order 1995	**30**
Bulk Entitlement (Yea) Conversion Order 1997	**438**
Environmental Entitlement (Goulburn System – NVIRP Stage 1) 2012	**28,449**
Bulk Entitlement (Rubicon – Southern Hydro Ltd) Conversion Order 1997(9)	**0**
Silver and Wallaby Creeks Environmental Entitlement 2006	**n/a**
Take and use licences – unregulated surface water	**25,871**
Total volume of water entitlements in the Goulburn basin	**2,193,009**

Notes:

(1) Under G-MW'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 Grampians Wimmera Mallee Water for towns supplied from irrigation districts, and entitlements held by the VEWH.

(2) This bulk entitlement is granted in July 2012 to consolidate the Boort, Dingee, Lockington, Macorna, Mitiamo, Mysia, Pyramid Hill and Rochester entitlements.

(3) This bulk entitlement is granted in July 2012 to consolidate the Alexandra, Bonnie Doon, Eildon, Mooroopna, Murchison, Nagambie, Seymour and Shepparton entitlements.

(4) The bulk entitlement is granted in July 2012 to consolidate the Colbinabbin, Corop, Dookie, Girgarre, Katandra West, Kyrabram, Rushworth, Stanhope, Tatura and Tongala entitlements.

(5) The Retail Water Corporations hold equal shares to this bulk entitlement which were granted in July 2013 in the Goulburn system.

(6) The volume specified is the loss entitlement volume recorded in the Victorian Water Register.

(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 retail water corporations hold an equal share of the 22,000 ML bulk entitlement on the Silver and Wallaby Creeks. Compliance with a three year diversion limit of 66,000 ML is assessed using a three-year rolling total diversion.

(9) The Rubicon – Southern Hydro Limited bulk entitlement held by AGL Hydro Ltd is for non-consumptive purposes and therefore the volume has not been included. Any water diverted under this entitlement is returned to the watercourse.

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.6-5. Entitlements to water in regulated systems in the Goulburn basin provide for the right to carry over unused allocation to the next season. In the Goulburn 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; 333,969 ML was written off due to actual spill events in 2012–13.

The VEWH holds *Bulk Entitlement (Goulburn System – Snowy Environmental Reserve) Order 2004* in trust for the Snowy River. Allocation to the entitlement is traded out of VEWH environmental accounts to supply consumptive users who would otherwise have been supplied through water diverted from the Snowy system. By reducing the demand by consumptive users for water from the Snowy system, this water can be used to maximise environmental flows in both the Snowy River and the Murray River. Information on this entitlement is available in Table 4-3 in Chapter 4.

Diversions under bulk entitlements for 2012–13 are presented in Table 6.6-5. Diversions under these bulk entitlements are assessed against the Murray–Darling basin annual cap target for the Goulburn–Broken–Loddon valley. Details of this assessment are published annually in the Murray–Darling Basin Authority's *Water Audit Monitoring Report.*

Table 6.6-5 Allocation account balance summary for the Goulburn basin

Water entitlement	Opening carryover	Allocation issued	Net trade In/(Out)	Water use	Write-off due to spill	End of season forfeitures	Carried forward to 2013–14
Eildon – Goulburn Weir							
Water shares	933,290	995,160	(148,469)	(1,077,710)	(317,142)	(40,499)	344,629
Supply by agreements	6,110	4,661	(836)	(4,136)	(3,071)	(420)	2,307
Water allowances – Water works districts	-	1,919	0	(1,118)	-	(801)	-
Goulburn Channel System – CW	1,976	2,420	0	(1,937)	(1,168)	(127)	1,164
Goulburn River and Eildon – GVW	2,209	26,299	(11,321)	(15,381)	(1,306)	(32)	468
Goulburn Channel System – GVW	1,074	7,191	(1,650)	(5,199)	(635)	11	791
Quambatook – GWMWater	54	100	30	(126)	(32)	(6)	20
Goulburn System – Melbourne Retailers	0	0	0	0	0	0	0
Environmental Entitlement Goulburn System – Living Murray(1)	33,053	39,625	34,598	(50,344)	(10,071)	(2,343)	44,518
Goulburn System – Snowy Environmental Reserve(1)	0	7,853	(7,853)	n/a	0	0	0
Goulburn River Environmental Entitlement(1)	1,432	996	0	(1,886)	(543)	0	0
Operating provisions (whole of system)(2)	-	-	-	150,315	-	-	-
Loss provisions	-	-	-	(221,525)	-	-	-
Diversion: Eildon – Goulburn Weir(3)				**(1,176,818)**			
Broadford, Kilmore and Wallan	-	2,238	0	(1,136)	-	(1,102)	-
Buxton	-	110	0	0	-	(110)	-
Euroa System	-	1,990	0	(738)	-	(1,252)	-
Longwood	-	120	0	(78)	-	(42)	-
Mansfield	-	1,300	0	(576)	-	(724)	-
Marysville	-	462	0	(158)	-	(304)	-
Pyalong	-	75	0	(36)	-	(39)	-
Silver and Wallaby Creeks – Melbourne metropolitan retailers	-	22,000	0	(1,071)	-	(20,929)	-
Strathbogie	-	23	0	(12)	-	(11)	-
Thornton	-	120	0	0	-	(120)	-
Upper Delatite	-	235	0	(91)	-	(144)	-
Violet Town	-	20	0	0	-	(20)	-
Woods Point	-	30	0	(9)	-	(21)	-
Yea	-	438	0	(227)	-	(211)	-
Goulburn System – NVIRP Stage 1	9,725	18,722	218,157	(219,302)	0	(1,365)	25,937
Rubicon – Southern Hydro Ltd	-	-	-	-	-	-	-
Silver and Wallaby Creeks Environmental Entitlement	-	-	-	-	-	-	-
Take and use licences – unregulated surface water	-	25,871	(20)	(11,224)	-	(14,627)	-

Notes:

(1) The water use reported here is in-stream use and is therefore not included in the calculation of total diversion for the Eildon – Goulburn Weir bulk entitlement.

(2) This reflects use of water to manage the system including net transfer of water to off-stream storages (largely explained by draw down of Waranga basin and Greens Lake during the water year).
(3) 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.

The estimated volume of water harvested from small catchment dams in the Goulburn basin is provided in Table 6.6-6.

Table 6.6-6 Estimated small catchment dam information for the Goulburn basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	35,876	17,938	n/a
Registered commercial and irrigation	35,207	29,574	n/a
Total	**71,084**	**47,513**	**57,578**

n/a: No information available.

6.6.3 Recycled water

Goulburn Valley Water operates all wastewater treatment plants in the Goulburn basin. Approximately 78% of the volume of wastewater passing through treatment plants in the basin was recycled, similar to 2011–12. The percentage of wastewater that was recycled varied at each treatment plant. In addition to the recycled water reported below, 152 ML was returned from the Mount Bulla Resort to Black Dog Creek and other waterways during the water year.

Table 6.6-7 shows the volumes of water recycled in the Goulburn basin in 2012–13.

Table 6.6-7 Volume of recycled water

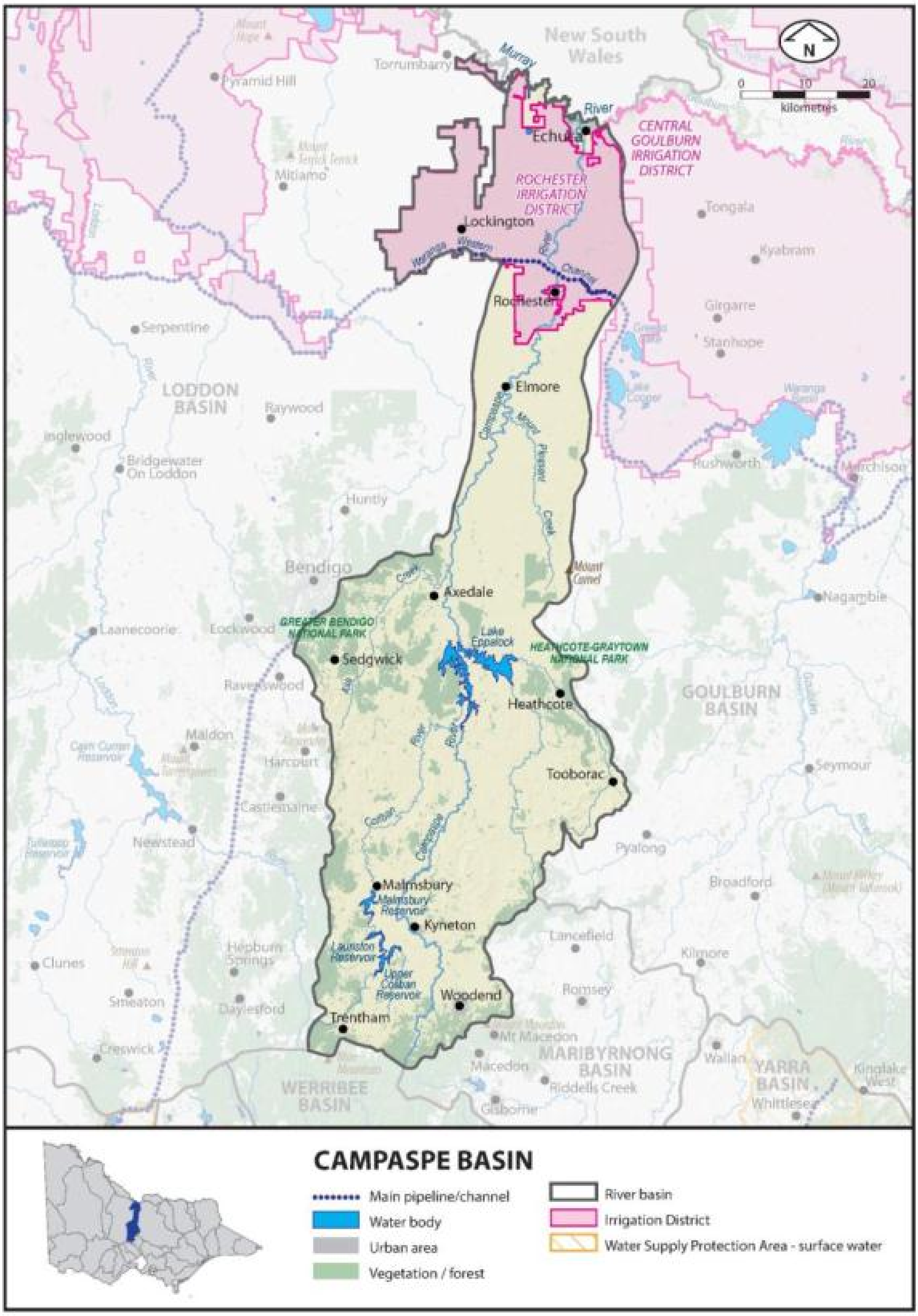
Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process(2))	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other(3) (ML)
				Urban and industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Alexandra	196	57	29%	0	57	0	0	139	0
Avenel	35	5	14%	0	5	0	0	30	0
Bonnie Doon	22	22	100%	0	22	0	0	0	0
Broadford	212	82	39%	0	82	0	0	130	0
Eildon	103	0	0%	0	0	0	0	103	0
Euroa	302	142	47%	60	83	0	0	160	0
Girgarre	0	0	0%	0	0	0	0	0	0
Kilmore	333	318	95%	0	318	0	0	15	0
Kyabram/Merrigum	385	385	100%	0	385	0	0	0	0
Mansfield	327	180	55%	72	108	0	0	147	0
Marysville	67	67	100%	48	19	0	0	0	0
Mooroopna	435	435	100%	0	435	0	0	0	0
Murchison	0	0	0%	0	0	0	0	0	0
Nagambie	88	19	22%	0	19	0	0	69	0
Seymour	706	586	83%	67	519	0	0	120	0
Shepparton	3,614	2,912	81%	0	2,912	0	0	702	0
Stanhope/Rushworth	20	20	100%	0	20	0	0	0	0
Tatura	1,027	850	83%	0	850	0	0	178	0
Tongala	310	310	100%	0	310	0	0	0	0
Upper Delatite	29	29	100%	0	29	0	0	0	0
Violet Town	10	10	100%	0	10	0	0	0	0
Yea	109	109	100%	46	64	0	0	0	0
Total 2012–13	**8,330**	**6,538**	**78%**	**291**	**6,247**	**0**	**0**	**1,792**	**0**
Total 2011–12	7,856	6,165	78%	184	5,981	0	0	1,691	0

Notes:
(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.
(2) 'Within process' refers to the water reused in sewage treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.
(3) 'Other' refers to a change in on-site effluent storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.7 Campaspe basin

The Campaspe basin (Figure 6.7-1) occupies 417,900 hectares of north-central Victoria. It extends 150 kilometres south from the Murray River to the Great Dividing Range and is 45 kilometres across at its widest point.

Figure 6.7-1 Map of the Campaspe basin



6.7.1 Water resources overview

Rainfall across the Campaspe basin in 2012–13 ranged from 60% to 80% of the long-term average, in contrast to the previous year when rainfall was generally above average. In contrast with the lower rainfall, the catchment inflow volume also increased to 47% of the long-term average, compared to 44% in 2011–12.

The year began with a 100% allocation for high reliability water shares for Campaspe system irrigators. Low reliability water shares also reached 100% by the middle of January. The Campaspe Irrigation District was decommissioned during 2011–12. Allocations in 2012–13 represent irrigators' rights to divert directly from the river. The volume of water in major storages in the Campaspe basin finished the year lower than it began, largely due to lower levels at Lake Eppalock. Campaspe storages held 88% of capacity at the start of the year and 78% at the end of June 2013. Accordingly, irrigation bans were put in place on 21 waterways in the basin between November 2012 and June 2013. However, there were no urban water restrictions in the Campaspe basin during 2012–13.

Table 6.7-1 shows the responsibilities of the authorities within the Campaspe basin.

Table 6.7-1 Responsibilities for water resources management in the Campaspe basin

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Goulburn–Murray Water	Supplies Rochester Irrigation District and Campaspe Irrigation District	Manages licensed diversions	Provides bulk water supply to Coliban Water	Operates Lake Eppalock Obliged to meet passing flow requirements
Coliban Water	Provides irrigation and domestic and stock supplies off the Coliban Main Channel		Supplies urban water for the majority of the Campaspe basin, including Echuca, Rochester and Kyneton	Operates Upper Coliban, Lauriston and Malmsbury Reservoirs in the upper reaches of the Campaspe basin Obliged to meet passing flow requirements
Western Water			Supplies urban water for Woodend at the southern end of the basin	Obliged to meet passing flow requirements
Victorian Environmental Water Holder				Holds and manages environmental entitlements in the basin
North Central Catchment Management Authority				Manages waterways in the whole of the Campaspe basin

Environmental Water Reserve

Important environmental assets, such as endangered flora and fauna species (including Murray Cod and Painted Snipe) and communities of threatened riparian vegetation, depend on the Environmental Water Reserve (EWR) in the Campaspe basin. 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 2012–13, the Campaspe basin EWR comprised:

- the *Campaspe River Environmental Entitlement 2013* (granted on 1 July 2013 and held by the Victorian Environmental Water Holder (VEWH)) which in 2012–13 comprised 8,020 ML facilitated through an allocation bank account and water use registration prior to the granting of the environmental entitlement
- the *Environmental Entitlement (Campaspe River – Living Murray Initiative) 2007* comprising 126 ML of high reliability and 5,048 ML of low reliability entitlement held by the VEWH
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Coliban Water, Western Water and Goulburn–Murray Water
- 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.

Commonwealth environmental water was traded into the Campaspe system in 2012–13. A total of 6,821 ML of water was delivered to meet a number of environmental objectives including providing connectivity for fish movement, promoting river red gum recruitment and supporting aquatic habitat for macroinvertebrates.

6.7.2 Surface water resources

6.7.2.1 Water balance

A surface water balance for the Campaspe basin is shown in Table 6.7-2.

Table 6.7-2 Balance of surface water in the Campaspe basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	330,507	362,316
Volume in storage at end of year	290,238	330,507
Change in storage	**(40,269)**	**(31,809)**
Inflows		
Catchment inflow(1)	165,079	155,699
Rainfall on major storages	15,548	26,439
Return flow from irrigation	0	0
Transfer from Waranga Western Channel to Lake Eppalock	361	1,661
Transfer to Campaspe basin from Waranga Western Channel	0	945
Treated wastewater discharged back to river	577	652
Total inflows	**181,565**	**185,396**
Outflows		
Diversions		
Urban diversions	16,643	12,617
Diversion for Coliban Water rural entitlements	10,809	2,599
Campaspe Irrigation District diversions(2)	0	8,917
Licensed diversions from regulated streams	11,558	4,256
Licensed diversions from unregulated streams	3,275	460
Small catchment dams	28,776	28,776
Transfer from Campaspe basin to Western Waranga Channel	2,796	1,101
Transfer from Campaspe Basin to White Swan Reservoir	43	110
Total diversions	***73,900***	***58,835***
Losses		
Evaporation losses from major storages	44,366	45,905
Losses from small catchment dams	14,794	14,794
In-stream infiltration to groundwater, flows to floodplain and evaporation	7,496	6,505
Total losses	***66,656***	***67,204***
Water passed at outlet of basin		
Campaspe River outflow to Murray River	81,278	91,165
Total water passed at outlet of basin	***81,278***	***91,165***
Total outflows	**221,834**	**217,204**

Notes:

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

(2) Campaspe Irrigation District has now been decommissioned.

6.7.2.2 Storages and flows

Levels for all major storages in the basin totalled 292,864 ML (78% of capacity) by the end of June 2013 compared to 333,162 ML (88% of capacity) in July 2012 (Table 6.7-3). In the Campaspe basin, major on-stream storages include Lake Eppalock, the Lauriston, Malmsbury and Upper Coliban reservoirs. The volume reported in the ‘catchment inflow less regulated releases’ column in Table 6.7-3 is the balancing item for each storage. It represents the flow of water in or out of the storage that is not shown as rainfall or evaporation, and may include other minor components influencing the change in storage during the year.

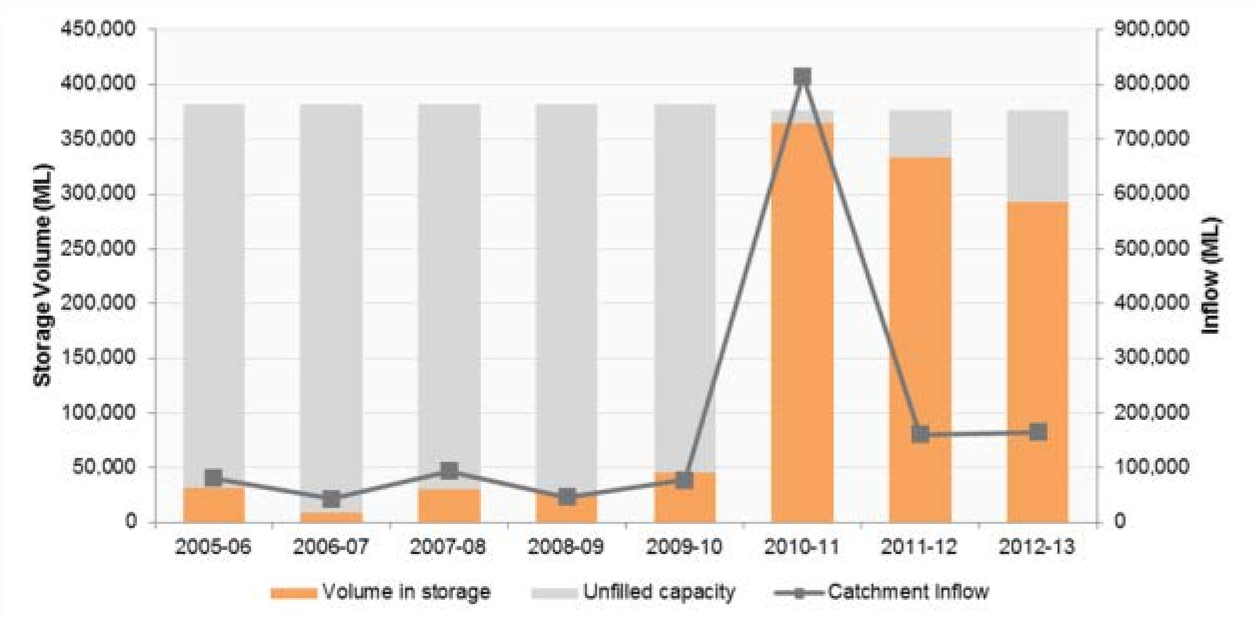
Campaspe basin

Table 6.7-3 Storage volumes in the Campaspe basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Lake Eppalock	304,651	271,779	10,402	35,780	(14,891)	231,510
Lauriston Reservoir	19,790	15,270	1,806	2,703	897	15,270
Malmsbury Reservoir	12,034	5,568	980	1,926	946	5,568
Upper Coliban Reservoir	37,770	37,890	2,360	3,957	1,596	37,890
Total on-stream storages	***374,245***	***330,507***	***15,548***	***44,366***	***(11,451)***	***290,238***
Off-stream storages						
Campaspe Weir	2,624	2,655	n/a	n/a	(29)	2,626
Total off-stream storages	***2,624***	***2,655***	***n/a***	***n/a***	***(29)***	***2,626***
Total storages	**376,869**	**333,162**	**15,548**	**44,366**	**(11,480)**	**292,864**

Catchment inflows to the Campaspe basin amounted to 165,122 ML in 2012–13, which is 47% of the long-term average (352,000 ML). This was a slight increase from 2011–12 when inflows were 44% of the long-term average (Figure 6.7-2). The amount of water flowing from the Campaspe basin into the Murray River in 2012–13 was 81,278 ML, representing 49% of the total inflows to the basin.

Figure 6.7-2 All major storages and catchment inflows in the Campaspe basin



6.7.2.3 Entitlement volumes and diversions

Goulburn–Murray Water, Coliban Water and Western Water hold bulk entitlements in the Campaspe basin. Surface water is also diverted by licensed diverters and harvested in small catchment dams.

Entitlements include rights granted to individuals (for example water shares and take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the VEWH. Rights to water in the Campaspe basin are outlined in Table 6.7-4.

Table 6.7-4 Entitlement volumes in the Campaspe basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Campaspe System – Goulburn Murray Water) Conversion Order 2000[1]	
High reliability water shares	37,831
Low reliability water shares	19,175
Bulk Entitlement (Axedale Goornong and Rochester) Conversion Order 1999[2]	349
Environmental Entitlement (Campaspe River – Living Murray Initiative) 2007	5,174
Plus provision for system operation	21,061
Sub-total: Bulk Entitlement (Campaspe System – Goulburn Murray Water) Conversion Order 2000	**83,590**
Bulk Entitlement (Campaspe System – Coliban Water) Conversion Order 1999	
Rural entitlements	15,742
Urban commitments	34,518
Sub-total: Bulk Entitlement (Campaspe System – Coliban Water) Conversion Order 1999	**50,260**
Bulk Entitlement (Trentham) Conversion Order 2012	**120**
Bulk Entitlement (Woodend) Conversion Order 2004	**470**
Take and use licences – unregulated surface water	**3,333**
Total volume of water entitlements in the Campaspe basin	**137,773**

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 and Goornong bulk entitlement and to supply the VEWH's environmental entitlement.

(2) Coliban Water also supplies Rochester under a bulk entitlement in the Goulburn system.

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.7-5. 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; 21,651 ML was written off due to actual spill events in 2012–13.

Diversions under these bulk entitlements are assessed against the Murray–Darling basin annual cap target for the Campaspe valley. Details of this assessment are published annually in the Murray–Darling Basin Authority's *Water Audit Monitoring Report*.

The VEWH holds an environmental entitlement for the Campaspe River, but the water available under the entitlement is used to support streamflows and is not diverted out of the waterway.

Table 6.7-5 Allocation account balance summary for the Campaspe basin

Water entitlement	Opening carryover	Allocation issued	Net trade In/(Out)	Water use	Write-off due to spill	End of season forfeitures	Carried forward to 2013–14
Campaspe System – Goulburn Murray Water							
Water shares[1]	41,983	57,004	(25,611)	(25,039)	(21,195)	(4,508)	22,635
Axedale, Goornong and Rochester	755	349	0	(61)	(456)	(257)	332
Campaspe River – Living Murray Initiative[2]	1	5,174	0	(3,406)	-	0	1,768
Supplement to the Goulburn system[3]	-	-	-	(2,796)	-	-	-
Plus provision for system operation	-	-	-	0	-	-	-
Diversion: Campaspe System – Goulburn Murray Water				**(14,414)**			
Campaspe System – Coliban Water							
Rural entitlements	-	15,742	0	(5,406)	-	(10,336)	-
Urban commitments	-	34,518	0	(13,117)	-	(21,401)	-
Plus provision for system operation	-	-	-	(8,534)	-	-	-
Diversion: Campaspe System – Coliban Water				(27,057)			
Trentham	-	120	0	(109)	-	(11)	-
Woodend	-	470	0	(225)	-	(245)	-
Take and use licences – unregulated surface water (GMW)	-	3,333	0	(3,275)	-	0	-

Notes:

(1) 13,481 ML of the water use reported here is environmental in-stream use and is therefore not included in the calculation of total diversion for the Campaspe system – Goulburn Murray Water bulk entitlement.

(2) The water use reported here is in-stream use and is therefore not included in the calculation of total diversion for the Campaspe system – Goulburn Murray Water bulk entitlement.

(3) The supplement supplies 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.

The estimated volume of water harvested from small catchment dams represents the largest diversion of surface water in the Campaspe basin (Table 6.7-6).

Table 6.7-6 Estimated small catchment dam information for the Campaspe basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	15,036	7,518	n/a
Registered commercial and irrigation	25,307	21,258	n/a
Total	**40,343**	**28,776**	**43,570**

n/a: No information available.

6.7.3 Recycled water

Coliban Water operates all wastewater treatment plants in the Campaspe basin except the Woodend Treatment Plant, which is operated by Western Water. Around 73% of the wastewater discharged from treatment plants in the basin was recycled, mostly for agricultural use (Table 6.7-7).

Table 6.7-7 Volume of recycled water in the Campaspe basin

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process(2))	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other(3) (ML)
				Urban and industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Axedale	14	14	100%	14	0	0	0	0	0
Echuca	1,017	1,017	100%	0	1,017	0	0	0	0
Elmore	0	0	0%	0	0	0	0	0	0
Heathcote	175	146	83%	146	0	0	0	29	0
Kyneton	690	339	49%	94	245	0	0	351	0
Lockington	0	0	0%	0	0	0	0	0	0
Rochester	0	0	0%	0	0	0	0	0	0
Woodend	251	56	22%	34	21	0	1	197	(2)
Total 2012–13	**2,147**	**1,572**	**73%**	**288**	**1,283**	**0**	**1**	**577**	**(2)**
Total 2011–12	2,554	1,942	76%	254	1,687	0	1	652	(40)

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

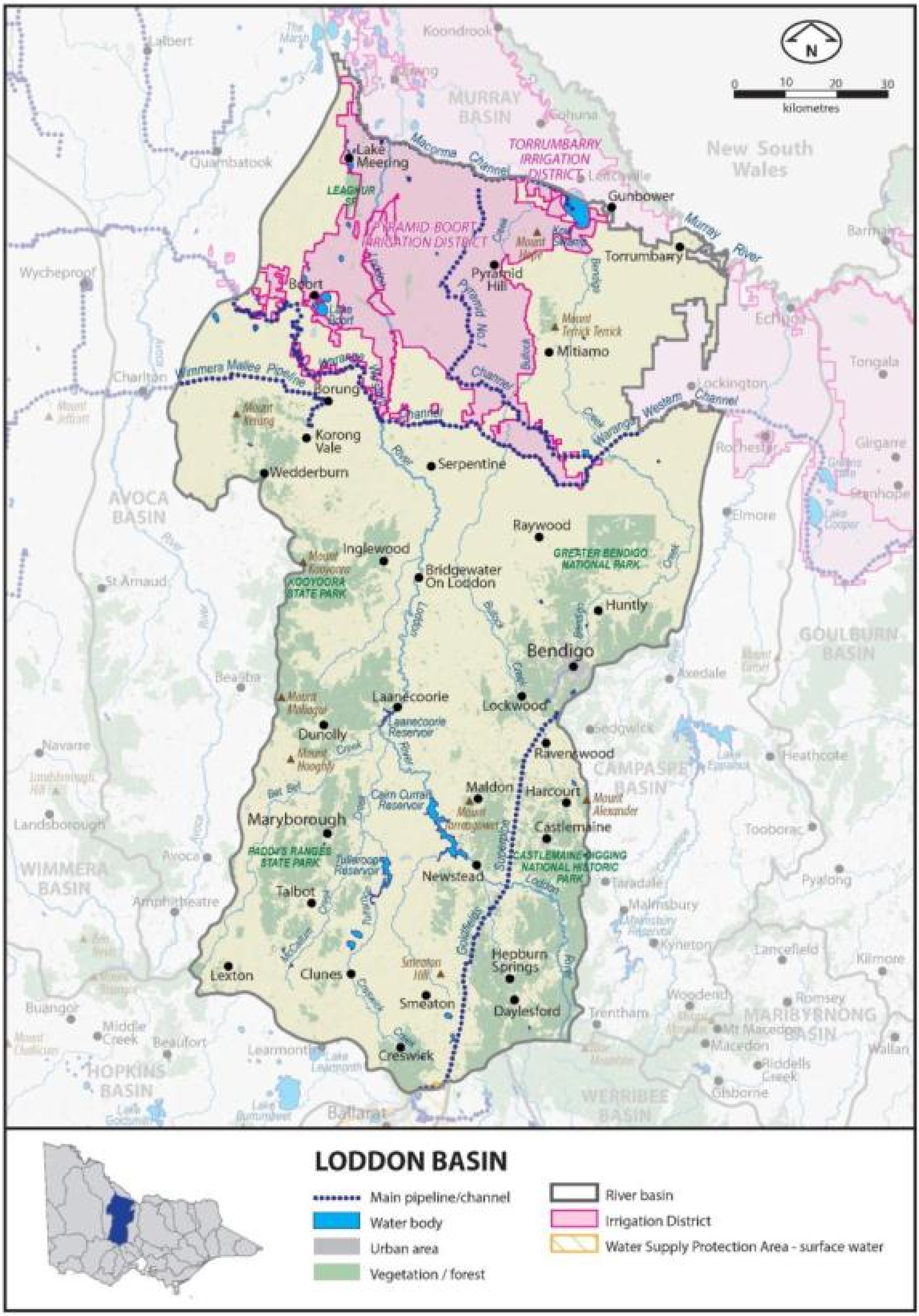
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site wastewater storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.8 Loddon basin

The Loddon basin (Figure 6.8-1) is located in northern Victoria and includes the Loddon River, Bullarook River and various other small tributaries such as Bendigo Creek. The basin is crossed by the Waranga Western Channel, which provides water to users in the Loddon basin from the Goulburn basin (ie the Pyramid Hill – Boort Irrigation District). For the purposes of the water accounts, the Loddon basin excludes the Torrumbarry Irrigation Area, which is mostly supplied from the Murray River.

Figure 6.8-1 Map of the Loddon basin



6.8.1 Water resources summary

In 2012–13, rainfall across the Loddon basin was between 60% and 80% of the long-term average and slightly lower than the previous year. In line with the lower rainfall, the catchment inflow volume was 52% of the long-term average, which is the same as in 2011–12.

The volume of water in major storages in the Loddon basin were at 85% of capacity at the start of the year and by the end of June 2013 were at 62%.

The year began with an 61% allocation for high reliability water shares for the Loddon system. By the start of October, Loddon high reliability water shares had increased to 100% allocation. Loddon low reliability water shares did not receive allocation for the 2012–13 year. Water shares in the Bullarook system had 100% high reliability and 100% low reliability allocation by mid-July.

Bans on licensed diversions were in place for a majority of streams in the Loddon basin during summer, with most continuing into autumn.

In January 2013, long-standing urban water restrictions were lifted for the townships of Raywood and Sebastian, after the pipeline connecting the towns to the Bendigo water supply system was completed. No other towns in the basin were subject to urban restrictions during 2012–13, remaining on permanent water saving rules throughout the year.

Table 6.8-1 shows the responsibilities of the authorities within the Loddon basin.

Table 6.8-1 Responsibilities for water resources management in the Loddon basin

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Goulburn–Murray Water	Supplies Pyramid-Boort irrigation district and domestic and stock supplies in Normanville area sourced from the Goulburn basin	Manages licensed diversions	Provides bulk supply to Coliban Water for towns supplied from the Loddon and Campaspe systems, including Pyramid Hill, Boort and Bendigo	Operates major reservoirs including Cairn Curran, Laanecoorie and Tullaroop 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	Obliged to meet passing flow requirements
Coliban Water			Supplies towns in the eastern part of the Loddon basin including Bendigo, Castlemaine, Pyramid Hill and Boort	
Victorian Environmental Water Holder				Holds and manages environmental entitlements in the basin
North Central Catchment Management Authority				Manages waterways for the whole of the Loddon basin

Environmental Water Reserve

Important environmental assets, such as endangered flora and fauna species (including Murray Cod and Painted Snipe) and communities of threatened riparian vegetation, depend on the Environmental Water Reserve (EWR) in the Loddon basin. Water from the Loddon basin also feeds into the Murray basin, helping to maintain internationally significant environmental assets including the Kerang Wetlands. Specifically, Gunbower Forest has Ramsar-listed wetlands which support 37 threatened and endangered flora and fauna species; these wetlands are shallow freshwater marshes and freshwater meadows, both of which are rare. Tullaroop Creek in the Loddon River system also has a population of regionally significant Blackfish.

In 2012–13, the Loddon basin EWR comprised:

- the *Bulk Entitlement (Loddon River – Environmental Water Reserve) Order 2005*, of 2,000 ML high reliability, 2,024 ML low reliability and 7,490 ML of provisional reliability water entitlements held by the Victorian Environmental Water Holder (VEWH)
- 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

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Central Highlands Water and Goulburn–Murray Water
- 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.

A total of 2,746 ML of Commonwealth environmental water was traded into the Loddon basin in 2012–13 to support vegetation health and fish movement, improve macroinvertebrate habitat, and to maintain water quality.

6.8.2 Surface water resources

6.8.2.1 Water balance

Total surface water use in 2012–13 increased by around 53,000 ML compared to 2011–12 largely due to a transfer of 32,263 ML to the Goulburn basin.

A surface water balance for the Loddon basin is shown in Table 6.8-2.

Table 6.8-2 Balance of surface water in the Loddon basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	200,771	212,985
Volume in storage at end of year	148,483	200,771
Change in storage	**(52,288)**	**(12,214)**
Inflows		
Catchment inflow(1)	194,784	195,230
Rainfall on major storages	11,699	15,743
Treated wastewater discharged back to river	4,470	4,910
Total inflows	**210,953**	**215,884**
Outflows		
Diversions		
Urban diversions	3,604	3,387
Licensed diversions and irrigation diversions from regulated streams(2)	13,370	5,344
Transfer to Goulburn basin (through Loddon supplement) (2)	32,362	n/a
Licensed diversions from unregulated streams	16,610	4,205
Small catchment dams	50,037	50,037
Total diversions	***115,983***	***62,973***
Losses		
Evaporation losses from major storages	34,255	34,959
Losses from small catchment dams	29,579	29,579
In-stream infiltration to groundwater, flows to floodplain and evaporation	24,404	26,979
Total losses	***88,238***	***91,517***
Water passed at outlet of basin		
Loddon River outflow to Murray River (Appin South)	51,808	44,789
Wandella Creek at Fairley	0	0
Mount Hope Creek at Mitiamo	4,317	23,869
Bullock Creek, Calivil Creek and Nine Mile Creek	2,896	4,949
Total water passed at outlet of basin	***59,020***	***73,607***
Total outflows	**263,241**	**228,098**

Notes:

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

(2) These line items have been calculated differently to previous water years. The licenced diversion amount now represents the bulk diversion for the supply of licences from the waterway, rather than the final supply to customers. The transfer to the Goulburn system represents Loddon water transferred to supply Goulburn water shares. An update to the 2011–12 values has not been made as the necessary volumes were not available at the time of printing.

6.8.2.2 Storages and flows

The volume of water held in major storages was 150,910 ML (64% of capacity) at the end of June 2013 compared with 203,564 ML (86% of capacity) at the beginning of the year (Table 6.8-3). The volume reported in the 'catchment inflow less regulated releases' column is the balancing item for each storage. It represents the flow of water in or out of the storage that is not shown as rainfall or evaporation, and may include other minor components influencing the change in storage during the year.

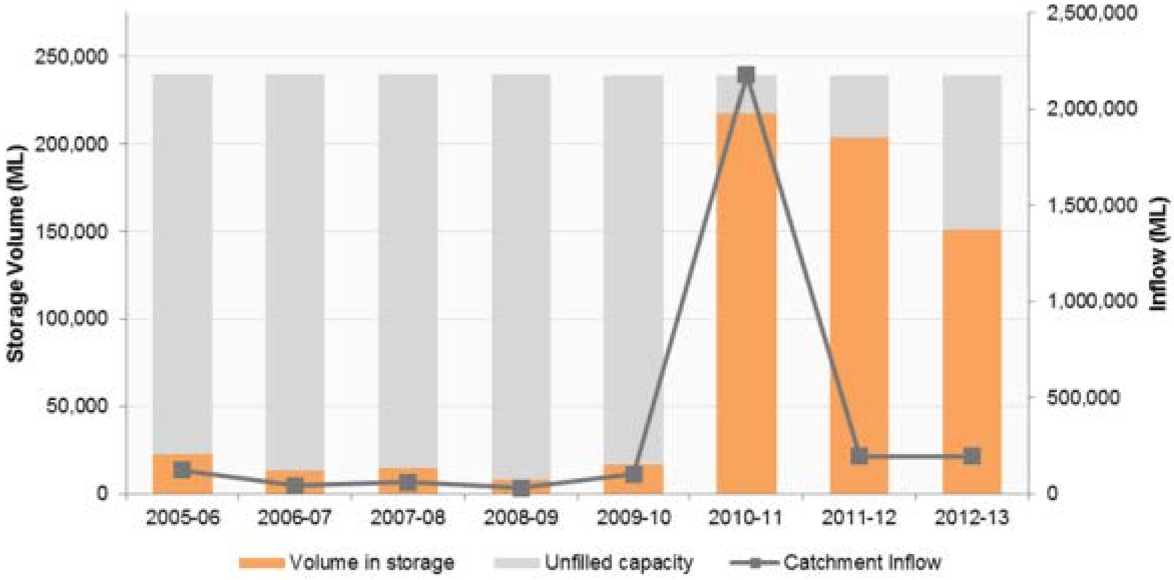
Only volumes for major on-stream storages are included in the water balance; off-stream storages are not included. The volume of water in the major on-stream storages in the basin was 148,483 ML at the end of the year, compared to 200,771 ML at the start. Cairn Curran Reservoir, which comprises nearly two-thirds of the storage capacity in the basin, finished the year with 97,400 ML in storage (66% of capacity).

Table 6.8-3 Storage volumes in the Loddon basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Cairn Curran Reservoir	147,130	131,391	6,875	20,120	(20,746)	97,400
Hepburn Lagoon	2,457	1,725	1,151	1,218	(666)	992
Laanecoorie Reservoir	7,940	2,938	747	3,885	5,006	4,806
Newlyn Reservoir	3,012	2,523	707	746	(1,095)	1,389
Tullaroop Reservoir	72,950	62,194	2,219	8,286	(12,231)	43,896
Total on-stream storages	***233,489***	***200,771***	***11,699***	***34,255***	***(29,732)***	***148,483***
Off-stream storages						
Evansford Reservoir	1,346	1,257	76	n/a	(442)	891
Sandhurst Reservoir	2,590	1,312	98	287	189	1,312
Spring Gully Reservoir	1,680	224	77	303	226	224
Total off-stream storages	***5,616***	***2,793***	***251***	***590***	***(27)***	***2,427***
Total storages	**239,105**	**203,564**	**11,950**	**34,845**	**(29,759)**	**150,910**

Catchment inflow volume for 2012–13 was 194,766 ML, representing 52% of the long-term average, the same as in 2011–12 (Figure 6.8-2). The amount of water flowing from the Loddon basin was 59,020 ML in 2012–13. This represents 28% of the total Loddon basin inflows.

Figure 6.8-2 All major storages and catchment inflows in the Loddon basin



6.8.2.3 Entitlement volumes and diversions

In the Loddon basin, surface water is diverted by Goulburn Murray Water, Central Highlands Water, Coliban Water, the Victorian Environmental Water Holder (VEWH) who all hold bulk entitlements in the basin. Surface water is also diverted by licensed diverters and harvested in small catchment dams.

Entitlements in the Loddon basin include rights granted to individuals (for example water shares and take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the VEWH). Rights to water in the Loddon basin are outlined in Table 6.8-4.

Table 6.8-4 Entitlement volumes in the Loddon basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Loddon System – Goulburn Murray Water) Conversion Order 2005[(1)]	
High reliability water shares – Loddon	21,392
Low reliability water shares – Loddon	8,083
Water allowances – Water works districts	205
Bulk Entitlement (Loddon River – Environmental Reserve) Order 2005	4,024
Bulk Entitlement (Loddon System – Part Maryborough – Central Highlands Water) Conversion Order 2005	1,200
Bulk Entitlement (Loddon System – Coliban Water) Conversion Order 2005	820
Goulburn supplement[(2)]	86,000
Sub-total: Bulk Entitlement (Loddon System – Goulburn Murray Water) Conversion Order 2005	**121,724**
Bulk Entitlement (Bullarook system – Goulburn Murray Water) Conversion Order 2009[(3)]	
High reliability water shares – Bullarook	758
Low reliability water shares – Bullarook	381
Bulk Entitlement (Bullarook System – Central Highlands Water) Conversion Order 2009	500
Environmental Entitlement (Birch Creek – Bullarook System) 2009	100
Sub-total: Bulk Entitlement (Bullarook system – Goulburn Murray Water) Conversion Order 2009	**1,739**
Bulk Entitlement (Creswick) Conversion Order 2004	**500**
Bulk Entitlement (Daylesford – Hepburn Springs) Conversion Order 2004	**916**
Bulk Entitlement (Evansford-Talbot System-Part Maryborough-Central Highlands Water) Conversion Order 2006	**3,000**
Bulk Entitlement (Lexton) Conversion Order 2004	**45**
Take and use licences – unregulated surface water	**23,175**
Total volume of water entitlements in the Loddon basin	**151,099**

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) The Loddon system – GMW 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, supplies from the Loddon system can be used to supplement the Goulburn system.

(3) 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.

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.8-5. 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 fifty percent of their entitlement volume, any unused water above this amount is written off (end of season forfeiture).

Diversions under these bulk entitlements are assessed against the Murray–Darling basin annual cap target for the Goulburn–Broken–Loddon Valley. Details of this assessment are published annually in the Murray–Darling Basin Authority's *Water Audit Monitoring Report.*

The VEWH did not divert any water available under the Bulk Entitlement (Loddon River – Environmental Reserve) Order 2005 to off-stream wetlands in 2012–13. Water released under the entitlement (2,745.5 ML) was used to support streamflows in the Loddon River.

Table 6.8-5 Allocation account balance summary for the Loddon basin

Water entitlement	Opening carryover	Allocation issued	Net trade In / (Out)	Water use	End of season forfeitures	Carried forward to 2013–14
Loddon System – Goulburn Murray Water						
Water shares – Loddon	10,543	13,619	(5,834)	(9,952)	(2,369)	6,007
Water allowances – Water Works Districts	0	205	0	0	(205)	0
Loddon River – Environmental Reserve(1)	2,000	2,000	2,746	(2,746)	(2,000)	2,000
Loddon System – Part Maryborough – Central Highlands Water	900	1,200	0	(1,116)	(84)	900
Loddon System – Coliban Water	390	431	0	(405)	(25)	390
Loddon supplement(2)	-	-	-	(32,362)	-	-
Operating provisions (whole of system)(3)	-	-	-	(2,460)	-	-
Diversion: Loddon system – Goulburn Murray Water(4)				**(46,295)**		
Bullarook System – Goulburn Murray Water						
Water shares – Bullarook	434	705	0	(958)	(31)	149
Bullarook System – Central Highlands Water	238	263	0	(18)	(245)	238
Environmental Entitlement Birch Creek – Bullarook System	51	0	0	0	(51)	0
Diversion: Bullarook system – Goulburn Murray Water(5)				**(976)**		
Creswick	-	500	0	(12)	(488)	-
Daylesford – Hepburn Springs	-	916	0	(671)	(245)	-
Lexton	-	45	0	(23)	(22)	-
Evansford-Talbot System-Part Maryborough-Central Highlands Water	-	3,000	0	(1,358)	(1,642)	-
Take and use licences – unregulated surface water	-	23,175	0	(16,610)	(6,565)	-

Notes:

(1) The water use reported here is in-stream use and is therefore not included in the calculation of total diversion for the Loddon system – Goulburn Murray Water bulk entitlement.

(2) The Loddon supplement supplies 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.

(3) This reflects use of water to manage the Loddon system, i.e. the amount diverted to Serpentine Creek and not used by customers.

(4) 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.

(5) The water use reported in this line item represents the bulk diversion to supply primary entitlements under the Bullarook system source bulk entitlement.

The estimated volume of water harvested from small catchment dams represents the largest diversion of surface water in the Loddon basin (Table 6.8-6.

Table 6.8-6 Estimated small catchment dam information for the Loddon basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	31,649	15,825	n/a
Registered commercial and irrigation	40,729	34,212	n/a
Total	**72,378**	**50,037**	**79,616**

n/a: No information available.

6.8.3 Recycled water

Coliban Water and Central Highlands Water operate wastewater treatment plants in the Loddon basin. The total volume of wastewater produced in 2012–13 was less than in 2011–12. The proportion of wastewater recycled in 2012–13 increased to 36%, compared to 34% in 2011–12. This is presented in Table 6.8-7.

Table 6.8-7 Volume of recycled water in the Loddon basin

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process(2))	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other(3) (ML)
				Urban and industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Bendigo	5,134	1,671	33%	897	774	0	0	3,463	0
Boort	9	9	100%	0	9	0	0	0	0
Bridgewater/ Inglewood	0	0	0%	0	0	0	0	0	0
Castlemaine	1,125	118	10%	118	0	0	0	1,007	0
Clunes	35	35	99%	0	35	0	0	0	0
Daylesford	449	448	100%	18	430	0	0	0	0
Dunolly	15	15	100%	0	15	0	0	0	0
Kerang	501	0	0%	0	0	0	0	0	501
Maryborough	462	462	100%	99	363	0	0	0	0
Pyramid Hill	9	9	100%	0	9	0	0	0	0
Wedderburn	8	8	100%	0	8	0	0	0	0
Total 2012–13	**7,746**	**2,775**	**36%**	**1,132**	**1,643**	**0**	**0**	**4,470**	**501**
Total 2011–12	8,244	2,815	34%	1,294	1,521	0	0	4,910	519

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

(2) 'Within process' refers to the water reused in sewage treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site effluent storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.9 East Gippsland basin

The East Gippsland basin (Figure 6.9-1) 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 6.9-1 Map of the East Gippsland basin

6.9.1 Water resources overview

In 2012–13, rainfall in the East Gippsland basin was generally consistent with the long-term average, with levels ranging from 80% to 125%, with greater rainfall in the west of the catchment. Catchment inflows were 134% of the long-term annual average, a decrease from the 231% recorded in 2011–12. Consumptive use in the basin is generally very low compared to water availability, and almost 100% of inflows passed to Bass Strait in 2012–13.

Licensed diversions from unregulated streams were similar to those in 2011–12, with use considerably lower than the total licensed volume.

Table 6.9-1 shows the responsibilities of the authorities within the East Gippsland basin.

Table 6.9-1 Responsibilities for water resources management

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages licensed diversions		
East Gippsland Water		Supplies urban water to towns including Mallacoota, Cann River and Bemm River	Obliged to meet passing flow requirements
East Gippsland Catchment Management Authority			Manages waterways in the whole of the East Gippsland basin

Environmental Water Reserve

Environmental assets that rely on the Environmental Water Reserve (EWR) in the East Gippsland basin include the 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 2012–13, the EWR 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
- 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.

6.9.2 Surface water resources

6.9.2.1 Water balance

The total volumes of water available and supplied from water resources in the East Gippsland basin are shown in Table 6.9-2. Very low volumes of surface water are used relative to the available resource in the basin.

No storage information is recorded in the water balance as there are no major on-stream storages in the East Gippsland basin.

Less than 1% of the catchment inflows were diverted for consumptive use, predominantly from small catchment dams.

Table 6.9-2 Balance of surface water in the East Gippsland basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	-	-
Volume in storage at end of year	-	-
Change in storage	**-**	**-**
Inflows		
Catchment inflow(1)	953,355	1,647,803
Rainfall on major storages	-	-
Treated wastewater discharged back to river	25	12
Total inflows	**953,380**	**1,647,815**
Outflows		
Diversions		
Urban diversions	135	156
Licensed diversions from unregulated streams	137	66
Small catchment dams	1,100	1,100

East Gippsland basin

Water account component	2012–13 (ML)	2011–12 (ML)
Total diversions	***1,371***	***1,322***
Losses		
Evaporation losses from major storages	-	-
Evaporation from small catchment dams	67	67
In-stream infiltration to groundwater, flows to floodplain and evaporation(2)	n/a	n/a
Total losses	***67***	***67***
Water passed at outlet of basin		
River outflows	951,942	1,646,426
Total water passed at outlet of basin	***951,942***	***1,646,426***
Total outflows	**953,380**	**1,647,815**

Notes:

(1) Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows and the known inflows.

(2) No suitable model is available to make an estimate of in-stream losses.

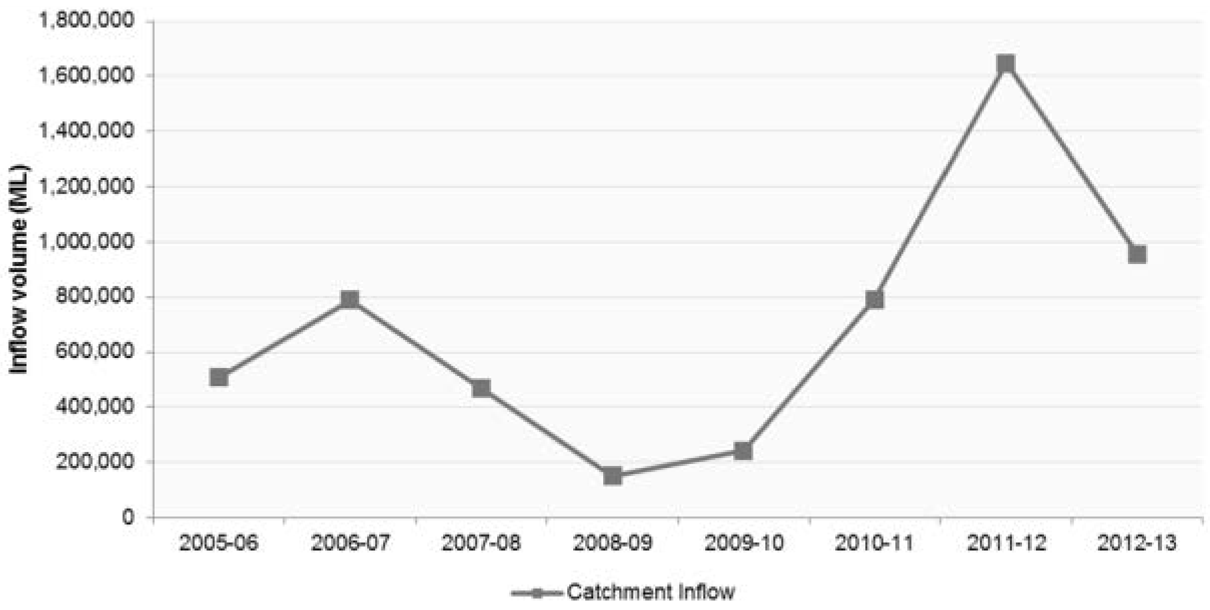
6.9.2.2 Storages and flows

Catchment inflows in 2012–13 were 134% of the long-term annual average of 714,000 ML, considerably lower than the volume for 2011–12, which was 231% of the long-term average (Figure 6.9-2).

The amount of water flowing from the East Gippsland basin into Bass Strait was 951,942 ML in 2012–13, compared to 1,646,426 ML in 2011–12. Basin outflow was close to 100% of total inflows into the basin.

There are no major storages located within the East Gippsland basin.

Figure 6.9-2 Catchment inflows



6.9.2.3 Entitlement volumes and diversions

In the East Gippsland basin, surface water is diverted by East Gippsland Water and licensed diverters, and water is also harvested in small catchment dams.

Entitlements include rights granted to individuals (take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the Victorian Environmental Water Holder). Rights to water in the East Gippsland basin are outlined in Table 6.9-3.

Table 6.9-3 Entitlement volumes in the East Gippsland basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Bemm River) Conversion Order 1997	100
Bulk Entitlement (Cann River) Conversion Order 1997	192
Bulk Entitlement (Mallacoota) Conversion Order 1997	330
Take and use licences – unregulated surface water	660
Total volume of water entitlements in the East Gippsland basin	**1,282**

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.9-4. The total volume of water diverted by bulk entitlement holders was similar to volume reported in the 2011–12 Victorian Water Accounts.

As in previous years, the volume of water diverted from unregulated streams by take and use licence holders in the East Gippsland basin (Table 6.9-4) remains significantly lower than the total licence volume.

Table 6.9-4 Allocation account balance summary for the East Gippsland basin

Water entitlement	Allocation issued	Net trade In/(Out)	Water use	End of season forfeitures
Bemm River	100	0	(17)	(83)
Cann River	192	0	(33)	(159)
Mallacoota	330	0	(84)	(246)
Take and use licences – unregulated surface water	660	0	(137)	(523)

The estimated volume of water harvested from small catchment dams represents the largest diversion of water in the East Gippsland basin (Table 6.9-5).

Table 6.9-5 Estimated small catchment dam information

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	770	385	n/a
Registered commercial and irrigation	851	714	n/a
Total	**1,621**	**1,100**	**1,167**

n/a: Information not available.

6.9.3 Recycled water

East Gippsland Water operates wastewater treatment plants at Bemm River, Cann River and Mallacoota. The volume of wastewater produced in 2012–13 was similar to 2011–12, and 85% was recycled for agricultural applications including pasture and tree plantations.

Table 6.9-6 shows the volumes of water recycled in the East Gippsland basin in 2012–13.

Table 6.9-6 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process(2))	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other(3) (ML)
				Urban and industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Bemm River	3	3	100%	0	3	0	0	0	0
Cann River	51	26	51%	0	26	0	0	25	0
Mallacoota	107	107	100%	0	107	0	0	0	0
Total 2012–13	**162**	**137**	**85%**	**0**	**137**	**0**	**0**	**25**	**0**
Total 2011–12	159	147	93%	0	147	0	0	12	0

Notes:

(1) ‘Beneficial allocation’ refers to the volume used to deliver specific environmental flow benefits.

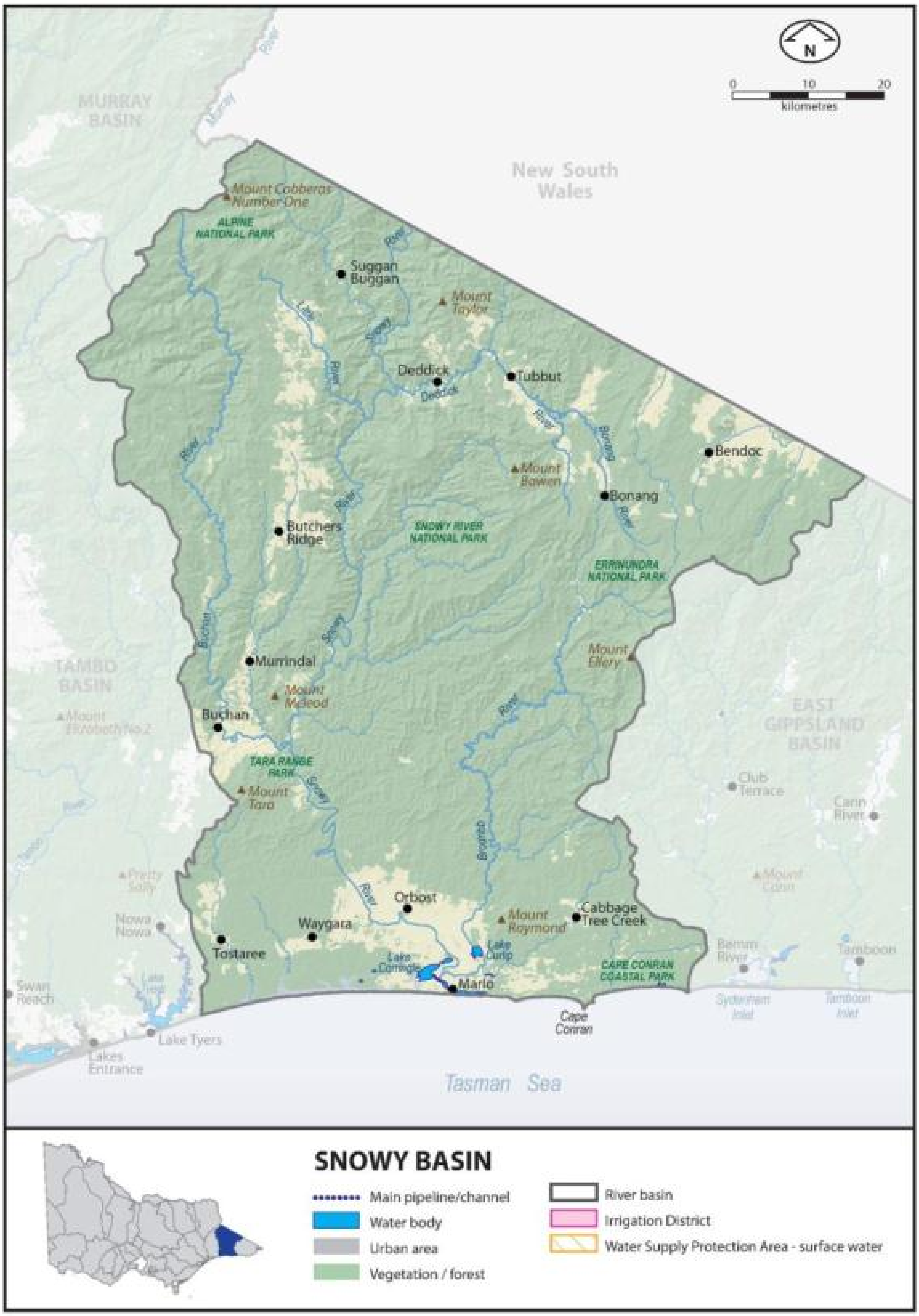
(2) ‘Within process’ refers to water reused in wastewater treatment processes, for example to maintain biological processes. This value is not included in the total percentage recycled, consistent with its treatment in the ESC’s performance report.

(3) ‘Other’ refers to a change in on-site wastewater storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.10 Snowy basin

The Snowy basin (Figure 6.10-1) is located in south-east Victoria. 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. In the Victorian part of the basin, major tributaries such as the Deddick River, Buchan River and Brodrobb River join the Snowy River before it flows into the ocean at Marlo.

Figure 6.10-1 Map of the Snowy basin



6.10.1 Water resources overview

In 2012–13, rainfall in the Snowy basin ranged from 80%-125% of the long-term average, with greater rainfall in the east of the catchment. Catchment inflows were above average. Total inflows from New South Wales and Victoria were 1,825,842 ML compared to 3,740,726 ML in the previous year. Consumptive water use in the Snowy basin is generally low compared to the total water resource, and more than 99% of the basin's total inflows for 2012–13 flowed into Bass Strait. Urban and rural water users were unrestricted throughout the year.

Table 6.10-1 shows the responsibilities of the authorities within the Victorian portion of the Snowy basin.

Table 6.10-1 Responsibilities for water resources management in the Snowy basin

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages surface water licensed diversions		
East Gippsland Water		Supplies towns including Buchan, Orbost and Marlo	Obliged to meet passing flow requirements
Victorian Environmental Water Holder			Manages environmental entitlements held in trust for the Snowy River
East Gippsland Catchment Management Authority			Manages waterways for the whole of the Snowy basin

Environmental Water Reserve

The health of the Snowy River depends on the Environmental Water Reserve (EWR). Environmental assets include Australian Grayling populations, Australian Bass, the lower Snowy wetlands and estuary (which are nationally important wetlands), heritage river reaches, the Ewings Marsh wetlands complex and the Snowy River Daisy.

In 2012–13 the EWR for the Snowy basin comprised:

- water set aside for the environment through the operation of passing flows released as a condition of the water licence issued to Snowy Hydro
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by East Gippsland Water
- environmental allocations from outcomes of the Snowy Water Inquiry
- 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.

6.10.2 Surface water resources

6.10.2.1 Water balance

A surface water balance for the Snowy basin is shown in Table 6.10-2. As these accounts provide a record of water availability and use across Victoria, this balance only considers the portion of the Snowy basin that is located within Victoria.

No storage information is recorded in the water balance as there are no major on-stream storages in the Snowy basin.

Catchment inflows from the Victorian portion of the basin accounted for 79% of the total inflows to the Snowy basin. The volume of water diverted within the Victorian portion of the basin represents less than one per cent of the total inflows.

Table 6.10-2 Balance of surface water in the Snowy basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	-	-
Volume in storage at end of year	-	-
Change in storage	**-**	**-**
Inflows		
Catchment inflow from Victoria(1)	1,441,377	2,796,999
Catchment inflow from NSW(2)	384,465	943,727
Rainfall on major storages	-	-
Treated effluent discharged back to river	0	112
Total inflows	**1,825,842**	**3,740,838**

Snowy basin

Water account component	2012–13 (ML)	2011–12 (ML)
Outflows		
Diversions		
Urban diversions	725	701
Licensed diversions from unregulated streams	732	385
Small catchment dams	3,356	3,356
Total diversions	***4,812***	***4,442***
Losses		
Evaporation losses from major storages	-	-
Evaporation from small catchment dams	700	700
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	n/a	n/a
Total losses	***700***	***700***
Water passed at outlet of basin		
River outflows to the ocean	1,820,329	3,735,696
Total water passed at outlet of basin	***1,820,329***	***3,735,696***
Total outflows	**1,825,842**	**3,740,838**

Notes:

(1) Catchment inflow from Victoria is the balancing item in this water balance. It is the difference between the total outflows and the known inflows.

(2) Catchment inflow from NSW recorded on the Snowy River at Burnt Hut Crossing (gauge 222013).

(3) No suitable model is available to make an estimate of in-stream losses.

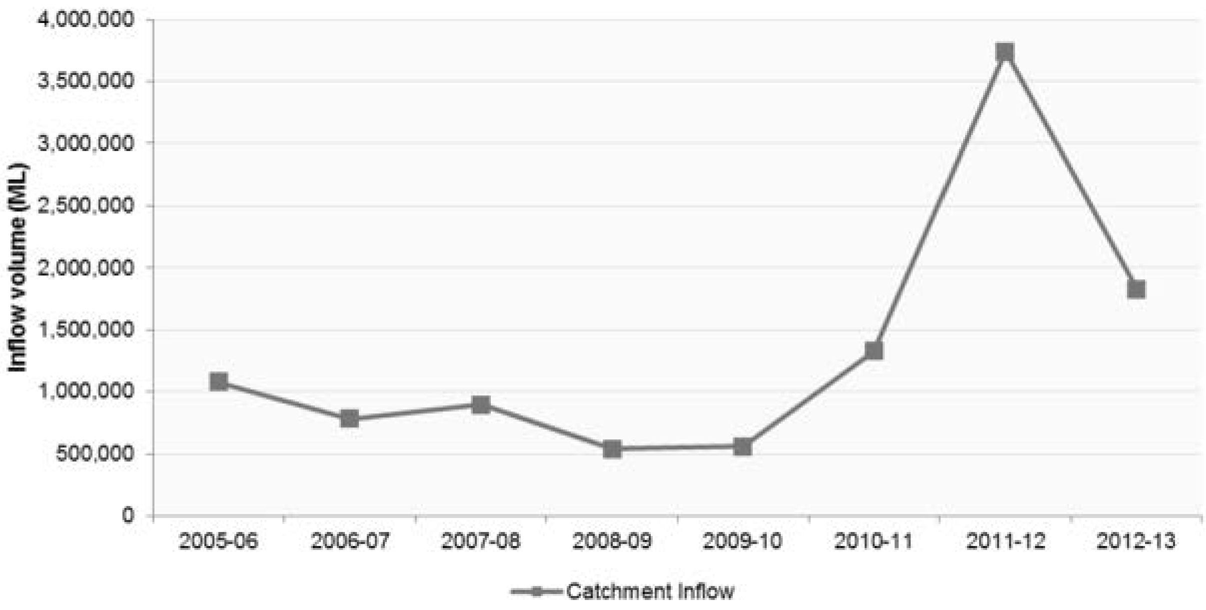
6.10.2.2 Storages and flows

Total inflows to the Victorian portion of the basin were 1,441,377 ML, or 141% of the long-term average (of 1,022,000 ML), compared to 2,796,999 ML, or 274% of the long-term average in 2011–12 (Figure 6.10-2). Inflows from New South Wales are regulated by the Snowy Mountains Hydro-Electric Scheme. This inflow was 384,465 ML in 2012–13, down from 943,727 ML in 2011–12.

The amount of water flowing from the Snowy basin into Bass Strait was 1,820,329 ML in 2012–13. This represents over 99% of total inflows to the basin.

There are no major storages located within the Victorian portion of the Snowy basin.

Figure 6.10-2 Catchment inflows for the Snowy basin (including contribution from NSW)



6.10.2.3 Entitlement volumes and diversions

In the Snowy basin, surface water is diverted by East Gippsland Water and licensed diverters, and is also harvested in small catchment dams.

Entitlements include rights granted to individuals (take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the Victorian Environmental Water Holder). Rights to water in the Snowy basin are outlined in Table 6.10-3.

Table 6.10-3 Entitlement volumes in the Snowy basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Buchan) Conversion Order 1997	170
Bulk Entitlement (Orbost System) Conversion Order 1997	2,031
Take and use licences – unregulated surface water	3,992
Total volume of water entitlements in the Snowy basin	**6,193**

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.10-4. The total volume of water diverted by bulk entitlement holders was similar to amount reported in the 2011–12 Victorian Water Accounts.

As in previous years, the volume of water diverted from unregulated streams by take and use licence holders in the Snowy basin (Table 6.10-4) remains significantly lower than the total licence volume. The volume of water diverted from unregulated streams by licence holders in the Snowy basin was 732 ML which was higher than the 2011–12 volume of 385 ML (Table 6.10-4).

Table 6.10-4 Allocation account balance summary for the Snowy basin

Water entitlement	Allocation issued	Net trade In/(Out)	Water use	Forfeitures
Buchan	170	0	(23)	(147)
Orbost System	2,031	0	(702)	(1,329)
Take and use licences – unregulated surface water	3,992	0	(732)	(3,261)

The estimated volume of water harvested from small catchment dams represents the largest diversion of water in the Snowy basin (Table 6.10-5).

Table 6.10-5 Estimated small catchment dam information for the Snowy basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	3,143	1,572	n/a
Registered commercial and irrigation	2,124	1,784	n/a
Total	**5,267**	**3,356**	**4,056**

6.10.3 Recycled water

The Orbost wastewater treatment plant is the only treatment plant in the Snowy basin. In 2012–13, all of the wastewater passing through this treatment plant was recycled and used for agricultural applications including pasture and tree plantations (Table 6.10-6).

Table 6.10-6 Volume of recycled water in the Snowy basin

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process[2])	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other[3] (ML)
				Urban and industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Orbost	326	326	100%	0	326	0	0	0	0
Total 2012–13	**326**	**326**	**100%**	**0**	**326**	**0**	**0**	**0**	**0**
Total 2011–12	321	209	65%	0	209	0	0	112	0

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

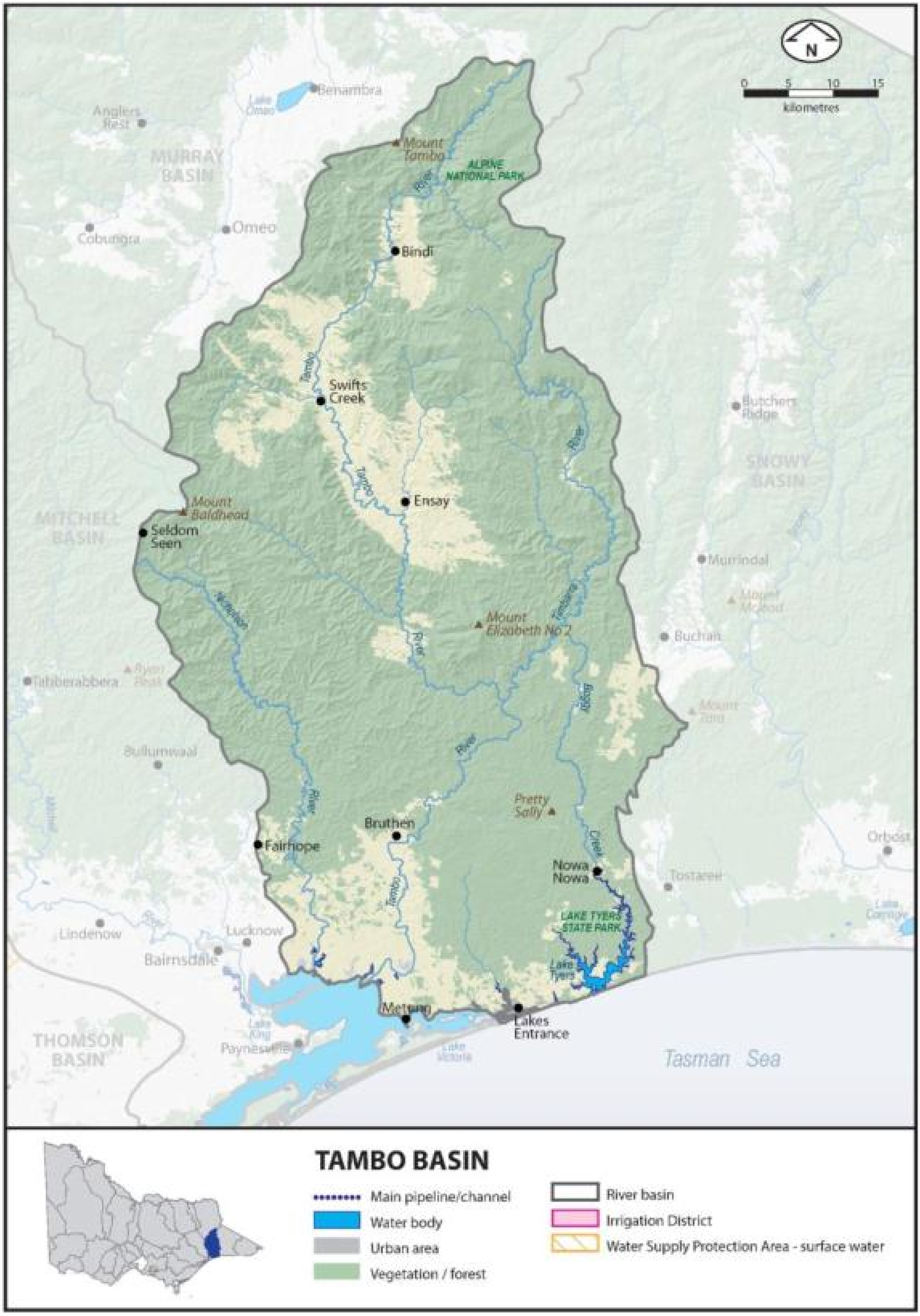
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site wastewater storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.11 Tambo basin

The Tambo basin (Figure 6.11-1) is located in south-east Victoria. The basin contains the Tambo River and the Nicholson River, which flow into the Gippsland Lakes.

Figure 6.11-1 Map of the Tambo basin



6.11.1 Water resources overview

In 2012–13, rainfall in the Tambo basin was close to average, ranging between 80% to 100% of the long-term average. Inflow volumes were also similar to the long-term average and much lower than those recorded in the wet conditions of 2011–12.

There are no large authorised diversions in the Tambo basin; its larger towns, such as Lakes Entrance, are supplied by the Bairnsdale water system. As such, approximately 98% of basin inflows flow to the Gippsland Lakes.

Table 6.11-1 shows the responsibilities of the authorities within the Tambo basin.

Table 6.11-1 Responsibilities for water resources management in the Tambo basin

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages licensed diversions		
East Gippsland Water		Towns including Lakes Entrance, Bruthen and Swifts Creek are supplied from neighbouring basins	Obliged to meet passing flow requirements
East Gippsland Catchment Management Authority			Manages waterways in the whole of the Tambo basin

Environmental Water Reserve

The Gippsland Lakes are important environmental assets partially dependent on water from the Environmental Water Reserve (EWR) in the Tambo basin. They are listed as internationally significant wetlands under the Ramsar Convention and rely on the freshwater inputs from the Tambo basin to function ecologically. Other environmental assets that rely on the EWR include fish populations (Australian Grayling, Black Bream) and the Bosses, Nebbor, Russells and Tambo River East swamps, which are nationally important wetlands.

In 2012–13, the Environmental Water Reserve in the Tambo basin comprised:

- water set aside for the environment through the operation of passing flow conditions on licensed diversions and consumptive bulk entitlements held by East Gippsland Water
- all other water in the basin not allocated for consumptive use.

6.11.2 Surface water resources

6.11.2.1 Water balance

The total volumes of water available and supplied from water resources in the Tambo basin are shown in Table 6.11-2. Consumptive use in the Tambo basin is low compared to the available resource in the basin.

No storage information is recorded in the water balance as there are no major on-stream storages in the Tambo basin.

Table 6.11-2 Balance of surface water in the Tambo basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	-	-
Volume in storage at end of year	-	-
Change in storage	**-**	**-**
Inflows		
Catchment inflow(1)	309,242	839,137
Rainfall on major storages	-	-
Treated effluent discharged back to river	0	0
Total inflows	**309,242**	**839,137**
Outflows		
Diversions		
Urban diversions	31	21
Licensed diversions from unregulated streams	812	528
Small catchment dams	3,971	3,971
Total diversions	***4,813***	***4,520***

Water account component	2012–13 (ML)	2011–12 (ML)
Losses		
Evaporation losses from major storages	-	-
Evaporation from small catchment dams	1,986	1,986
In-stream infiltration to groundwater, flows to floodplain and evaporation(2)	n/a	n/a
Total losses	***1,986***	***1,986***
Water passed at outlet of basin		
River outflows to the ocean	302,443	832,631
Total water passed at outlet of basin	***302,443***	***832,631***
Total outflows	**309,242**	**839,137**

Notes:

(1) Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows and the known inflows

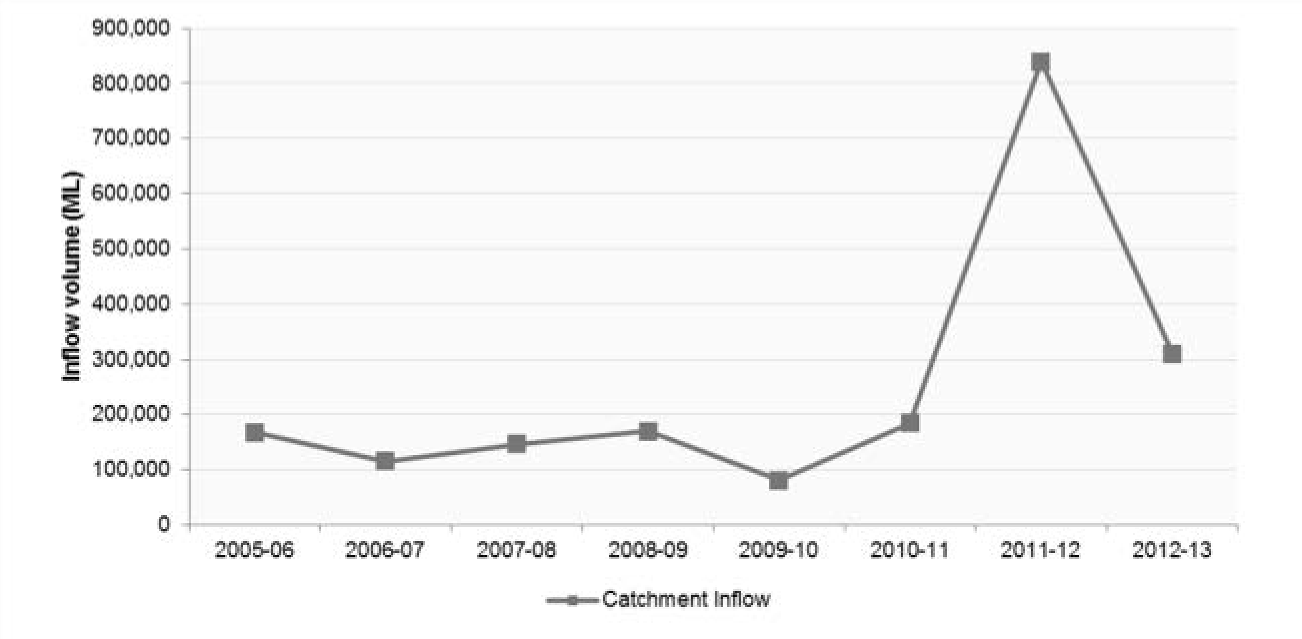
(2) No suitable model is available to make an estimate of in-stream losses.

6.11.2.2 Storages and flows

Catchment inflows to the basin were 309,242 ML, or 104% of the long-term average (of 297,800 ML), compared to 839,137 ML or 282% of the long-term average in 2011–12 (Figure 6.11-2). The amount of water flowing from the Tambo basin into the Gippsland Lakes was 302,443 ML in 2012–13, which was approximately 98% of total inflows to the basin.

There are no major storages located within the Tambo basin.

Figure 6.11-2 Catchment inflows in the Tambo basin



6.11.2.3 Entitlement volumes and diversions

In the Tambo basin, surface water is diverted by East Gippsland Water and licensed diverters, and water is also harvested in small catchment dams.

Entitlements in the Tambo basin include rights granted to individuals (take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the Victorian Environmental Water Holder). Rights to water in the Tambo basin are outlined in Table 6.11-3.

Table 6.11-3 Entitlement volumes in the Tambo basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Nowa Nowa) Conversion Order 1997	118
Bulk Entitlement (Swifts Creek) Conversion Order 1997	224
Take and use licences – unregulated surface water	4,167
Total volume of water entitlements in Tambo basin	**4,509**

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.11-4.

The volume of water diverted from unregulated streams by licence holders in the Tambo basin was slightly more in 2012–13 compared to the volume reported in the 2011–12 Victorian Water Accounts.

Table 6.11-4 Allocation account balance summary for the Tambo basin

Water entitlement	Allocation issued	Net trade In/(Out)	Water use	End of season forfeitures
Nowa Nowa[1]	118	0	0	(118)
Swifts Creek	224	0	(31)	(193)
Take and use licences – unregulated surface water	4,167	0	(812)	(3,355)

Note:

(1) No water was taken under the Nowa Nowa bulk entitlement in 2012–13. East Gippsland Water supplied this town under the Bairnsdale bulk entitlement, reported in Table 6.12-4 in the Mitchell basin.

The estimated volume of water harvested from small catchment dams represents the largest diversion of water in the Tambo basin (Table 6.11-5).

Table 6.11-5 Estimated small catchment dam information for the Tambo basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	4,494	2,247	n/a
Registered commercial and irrigation	2,052	1,724	n/a
Total	**6,546**	**3,971**	**5,957**

n/a: Information not available.

6.11.3 Recycled water

East Gippsland Water operates the wastewater treatment plants at Lakes Entrance and Metung. All of the wastewater passing through these treatment plants was recycled and used for agricultural applications including pasture, tree plantations, racecourses and golf courses.

Table 6.11-6 shows the volumes of water recycled in the Tambo basin in 2012–13.

Table 6.11-6 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process[2])	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other[3] (ML)
				Urban and industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Lakes Entrance	912	912	100%	0	912	0	0	0	0
Metung	119	119	100%	0	119	0	0	0	0
Total 2012–13	**1,031**	**1,031**	**100%**	**0**	**1,031**	**0**	**0**	**0**	**0**
Total 2011–12	668	668	100%	0	668	0	0	0	0

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

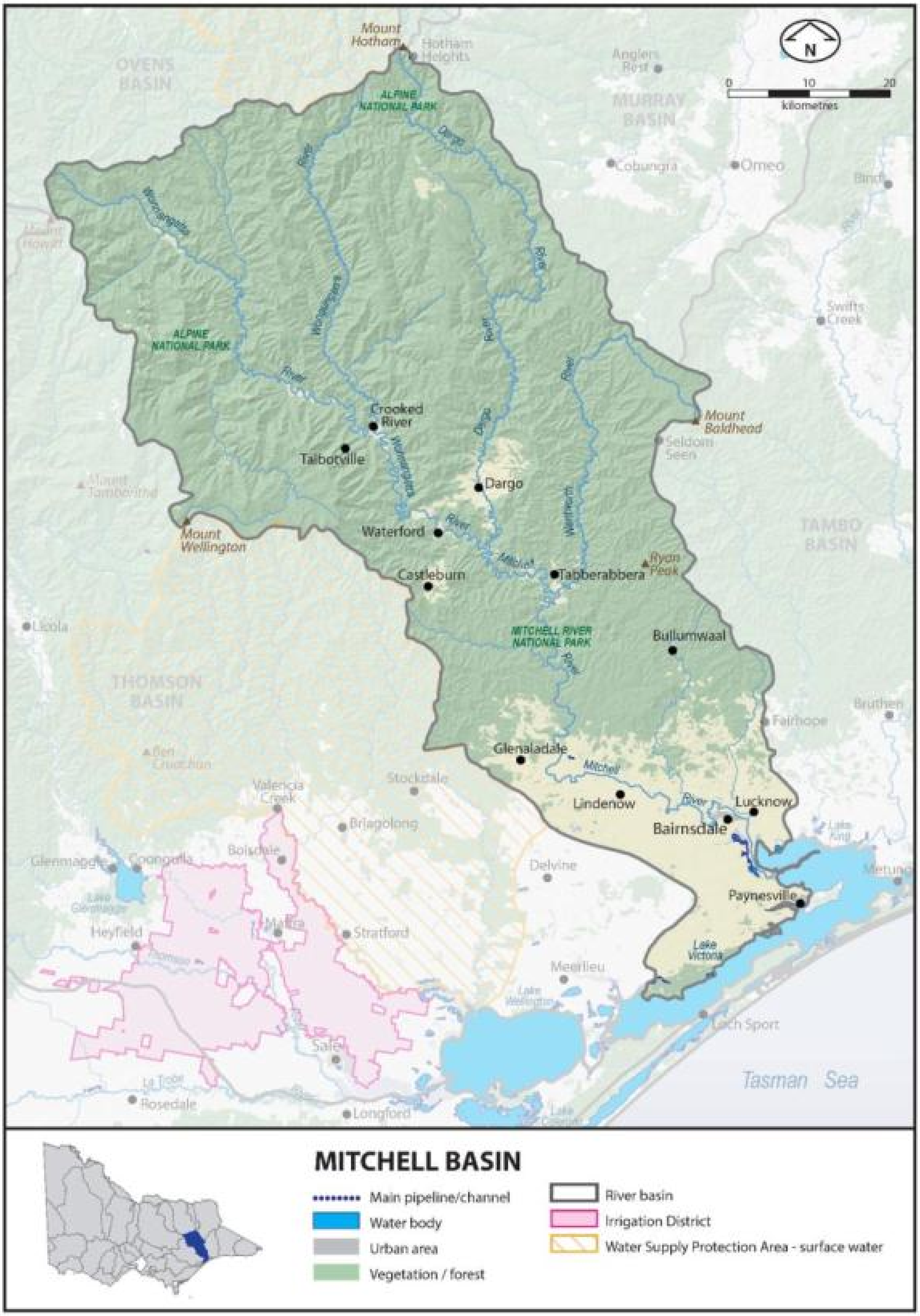
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site wastewater storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.12 Mitchell basin

The Mitchell basin (Figure 6.12-1) is located in south-east Victoria and occupies 477,800 hectares. Its waterways flow into the Gippsland Lakes near Bairnsdale.

Figure 6.12-1 Map of the Mitchell basin



6.12.1 Water resources overview

In 2012–13, rainfall in the Mitchell basin ranged between 80% and 100% of the long-term average. Inflows in the Mitchell basin were 82% of the long-term average, compared to 143% in 2011–12. Consumptive use in the basin is generally low when compared to the total water resource. About 97% of the inflows were not diverted, and hence entered the Gippsland Lakes.

Restrictions to licensed diversions were in effect in the basin between February and June 2013, with Stage 4 restrictions in place for the Mitchell River and Stage 1 restrictions for both the Dargo and Wonanngatta rivers.

Table 6.12-1 shows the responsibilities of the authorities within the Mitchell basin.

Table 6.12-1 Responsibilities for water resources management in the Mitchell basin

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages licensed diversions		
East Gippsland Water		Supplies towns including Bairnsdale, Lakes Entrance and Paynesville	Obliged to meet passing flow requirements
East Gippsland Catchment Management Authority			Manages waterways in the Mitchell basin

Environmental Water Reserve

The Gippsland Lakes are important environmental assets which are partially dependent on water from the Environmental Water Reserve (EWR) in the Mitchell basin. The lakes are listed as internationally significant wetlands under the Ramsar Convention and rely on freshwater inputs from the Mitchell basin to function ecologically. Other environmental assets that rely on the EWR include heritage river reaches, fish populations (including Australian Grayling and Black Bream), water birds (Great Egret) and botanical values (Yellowwood).

In 2012–13, the EWR in the Mitchell basin comprised:

- water set aside for the environment through the release of passing flows, as a condition of the consumptive bulk entitlement held by East Gippsland Water
- 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.

6.12.2 Surface water resources

6.12.2.1 Water balance

A surface water balance for the Mitchell basin is shown in Table 6.12-2. As well as supplying Bairnsdale, the Mitchell River is the source of supply for the towns of Bruthen, Nicholson, Johnsonville, Swan Reach, Metung and Lakes Entrance in adjacent river basins. The river also supports irrigation on the Lindenow Flats. Diversions make up a relatively small proportion of total inflows, with approximately 2.9% of the total basin inflows diverted for consumptive use.

No storage information is recorded in the water balance as there are no major on-stream storages in the Mitchell basin.

Table 6.12-2 Balance of surface water in the Mitchell basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	-	-
Volume in storage at end of year	-	-
Change in storage	**-**	**-**
Inflows		
Catchment inflow[(1)]	722,170	1,264,868
Rainfall on major storages	-	-
Treated effluent discharged back to river	67	218
Total inflows	**722,237**	**1,265,087**

Mitchell basin

Water account component	2012–13 (ML)	2011–12 (ML)
Outflows		
Diversions		
Urban diversions	4,957	3,887
Licensed diversions from unregulated streams	11,493	5,086
Small catchment dams	4,558	4,558
Total diversions	***21,008***	***13,531***
Losses		
Evaporation losses from major storages	-	-
Evaporation from small catchment dams	1,006	1,006
In-stream infiltration to groundwater, flows to floodplain and evaporation	623	0
Total losses	***1,629***	***1,006***
Water passed at outlet of basin		
River outflows to the ocean	699,601	1,250,550
Total water passed at outlet of basin	***699,601***	***1,250,550***
Total outflows	**722,237**	**1,265,087**

Note:

(1) Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows and the known inflows.

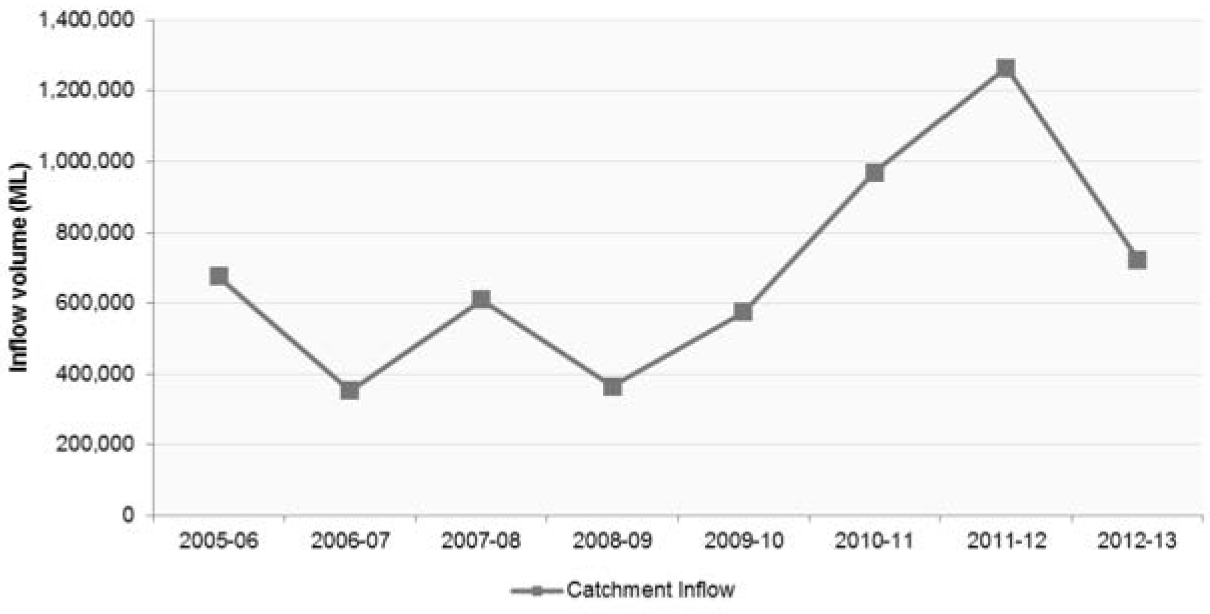
6.12.2.2 Storages and flows

Catchment inflows to the basin were 82% of the long-term average (of 884,500 ML), compared to 143% in 2011–12 (Figure 6.12-2).

The amount of water flowing from the Mitchell basin into the Gippsland Lakes was 699,601 ML in 2012–13, a significant decrease from 1,250,550 ML recorded in 2011–12. The 2012–13 outflows were 97% of the total inflows into the basin.

There are no major storages located within the Mitchell basin.

Figure 6.12-2 Catchment inflows



6.12.2.3 Entitlement volumes and diversions

In the Mitchell basin, surface water is diverted by East Gippsland Water and licensed diverters, and harvested in small catchment dams. The total volume of take and use licences in the Mitchell basin includes licences for irrigation as well as for domestic and stock purposes.

East Gippsland Water holds one bulk entitlement in the Mitchell basin, used to supply Bairnsdale, Lakes Entrance, Bruthen and surrounding towns.

Entitlements include rights granted to individuals (take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the Victorian Environmental Water Holder). Rights to water in the Mitchell basin are outlined in Table 6.12-3.

Table 6.12-3 Entitlement volumes in the Mitchell basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Bairnsdale) Conversion Order 2000	9,208
Take and use licences – unregulated surface water	16,387
Total volume of water entitlements in the Mitchell basin	**25,595**

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.12-4.

The volume of water diverted from unregulated streams by licence holders in the Mitchell basin was significantly more in 2012–13 compared to the volume reported in the 2011–12 Victorian Water Accounts.

Table 6.12-4 Allocation account balance summary for the Mitchell basin

Water entitlement	Allocation issued	Net trade In/(Out)	Water use	End of season forfeitures
Bairnsdale	9,208	0	(4,957)	(4,251)
Take and use licences – unregulated surface water	16,387	0	(11,493)	(4,894)

The estimated volume of water harvested from small catchment dams is presented in Table 6.12-5.

Table 6.12-5 Estimated small catchment dam information

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	4,218	2,109	n/a
Registered commercial and irrigation	2,915	2,449	n/a
Total	**7,133**	**4,558**	**5,564**

n/a: Information not available.

6.12.3 Recycled water

The wastewater treatment plants at Bairnsdale, Lindenow and Paynesville are operated by East Gippsland Water.

All of the wastewater passing through the Paynesville treatment plants was recycled and used for applications including pasture, tree plantations, racecourses and golf courses (Table 6.12-6).

The Bairnsdale Wastewater Treatment Plant has, as part of its treatment process, a series of constructed wetlands located within the Macleod Morass. The constructed wetlands provide additional filtration for water discharged from the treatment plant before it is released into the morass as environmentally beneficial water for the deep freshwater marsh. This discharge is considered a beneficial allocation. In addition to the recycled water reported in Table 6.12-6, 67 ML was returned to the environment from the alpine resorts during the water year.

Table 6.12-6 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process(2))	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other(3) (ML)
				Urban and industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Bairnsdale	1,229	1,229	100%	0	40	1,189	0	0	0
Lindenow	13	13	100%	0	0	13	0	0	0
Paynesville	145	145	100%	0	145	0	0	0	0
Total 2012–13	**1,387**	**1,387**	**100%**	**0**	**185**	**1,202**	**0**	**0**	**0**
Total 2011–12	1,514	1,361	90%	0	123	1,238	0	153	0

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

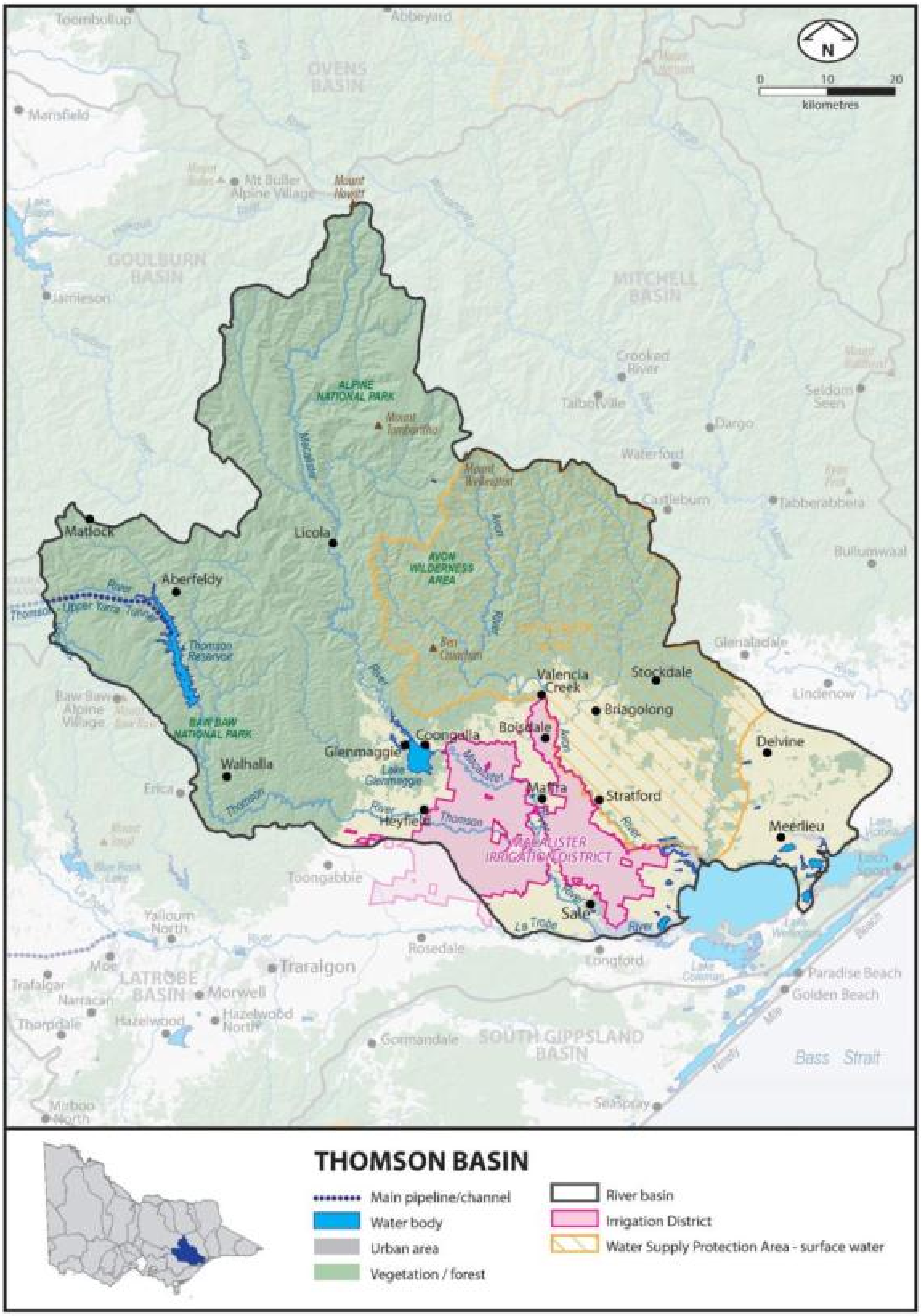
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site wastewater storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.13 Thomson basin

The Thomson basin (Figure 6.13-1) is located in south-east Victoria. The Thomson and Macalister rivers join the Latrobe River before flowing into the Gippsland Lakes.

Figure 6.13-1 Map of the Thomson basin



6.13.1 Water resources overview

In 2012–13, rainfall in the Thomson basin ranged between 80% and 100% of the long-term average in the south of the basin, with slightly drier conditions (60% to 80%) in the north. Catchment inflows were 80% of the long-term average, compared to 162% in 2011–12. The amount of water flowing from the Thomson basin into the Gippsland Lakes represented 63% of the total inflows in the basin in 2012–13.

Major storages in the Thomson basin started the year at 67% of capacity and were at 72% at the end of June 2013. Most of the change was attributable to the change in the level of the Thomson Reservoir, which was at 64% of capacity at the start of the year and at 74% at year end.

The year began with a 90% allocation for high reliability water shares for the Thomson/Macalister system. Low reliability water shares reached 20% by mid-April.

Towns in the Thomson basin were not subject to restrictions in 2012–13. However, licensed surface water diverters on the Avon River and Valencia Creek experienced restrictions during 2012–13 where an irrigation ban running from January to April 2013 progressed to Stage 1 water restrictions in May and June.

Table 6.13-1 shows the responsibilities of the authorities within the Thomson basin.

Table 6.13-1 Responsibilities for water resources management

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Melbourne Water				Operates Thomson Reservoir, which supplies water to Melbourne and irrigators in the Macalister Irrigation District Releases water to the Thomson River for environmental flows Obliged to meet passing flow requirements
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 Obliged to meet passing flow requirements
Gippsland Water			Supplies towns including Sale, Maffra, Heyfield, Stratford and Boisdale	
Victorian Environmental Water Holder				Holds and manages environmental entitlements in the basin
West Gippsland Catchment Management Authority				Manages waterways in the Thomson basin

Environmental Water Reserve

The Gippsland Lakes are important environmental assets partially dependent on water from the Environmental Water Reserve (EWR) in the Thomson basin. The lakes are listed as internationally significant wetlands under the Ramsar Convention and rely on the freshwater inputs from basins including the Thomson to function ecologically. The Upper Thomson River is a heritage river reach and its Australian Grayling populations also rely on the Thomson EWR.

In 2012–13 the EWR in the Thomson basin comprised:

- the *Bulk Entitlement (Thomson River – Environment) Order 2005* comprising 10,000 ML of high reliability entitlement held by the Victorian Environmental Water Holder (VEWH)
- the *Macalister River Environmental Entitlement 2010* comprising 12,461 ML of high reliability and 6,230 ML of low reliability water shares held by the VEWH
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Melbourne Water and Southern Rural Water
- water set aside for the environment through the operation of passing flow conditions on licensed diversions
- all other water in the basin not allocated under entitlements.

6.13.2 Surface water resources

6.13.2.1 Water balance

A surface water balance for the Thomson basin is shown in Table 6.13-2. Irrigation water use in the Macalister Irrigation District comprised the majority of diversions within the basin.

A total volume of 198,851ML was diverted to irrigation districts in 2012–13, higher than 2011–12. Melbourne Water's diversion from the Thomson Reservoir significantly increased to 25,148 ML in 2012–13.

Table 6.13-2 Balance of surface water in the Thomson basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	838,611	586,123
Volume in storage at end of year	891,681	838,611
Change in storage	**53,070**	**252,488**
Inflows		
Catchment inflow(1)	876,174	1,788,987
Rainfall on major storages	26,925	38,182
Return flow from irrigation	22,626	25,786
Treated effluent discharged back to river	216	33
Total inflows	**925,940**	**1,852,988**
Outflows		
Diversions		
Urban diversions	1,511	1,422
Transfers to Yarra River basin for urban use	25,148	1,100
Irrigation district diversions	198,851	123,295
Licensed diversions from regulated streams	21,117	8,572
Licensed diversions from unregulated streams	7,647	7,092
Small catchment dams	6,984	6,984
Total diversions	***261,258***	***148,466***
Losses		
Evaporation losses from major storages	28,776	28,985
Evaporation from small catchment dams	2,552	2,552
In-stream infiltration to groundwater, flows to floodplain and evaporation	17,460	29,757
Total losses	***48,787***	***61,294***
Water passed at outlet of basin		
River outflows to the Latrobe River	415,734	861,432
River outflows to the Lake Wellington	147,091	529,309
Total water passed at outlet of basin	***562,825***	***1,390,741***
Total outflows	**872,870**	**1,600,500**

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

6.13.2.2 Storages and flows

The volume of water held in major storages was 891,681 ML (72% of capacity) at the end of June 2013 compared to 838,611 ML at the start of July 2012.

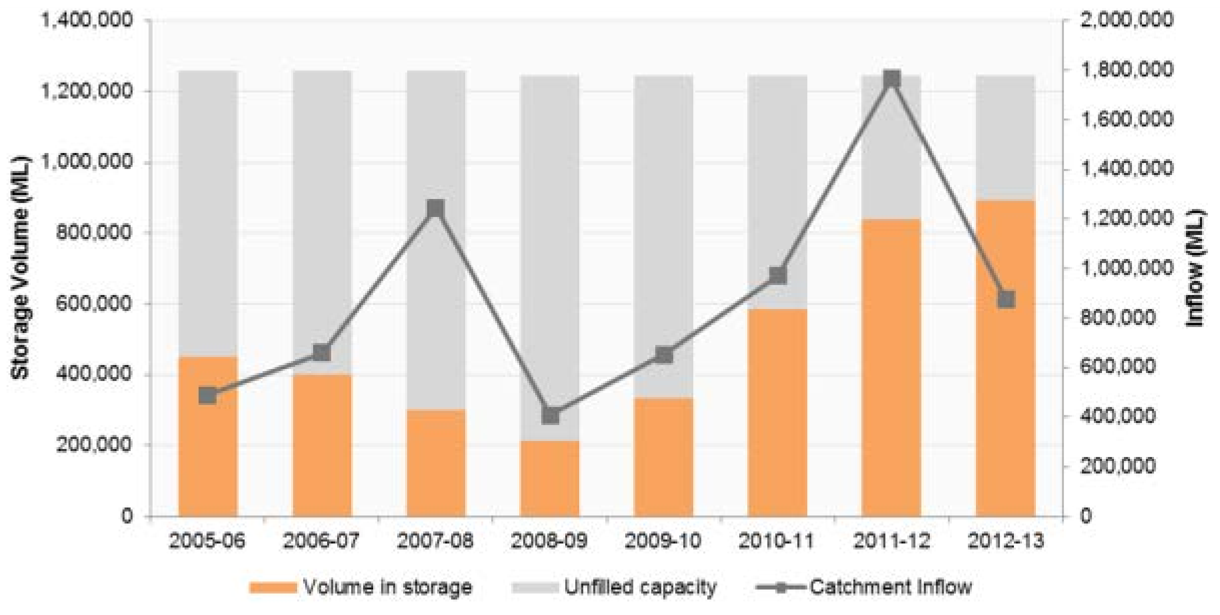
In the Thomson basin, major on-stream storages include the Thomson Reservoir and Lake Glenmaggie. Melbourne's biggest water storage, the Thomson Reservoir, began the year at 64% of capacity and increased to 74% by the end of June 2013. Lake Glenmaggie finished the year with a volume of 103,993 ML, which is 59% of its total capacity. The volume reported in the 'catchment inflow less regulated releases' column in Table 6.13-3 is the balancing item for each storage. It represents the flow of water in or out of the storage that is not shown as rainfall or evaporation, and may include other minor components influencing the change in storage during the year.

Table 6.13-3 Storage volumes in the Thomson basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Lake Glenmaggie	177,640	158,245	10,120	9,817	(54,555)	103,993
Thomson Reservoir	1,068,000	680,366	16,805	18,958	109,476	787,688
Total storages	**1,245,640**	**838,611**	**26,925**	**28,776**	**54,921**	**891,681**

Catchment inflows to the Thomson basin amounted to 876,174 ML in 2012–13, which is 80% of the long-term average (Figure 6.13-2). The amount of water flowing from the Thomson basin into the Gippsland Lakes in 2012–13 was 562,825 ML, representing 63% of catchment inflows. Outflows to the lakes in 2012–13 were lower than the 1,390,741 ML of outflows in 2011–12 and were also a smaller proportion of catchment inflows.

Figure 6.13-2 Major storages and catchment inflows in the Thomson basin



6.13.2.3 Entitlement volumes and diversions

Southern Rural Water, Gippsland Water and the Melbourne metropolitan retailers (City West Water, South East Water and Yarra Valley Water) hold bulk entitlements in the Thomson basin. Surface water is also diverted by licensed diverters, and is harvested in small catchment dams.

Entitlements include rights granted to individuals (for example water shares and take and use licences) and rights granted to authorities (for example bulk entitlements granted to water authorities or the VEWH. Rights to water in the Thomson basin are outlined in Table 6.13-4.

Table 6.13-4 Entitlement volumes in the Thomson basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Thomson Macalister – Southern Rural Water) Conversion Order 2001(1)	
High reliability water shares	146,960
Low reliability water shares	69,759
Bulk Entitlement (Thomson Macalister Towns – Gippsland Water) Conversion Order 2005	2,335
Macalister River Environmental Entitlement 2010	18,690
Sub-total: Bulk Entitlement (Thomson Macalister – Southern Rural Water) Conversion Order 2001	**237,744**
Transfer of Bulk Entitlement (Thomson River – Melbourne Retailers (combined) Conversion Order 2001	
Transfer of Bulk Entitlement (Thomson River – Melbourne Water Corporation) Conversion Order 2001 to City West Water Limited 2006(2)	n/a
Transfer of Bulk Entitlement (Thomson River – Melbourne Water Corporation) Conversion Order 2001 to South East Water Limited 2006(2)	n/a

Water entitlements	Annual entitlement volume (ML)
Transfer of Bulk Entitlement (Thomson River – Melbourne Water Corporation) Conversion Order 2001 to Yarra Valley Water Limited 2006[2]	n/a
Transfer of Bulk Entitlement (Thomson River – Melbourne Retailers (combined)) Conversion Order 2001	**171,800**
Bulk Entitlement (Thomson River – Environment) Conversion Order 2005	**10,000**
Take and use licences – unregulated surface water	**17,244**
Total volume of water entitlements in the Thomson basin	**436,788**

Notes:

(1) Under this bulk entitlement, Southern Rural Water operates Lake Glenmaggie and Cowwarr Weir to supply private diverters on the Thomson and Macalister rivers and water share holders in the Macalister Irrigation District, and to supply water to Gippsland Water's Thomson Macalister towns bulk entitlement.

(2) The Melbourne retailers hold the bulk entitlements on the Thomson River, which are assessed against a 15-year annual volume of 171,800 ML.

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.13-5. The total volume of water diverted by bulk entitlement holders was higher in 2012–13 compared to the volume reported in the 2011–12 Victorian Water Accounts. The volume of water diverted from unregulated streams by licence holders in the Thomson basin was 7,647 ML, which was slightly higher than the 2011–12 volume of 7,092 ML.

The VEWH holds environmental entitlements for the Thomson River and Macalister River, but the water available under these entitlements is used to support streamflows and is not diverted out of waterways in the basin.

Table 6.13-5 Allocation account balance summary for the Thomson basin

Water entitlement	Allocation issued	Net trade In / (Out)	Water use	End of season forfeitures
Thomson Macalister – Southern Rural Water				
Water shares[1]	176,559	0	(166,878)	(9,681)
Thomson Macalister Towns – Gippsland Water	2,335	0	(1,511)	(824)
Macalister River Environmental Entitlement 2010[2][3]	18,690	0	(9,565)	(9,125)
Operating provisions[4]	-	-	(53,090)	-
Diversion: *Thomson Macalister – Southern Rural Water*[5]			**(221,479)**	
Thomson River – Melbourne Retailers (combined)[6][7]	171,800	0	(25,148)	(146,652)
Thomson River – Environment[3]	10,000	0	(10,936)	-
Take and use licences – unregulated surface water	17,244	0	(7,647)	(9,597)

Notes:

(1) Allocation issued includes 15,650 ML of spill allocation made available to high reliability water shares in 2012–13.

(2) Water use reported reflects environmental in-stream use. These amounts are not reflected in the water balance in Table 6.13-2 as they do not represent an actual diversion from the waterway. Unused water is available to carry over under these entitlements. Refer to Chapter 4, Table 4.1.

(3) The environmental diversion reported here is not included in the total diversion for the Thomson Macalister – Southern Rural Water bulk entitlement as the water was not diverted out of the waterway.

(4) This reflects use of water to manage the system. It includes any loss incurred in supplying the primary entitlements.

(5) The water use reported in this line item represents the bulk diversion to supply primary entitlements and fulfil other operating requirements under the Thomson Macalister source bulk entitlement.

(6) The volume of water taken by the Melbourne metropolitan retailers under this bulk entitlement is assessed against a 15-year average annual volume of 171,800 ML. The corresponding average annual volume of diversions over the 15 years to 2012–13 was 109,694 ML.

(7) The combined volume of water taken by the Melbourne metropolitan retailers from the Thomson River basin, Yarra River basin and Silver and Wallaby creeks is assessed against a 15-year average annual volume of 555,000 ML. The corresponding average annual volume of diversions over the 15 years to 2012–13 was 411,571 ML.

The estimated volume of water harvested from small catchment dams in the Thomson basin is provided in Table 6.13-6.

Table 6.13-6 Estimated small catchment dam information for the Thomson basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	5,635	2,817	n/a
Registered commercial and irrigation	4,961	4,167	n/a
Total	**10,595**	**6,984**	**9,536**

n/a: Information not available.

6.13.3 Recycled water

Gippsland Water operates four wastewater treatment plants in the Thomson basin. Recycled water is mainly used to irrigate pasture and for watering facilities such as the Maffra Recreational Reserve. The volume of wastewater produced in 2012–13 was higher than 2011–12. A total of 57% of wastewater was recycled in the basin in 2012–13 (Table 6.13-7).

Table 6.13-7 Volume of recycled water in the Thomson basin

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other[3] (ML)
				Urban and industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Heyfield	128	57	45%	0	57	0	0	71	0
Maffra	310	193	62%	4	189	0	0	117	0
Rawson	28	0	0%	0	0	0	0	28	0
Stratford	42	42	100%	0	42	0	0	0	0
Total 2012–13	**508**	**292**	**57%**	**4**	**288**	**0**	**0**	**216**	**0**
Total 2011–12	368	335	91%	3	332	0	0	33	0

Notes:

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

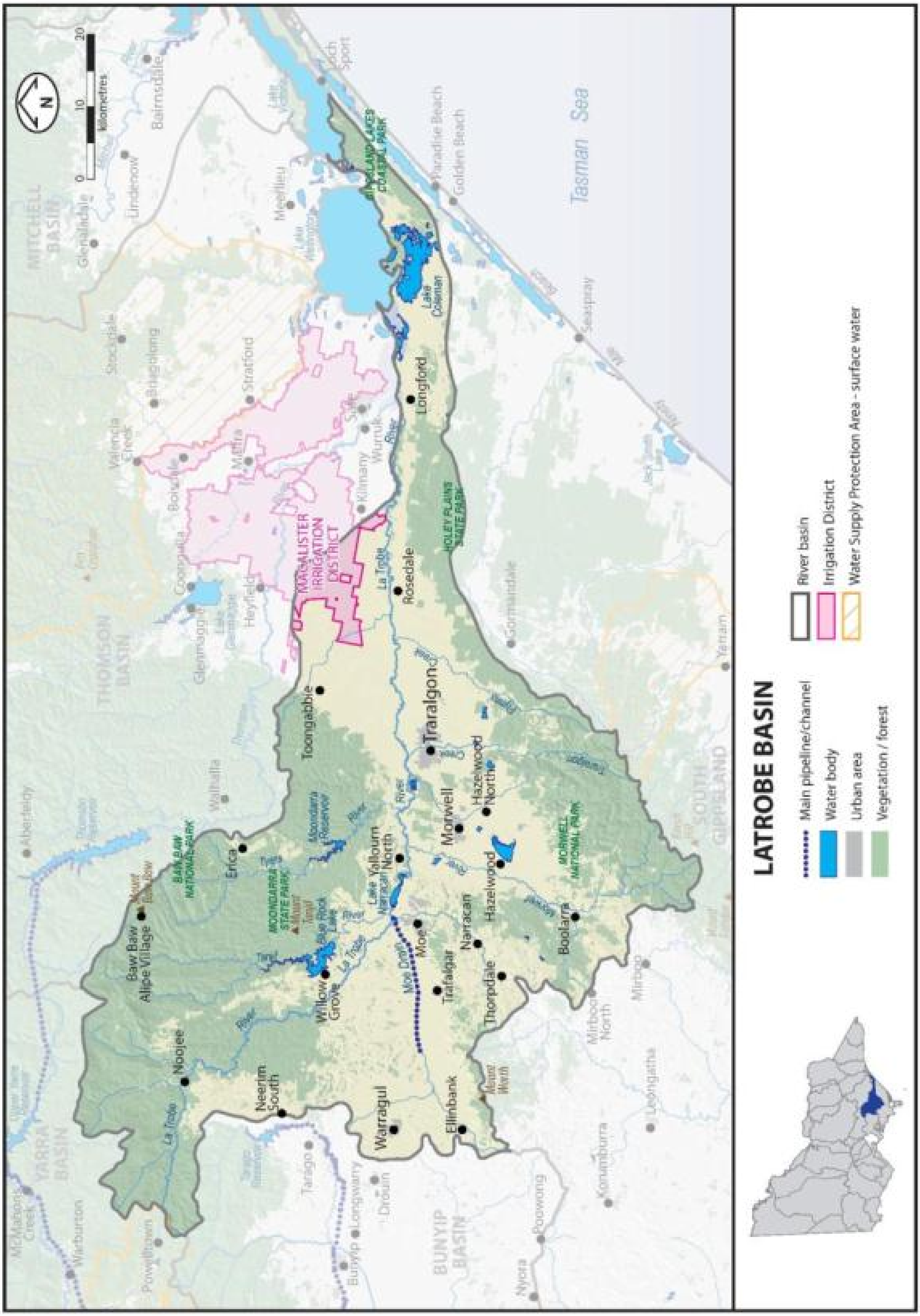
(2) Water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site wastewater storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.14 Latrobe basin

The Latrobe basin (Figure 6.14-1) 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 6.14-1 Map of the Latrobe basin



6.14.1 Water resources overview

In 2012–13, the Latrobe basin received rainfall between 80% and 100% of the long-term average. Catchment inflows were 106% of the long-term average. The amount of water flowing from the Latrobe basin into the Gippsland Lakes (excluding the Thomson River), represented 89% of the catchment inflows in the basin in 2012–13.

The volume of water in major storages remained high throughout the year, starting the year at 99% of capacity and ending the year at 98%. Licensed surface water diverters were subject to restrictions on the Latrobe River between January and June 2013, however the volume diverted remained similar to the previous year. Urban water use was unrestricted in 2012–13.

Table 6.14-1 shows the responsibilities of the authorities within the Latrobe basin.

Table 6.14-1 Responsibilities for water resources management in the Latrobe basin

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
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 Lake and Lake Narracan for supply to Gippsland Water, power stations and licensed diverters Obliged to meet passing flow requirements
Gippsland Water			Supplies towns including Moe, Morwell and Traralgon Provides industrial supply to Hazelwood and Energy Brix power stations, and other major industries	Operates Moondarra Reservoir Obliged to meet passing flow requirements
Victorian Environmental Water Holder				Holds and manages environmental entitlements in the basin
West Gippsland Catchment Management Authority				Manages waterways in the Latrobe basin

Environmental Water Reserve

The Gippsland Lakes and the Australian Grayling population are important environmental assets partially dependent on water from the Environmental Water Reserve (EWR) in the Latrobe basin. The lakes are listed as internationally significant wetlands under the Ramsar Convention and rely on the freshwater inputs from rivers (including the Latrobe River) to function ecologically. Australian Grayling are listed in the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* and the Victorian *Flora and Fauna Guarantee Act 1988*.

In 2012–13, the EWR in the Latrobe basin comprised:

- the *Latrobe River Environmental Entitlement 2010*(1)
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Southern Rural Water and Gippsland Water
- 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.

Note:

(1) This entitlement was to be renamed the *Lower Latrobe Wetlands Environmental Entitlement 2010* on 1 July 2013 to avoid confusion with an environmental entitlement for the Latrobe River allocated to implement Action 6.15 of the Gippsland Region Sustainable Water Strategy.

6.14.2 Surface water resources

6.14.2.1 Water balance

A surface water balance for the Latrobe basin is shown in Table 6.14-2. The major industrial water users in the basin include some electricity generators and Australian Paper. In 2012–13, these entities accounted for more than half the surface water diversions in the Latrobe basin. They also returned 50,880 ML to the Latrobe River system.

Table 6.14-2 Balance of surface water in the Latrobe basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	243,291	242,899
Volume in storage at end of year	240,813	243,291
Change in storage	**(2,478)**	**392**
Inflows		
Catchment inflow(1)	900,762	1,338,357
Rainfall on major storages	4,063	13,404
Return flow from power stations and major industry	50,880	51,730
Treated effluent discharged back to river	4,120	4,633
Total inflows	**959,825**	**1,408,123**
Outflows		
Diversions		
Urban and industrial diversions	112,401	119,031
Licensed diversions from regulated streams	6,007	1,622
Licensed diversions from unregulated streams	8,320	9,974
Small catchment dams	20,547	20,547
Total diversions	***147,275***	***151,174***
Losses		
Evaporation losses from major storages	7,592	13,165
Evaporation from small catchment dams	5,612	5,612
In-stream infiltration to groundwater, flows to floodplain and evaporation(2)	n/a	n/a
Total losses	***13,204***	***18,777***
Water passed at outlet of basin		
River outflows to the Gippsland Lakes (excluding Thomson River)	801,824	1,237,780
Total water passed at outlet of basin	***801,824***	***1,237,780***
Total outflows	**962,303**	**1,407,731**

Notes:

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

(2) No suitable model is available to make an estimate of in-stream losses.

6.14.2.2 Storages and flows

Storage levels for all major storages in the basin totalled 240,813 ML (98% of capacity) in June 2012 compared to 243,291 ML in July 2012 (Table 6.14-3). The volume reported in the 'catchment inflow less regulated releases' column in Table 6.14-3 is the balancing item for each storage. It represents the flow of water in or out of the storage that is not shown as rainfall or evaporation, and may include other minor components influencing the change in storage during the year.

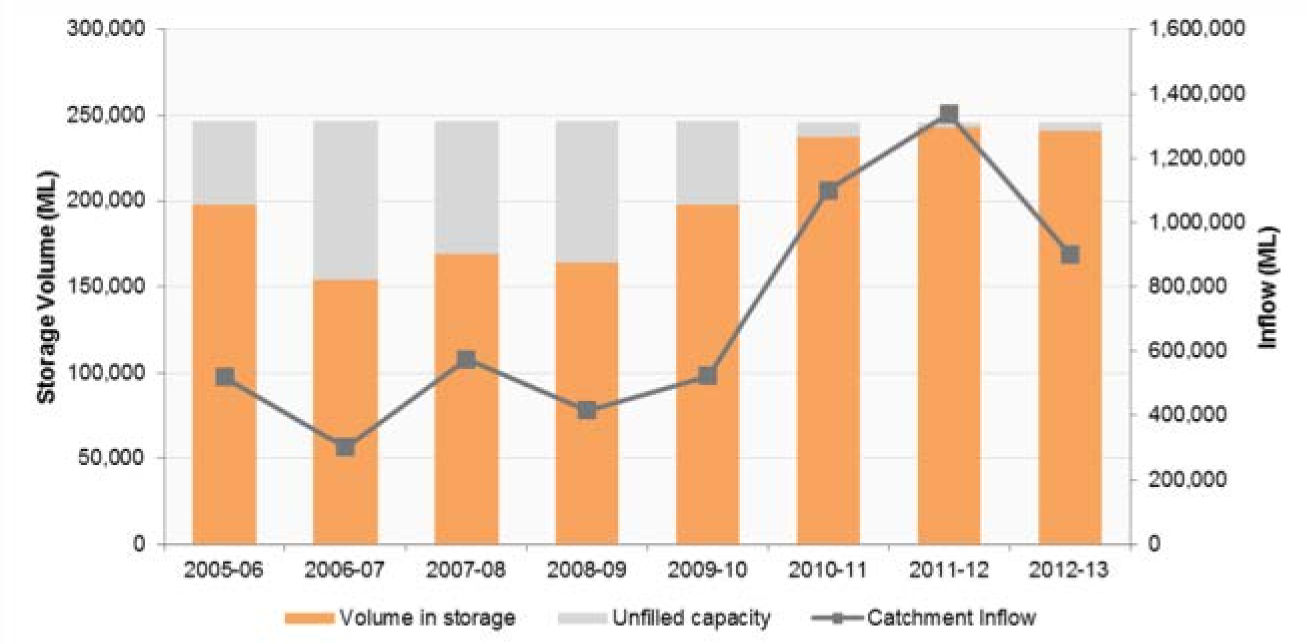
Only volumes for major on-stream storages have been included in the water balance. In the Latrobe basin, this includes Blue Rock Lake, Lake Narracan and Moondarra Reservoir. The largest storage in the basin is Blue Rock Lake, which has a capacity of approximately 208,000 ML. The volume of water held in Blue Rock Lake at the end of the year was 205,668 ML (99% of capacity).

Table 6.14-3 Storage volumes in the Latrobe basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Blue Rock Lake	208,188	210,021	688	1,270	(3,771)	205,668
Lake Narracan	7,230	2,970	1,749	3,347	3,473	4,845
Moondarra Reservoir	30,300	30,300	1,626	2,975	1,349	30,300
Total storages	**245,718**	**243,291**	**4,063**	**7,592**	**1,051**	**240,813**

Catchment inflows were 106% of the long-term average (of 847,400 ML), compared to 158% in 2011–12 (Figure 6.14-2). The amount of water flowing from the Latrobe basin into the Gippsland Lakes (excluding the Thomson River) decreased to 801,824 ML in 2012–13 from 1,237,780 ML in 2011–12.

Figure 6.14-2 All major storages and catchment inflows in the Latrobe basin



6.14.2.3 Entitlement volumes and diversions

In the Latrobe basin, surface water is diverted by Gippsland Water, Southern Rural Water, Latrobe Valley power stations, the Victorian Environmental Water Holder (VEWH) and licensed diverters. Surface water is also harvested in small catchment dams.

Entitlements in the Latrobe basin include rights granted to individuals (take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the Victorian Environmental Water Holder). Rights to water in the Latrobe basin are outlined in Table 6.14-4.

Table 6.14-4 Entitlement volumes in the Latrobe basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Boolarra) Conversion Order 1997	145
Bulk Entitlement (CGRWA – Blue Rock) Conversion Order 1997	15,150
Bulk Entitlement (Erica) Conversion Order 1997	340
Bulk Entitlement (Latrobe – Southern Rural) Conversion Order 1996(1)	13,400
Latrobe River Environmental Entitlement 2010(2)	n/a
Bulk Entitlement (Mirboo North) Conversion Order 1997	270
Bulk Entitlement (Moe – Narracan Creek) Conversion Order 1998	3,884
Bulk Entitlement (Moondarra Reservoir) Conversion Order 1997	62,000
Bulk Entitlement (Noojee) Conversion Order 1997	73
Bulk Entitlement (Thorpdale) Conversion Order 1997	80
Bulk Entitlement (Yallourn Energy Ltd for Gippsland and Southern Rural Water Authority) Conversion Order 1996	20,000
Bulk Entitlement (Yallourn Energy Ltd for Loy Yang Power Ltd) Conversion Order 1996	40,000
Bulk Entitlement (Yallourn Energy Ltd for SECV) Conversion Order 1996	25,000
Bulk Entitlement (Yallourn Energy Ltd) Conversion Order 1996	36,500
Take and use licences – unregulated surface water	19,188
Total volume of water entitlements in the Latrobe basin	**236,030**

Notes:

(1) This entitlement supplies water for take and use licences on the Tanjil River and Latrobe River Lower. For the 2012–13 year, 10,979 ML of entitlement was allocated for take and use licences .

(2) Use of this entitlement is dependent on suitable river heights, as specified in the entitlement.

Latrobe basin

Allocation available under bulk entitlements by water corporations, the Latrobe Valley power stations and licences in 2012–13 is shown in Table 6.14-5.

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 flow available for diversion varies depending on seasonal conditions. No use was recorded against this entitlement in 2012–13.

Licence holders diverted a volume of 8,320 ML from unregulated streams in 2012–13, less than the 2011–12 volume of 9,974 ML (Table 6.14-5).

Table 6.14-5 Allocation account balance summary for the Latrobe basin

Water entitlement	Allocation issued	Net trade In / (Out)	Water use	Forfeitures
Boolarra	145	0	(1)	(144)
CGRWA – Blue Rock	15,150	0	(6,325)	(8,825)
Erica	340	0	(80)	(260)
Latrobe – Southern Rural Water(1)	10,979	0	(6,007)	(4,972)
Latrobe River Environmental Entitlement(2)	-	0	-	-
Mirboo North	270	0	(186)	(84)
Moe – Narracan Creek	3,884	0	(1,621)	(2,263)
Moondarra Reservoir	62,000	0	(49,548)	(12,452)
Noojee(3)	73	0	0	(73)
Thorpdale	80	0	(17)	(63)
Yallourn Energy Ltd for Gippsland and Southern Rural Water Authority	20,000	0	(15,011)	(4,989)
Yallourn Energy Ltd for Loy Yang Power Ltd	40,000	0	(19,805)	(20,195)
Yallourn Energy Ltd for SECV	25,000	0	0	(25,000)
Yallourn Energy Ltd	36,500	0	(19,807)	(16,693)
Take and use licences – unregulated surface water	19,188	0	(8,320)	(10,868)

Notes:

(1) This represents the water allocated and used by take and use licence holders.

(2) Use of this entitlement is dependent on suitable river heights, as specified in the entitlement.

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

The estimated volume of water harvested from small catchment dams makes up a significant portion of total surface water diversions in the Latrobe basin (Table 6.14-6).

Table 6.14-6 Estimated small catchment dam information

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	13,009	6,505	n/a
Registered commercial and irrigation	16,717	14,042	n/a
Total	**29,726**	**20,547**	**26,159**

n/a: Information not available.

6.14.3 Recycled water

Gippsland Water treated over 23,000 ML of wastewater in the Latrobe basin, the majority of which was highly saline and unsuitable for recycling and was discharged to Bass Strait. The volume of water recycled in 2012–13 was similar to that for 2011–12, and represents around 5% of the wastewater produced.

Table 6.14-7 shows the volumes of water recycled in the Latrobe basin in 2012–13.

Table 6.14-7 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process(2))	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other(3) (ML)
				Urban and industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Mirboo North	150	53	35%	28	25	0	0	97	0
Moe	2,438	0	0%	0	0	0	0	2,438	0
Morwell	555	555	100%	0	0	555	0	0	0
Dutson Downs (regional outfall sewer)	9,991	672	7%	672	0	0	0	0	9,319
Saline wastewater outfall pipeline	8,835	0	0%	0	0	0	0	0	8,835
Warragul	1,569	0	0%	0	0	0	0	1,569	0
Willow Grove	19	3	16%	0	3	0	0	16	0
Total 2012–13	**23,557**	**1,283**	**5%**	**700**	**28**	**555**	**0**	**4,120**	**18,154**
Total 2011–12	25,643	777	3%	9	68	700	0	4,633	20,233

Notes:

(1) ‘Beneficial allocation’ refers to the volume used to deliver specific environmental flow benefits.

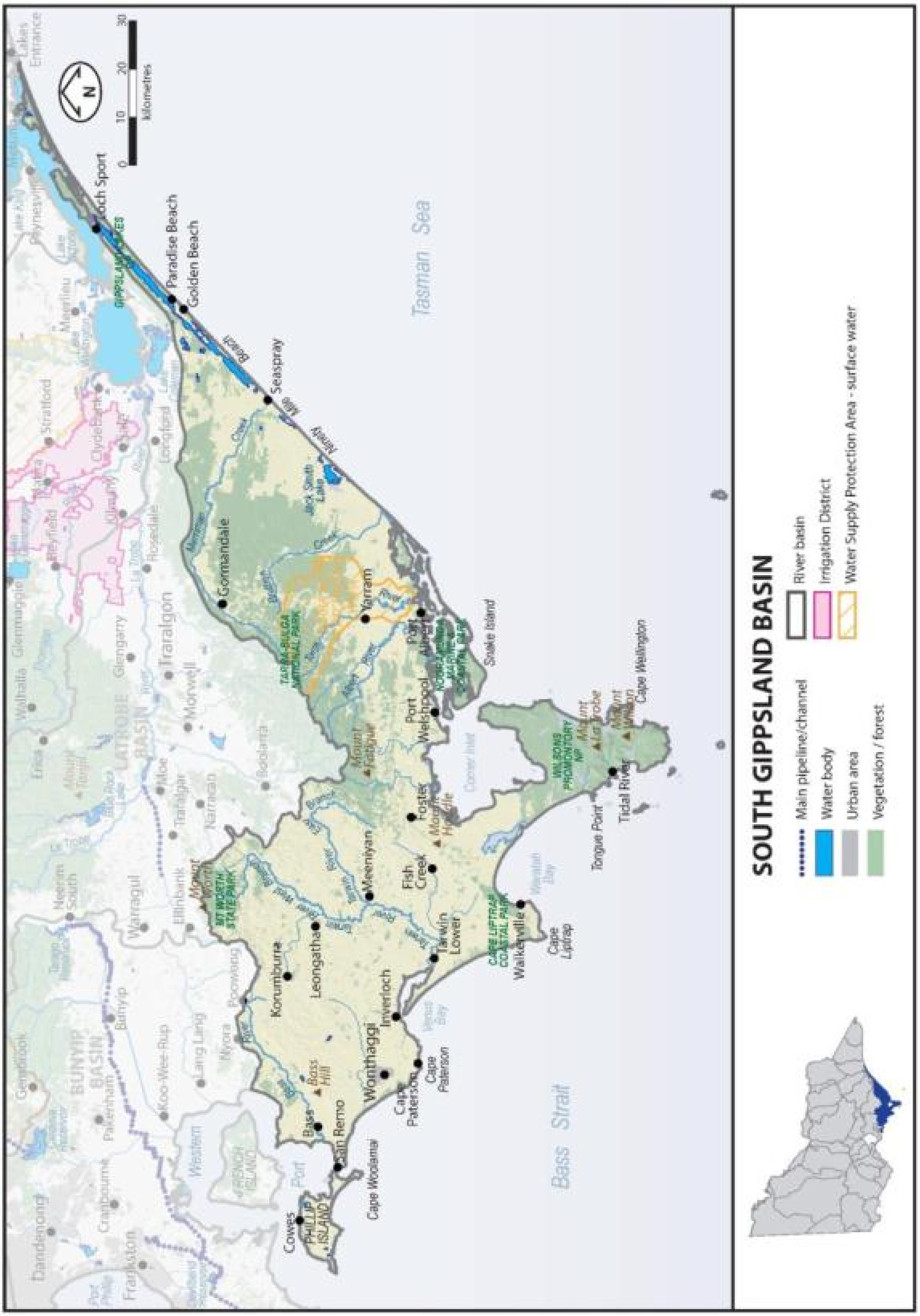
(2) ‘Within process’ refers to water reused in wastewater treatment processes, for example back-flush of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC’s performance report.

(3) ‘Other’ refers to a change in on-site wastewater storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.15 South Gippsland basin

The South Gippsland basin (Figure 6.15-1) is located within south-east Victoria. The basin includes the Bass River, which flows into Westernport Bay, and smaller rivers that flow directly into Bass Strait.

Figure 6.15-1 Map of the South Gippsland basin



6.15.1 Water resources overview

In 2012–13, rainfall over most of the South Gippsland basin was slightly below average (80% – 100% of the long-term average), with drier than average conditions over Wilson's Promontory (60% – 80% of the long-term average). Catchment inflows were 112% of the long-term average, significantly lower when compared to 203% in 2011–12. The amount of water flowing from the South Gippsland basin into Westernport Bay and Bass Strait represented 97% of the total inflows to the basin in 2012–13.

The maximum storage capacity in the South Gippsland basin rose in 2012–13 due to a doubling of storage volume in the Candowie Reservoir. Accordingly, this resulted in a fall in the percentage of storage used, while the volume of water in storages remained similar to levels in 2011–12.

Water availability was limited in Tarra and Jack rivers, which were subject to irrigation bans between January and June 2013. The volume of diversions for urban water use was similar to 2011–12, as were licensed diversions from unregulated streams. Water harvested from small catchment dams represents the largest diversion of water in the South Gippsland basin.

Table 6.15-1 shows the responsibilities of the authorities within the South Gippsland basin.

Table 6.15-1 Responsibilities for water resources management in the South Gippsland basin

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages surface water licensed diversions		
South Gippsland Water		Supplies towns including Leongatha, Inverloch, Wonthaggi, Korumburra and Foster	Obliged to meet passing flow requirements
Westernport Water		Supplies towns including San Remo and Phillip Island	Obliged to meet passing flow requirements
Gippsland Water		Supplies towns in the far east of the basin including Seaspray	Obliged to meet passing flow requirements
West Gippsland Catchment Management Authority			Manages waterways in most of the South Gippsland basin
Melbourne Water			Manages waterways in the far west of the South Gippsland basin

Environmental Water Reserve

Important environmental assets in the South Gippsland basin are dependent on water from the Environmental Water Reserve (EWR). Corner Inlet and Westernport Bay are listed as internationally significant wetlands under the Ramsar Convention and rely on the 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,* also relies on water from the South Gippsland EWR.

In 2012–13, the South Gippsland basin EWR comprised:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Gippsland Water and South Gippsland Water
- 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.

6.15.2 Surface water resources

6.15.2.1 Water balance

A surface water balance for the South Gippsland basin is shown in Table 6.15-2. Diversions make up a relatively small proportion of total inflows, with around 3% of basin inflows diverted for consumptive use in 2012–13. Most inflows leave the basin and flow into Bass Strait or Westernport Bay.

Table 6.15-2 Balance of surface water in the South Gippsland basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	8,271	8,341
Volume in storage at end of year	7,242	8,271
Change in storage	**(1,029)**	**(70)**

South Gippsland basin

Water account component	2012–13 (ML)	2011–12 (ML)
Inflows		
Catchment inflow[(1)]	1,017,893	1,854,567
Rainfall on major storages	1,416	1,992
Treated effluent discharged back to river	4,994	5,761
Total inflows	**1,024,304**	**1,862,320**
Outflows		
Diversions		
Urban diversions	7,688	7,564
Licensed diversions from unregulated streams	2,832	3,254
Small catchment dams	24,256	24,256
Total diversions	***34,776***	***35,074***
Losses		
Evaporation losses from major storages	1,867	1,484
Evaporation from small catchment dams	5,135	5,135
In-stream infiltration to groundwater, flows to floodplain and evaporation[(2)]	n/a	n/a
Total losses	***7,002***	***6,619***
Water passed at outlet of basin		
River outflows to Bass Strait and Westernport Bay	983,554	1,820,697
Total water passed at outlet of basin	***983,554***	***1,820,697***
Total outflows	**1,025,333**	**1,862,390**

Notes:

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

(2) No suitable model is available to make an estimate of in-stream losses.

6.15.2.2 Storages and flows

Levels for all major on-stream storages in the basin (Candowie, Hyland, Lance Creek and Western reservoirs) at the end of June 2013 were similar to the previous year (Table 6.15-3), with the exception of Candowie Reservoir. The Candowie Upgrade Project raised the full supply level of the reservoir by three metres, effectively doubling the capacity volume from 2,263 ML to 4,463 ML, and the reservoir's supply is expected to provide the region with a secure water supply for the next 50 years.

Table 6.15-3 shows detailed information for storages in the South Gippsland basin. The volume reported in the 'catchment inflow less regulated releases' column in Table 6.15-3 is the balancing item for each storage. It represents the flow of water in or out of the storage that is not shown as rainfall or evaporation, and may include other minor components influencing the change in storage during the year.

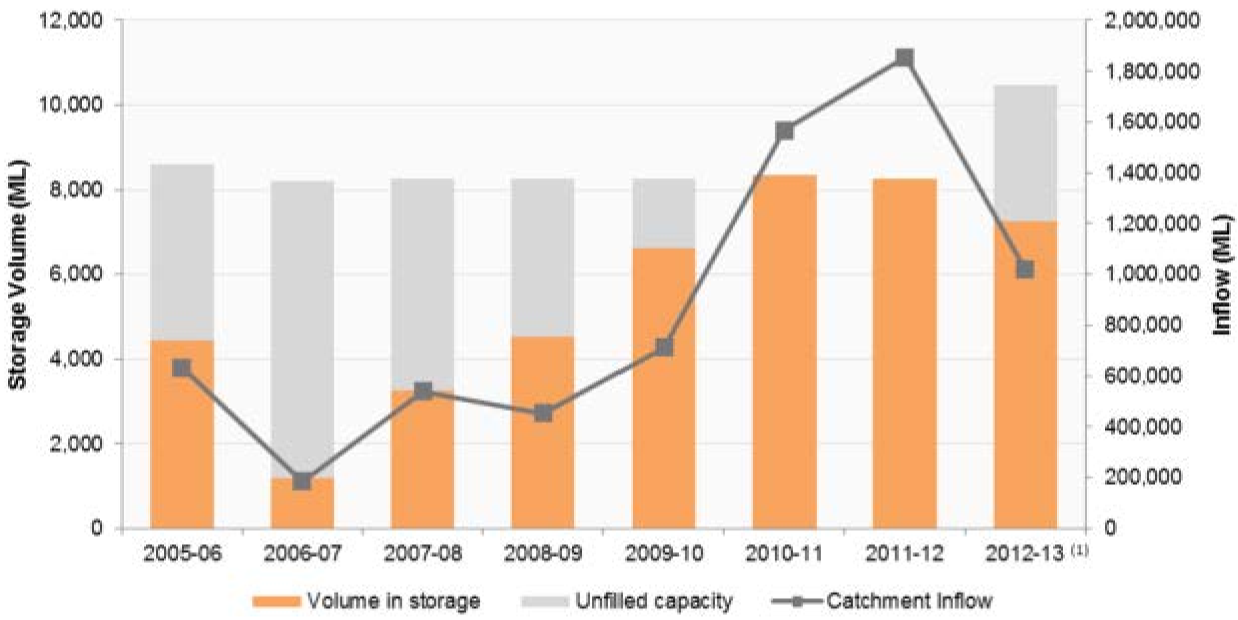
Table 6.15-3 Storage volumes in the South Gippsland basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Candowie Reservoir	4,463	2,263	510	658	(881)	1,234
Hyland Reservoir	671	671	80	131	51	671
Lance Creek Reservoir	4,200	4,200	703	876	173	4,200
Western Reservoir	1,137	1,137	123	202	79	1,137
Total storages	**10,471**	**8,271**	**1,416**	**1,867**	**(578)**	**7,242**

Catchment inflows were 1,017,893 ML, or 112% of the long-term average (of 911,500 ML), a decrease from 203% of average in 2011–12 (Figure 6.15-2).

The amount of water flowing from the South Gippsland basin into Westernport Bay and Bass Strait was 983,554 ML in 2012–13. This represents 97% of the total inflows into the basin.

Figure 6.15-2 All major storages and catchment inflows in the South Gippsland basin



Note:

(1) Capacity of Candowie Reservoir increased.

6.15.2.3 Entitlement volumes and diversions

In the South Gippsland basin, surface water is diverted by Gippsland Water, South Gippsland Water and Westernport Water. Melbourne Water may source desalinated seawater from the Wonthaggi Desalination Plant in the South Gippsland basin to supplement surface water supplies from the Melbourne headworks. Surface water is also diverted by licensed diverters and harvested in small catchment dams.

Entitlements include rights granted to individuals (take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the Victorian Environmental Water Holder). Rights to water in the South Gippsland basin are outlined in Table 6.15-4 Entitlement volumes in the South Gippsland basin.

Table 6.15-4 Entitlement volumes in the South Gippsland basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Devon North Alberton-Yarram and Port Albert) Conversion Order 1997	**853**
Bulk Entitlement (Dumbalk) Conversion Order 1997	**100**
Bulk Entitlement (Fish Creek) Conversion Order 1997	**251**
Bulk Entitlement (Foster) Conversion Order 1997	**326**
Bulk Entitlement (Korumburra) Conversion Order 1997	**1,000**
Bulk Entitlement (Leongatha) Conversion Order 1997	**2,476**
Bulk Entitlement (Loch, Poowong and Nyora) Conversion Order 1997	**420**
Bulk Entitlement (Meeniyan) Conversion Order 1997	**200**
Bulk Entitlement (Seaspray) Conversion Order 1997	**61**
Bulk Entitlement (Toora Port Franklin-Welshpool and Port Welshpool) Conversion Order 1997	**1,617**
Bulk Entitlement (Westernport) Conversion Order 1997	**2,911**
Bulk Entitlement (Westernport – Bass River) Order 2009	**3,000**
Bulk Entitlement (Wonthaggi-Inverloch) Conversion Order 1997	**5,600**
Bulk Entitlement (Desalinated Water – Melbourne Retailers (combined))(1)	
Bulk Entitlement (Desalinated Water – City West Water Limited) Order 2010	n/a
Bulk Entitlement (Desalinated Water – South East Water Limited) Order 2010	n/a
Bulk Entitlement (Desalinated Water – Yarra Valley Water Limited) Order 2010	n/a
Sub-total Bulk Entitlement (Desalinated Water – Melbourne Retailers (combined))	**150,000**
Take and use licences – unregulated surface water	**12,790**
Total volume of water entitlements in the South Gippsland basin	**181,605**

Note:

(1) Under this entitlement the authority may take up to a total of 150,000 ML in any one year and up to 750,000 ML in any consecutive five year period.

South Gippsland basin

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.15-5 Allocation account balance summary for the South Gippsland basin. As in previous years, the volume of water diverted from unregulated streams by take and use licence holders in the South Gippsland basin (Table 6.15-5) remains significantly lower than the total licence volume.

Table 6.15-5 Allocation account balance summary for the South Gippsland basin

Water entitlement	Allocation issued	Net trade In/(Out)	Water use	Forfeitures
Devon North Alberton – Yarram and Port Albert	853	0	(429)	(424)
Dumbalk	100	0	(31)	(69)
Fish Creek	251	0	(99)	(152)
Foster	326	0	(175)	(151)
Korumburra	1,000	0	(713)	(287)
Leongatha	2,476	0	(1,707)	(769)
Loch, Poowong and Nyora	420	0	(231)	(189)
Meeniyan	200	0	(66)	(134)
Seaspray(1)	61	0	(64)	3
Toora Port Franklin – Welshpool and Port Welshpool	1,617	0	(513)	(1,104)
Westernport	2,911	0	(1,637)	(1,274)
Westernport – Bass River	3,000	0	(201)	(2,799)
Wonthaggi – Inverloch	3,800	0	(1,822)	(1,978)
Desalinated water – Melbourne retailers(2)	0	0	0	0
Take and use licences – unregulated surface water	12,790	0	(2,832)	(9,958)

Note:

(1) Water use in 2012–13 was over cap as a new raw water basin was filled during the year. The breach was disclosed in the Gippsland Water annual report.

(2) The Minister for Water made a zero desalinated water order for the 2012–13 year.

The estimated volume of water harvested from small catchment dams represents the largest diversion of water in the South Gippsland basin (Table 6.15-6).

Table 6.15-6 Estimated small catchment dam information for the South Gippsland basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	22,962	11,481	n/a
Registered commercial and irrigation	15,208	12,775	n/a
Total	**38,170**	**24,256**	**29,391**

n/a: Information not available.

6.15.3 Recycled water

South Gippsland Water is responsible for eight wastewater treatment plants within the basin, with the Waratah Bay and Welshpool treatment plants the two sites where all wastewater is recycled. Recycling opportunities 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 gardens of significance. Gippsland Water operates Seaspray treatment plant and reuses all recycled water to irrigate pasture.

Across the basin, 8% of wastewater was reused, compared to 3% in 2011–12 (Table 6.15-7).

Table 6.15-7 Volume of recycled water in the South Gippsland basin

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process(2))	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other(3) (ML)
				Urban and industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Coronet Bay	183	160	87%	0	160	0	0	97	(74)
Cowes	1,164	79	6%	66	0	0	12	1,085	0
Foster	129	0	0%	0	0	0	0	129	0
Korumburra	608	0	0%	0	0	0	0	608	0
Leongatha Domestic	592	0	0%	0	0	0	0	592	0
Leongatha Trade Waste	976	0	0%	0	0	0	0	976	0
Seaspray	10	10	100%	0	10	0	0	0	0
Toora	49	7	14%	7	0	0	0	42	0
Waratah Bay	17	17	100%	0	17	0	0	0	0
Welshpool	18	18	100%	0	18	0	0	0	0
Wonthaggi/Cape Paterson/Inverloch	1,269	12	1%	0	12	0	0	1,257	0
Yarram/Tarraville	324	115	35%	0	115	0	0	209	0
Total 2012–13	**5,337**	**416**	**8%**	**73**	**331**	**0**	**12**	**4,994**	**(74)**
Total 2011–12	5,949	216	3%	32	176	0	9	5,761	(27)

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percent recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site wastewater storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.16 Bunyip basin

The Bunyip basin (Figure 6.16-1) is located within south-east Victoria. The basin includes the Lang Lang and Bunyip rivers which flow into Westernport Bay, and the Patterson River which flows into Port Phillip Bay. The south-eastern suburbs of Melbourne are located within the Bunyip basin.

Figure 6.16-1 Map of the Bunyip basin

6.16.1 Water resources overview

In 2012–13, rainfall in most of the Bunyip basin was between 80% and 100% of the long-term average, lower than the previous year. Inflows to the Bunyip basin in 2012–13 were 119% of the long-term average, compared to 191% in 2011–12. The amount of water flowing from the Bunyip basin into Port Phillip Bay, Westernport Bay and Bass Strait represented approximately 96% of the catchment inflows in the basin.

Total capacity in the basin's only major storage, the Tarago Reservoir, was increased to 37,580 ML, having previously been limited to 25,000 ML for safety reasons. Accordingly, stored water increased from 2011–12 to 83% of the new capacity.

In 2012–13, there were no towns in the basin that were subject to restrictions. Both Deep Creek and Main Creek were subject to irrigation bans between January and June 2013.

Table 6.16-1 shows the responsibilities of the authorities within the Bunyip basin.

Table 6.16-1 Responsibilities for water resources management in the Bunyip basin

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages surface water and private diversions		
Melbourne Water		Operates Eastern Treatment Plant Provides bulk water supply to South East Water	Operates Tarago Reservoir Obliged to meet passing flows Manages waterways
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	Obliged to meet passing flows
Victorian Environmental Water Holder			Holds and manages environmental entitlements in the basin

Note:
(1) Metropolitan Melbourne is mostly supplied from the Yarra and Thomson basins.

Environmental Water Reserve

Westernport Bay is an important environmental asset dependent on water from the Environmental Water Reserve (EWR) in the Bunyip basin. The bay is listed as an internationally significant wetland under the Ramsar Convention and relies on the freshwater inputs from the Bunyip basin to function ecologically. Additionally, there is a nationally threatened population of Dwarf Galaxias and Australian Grayling in the Tarago and Bunyip systems.

In 2012–13, the Bunyip basin EWR comprised:

- the *Tarago and Bunyip Rivers Environmental Entitlement 2009* comprising 10.9% of inflows (on average 3,000 ML per year) held by the Victorian Environmental Water Holder (VEWH)
- water set aside for the environment through the operation of passing flows released as a condition of the consumptive bulk entitlement held by Gippsland Water
- 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.

6.16.2 Surface water resources

6.16.2.1 Water balance

A surface water balance for the Bunyip basin is shown in Table 6.16-2.

Table 6.16-2 Balance of surface water in the Bunyip basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	22,434	24,000
Volume in storage at end of year	31,355	22,434
Change in storage	**8,921**	**(1,566)**

Bunyip basin

Water account component	2012–13 (ML)	2011–12 (ML)
Inflows		
Catchment inflow[(1)]	645,007	1,033,964
Rainfall on major storages	2,290	2,552
Treated effluent discharged back to river	8,524	10,357
Total inflows	**655,821**	**1,046,872**
Outflows		
Diversions		
Urban diversions	10,033	11,718
Licensed diversions from unregulated streams	4,577	3,982
Small catchment dams	15,525	15,525
Total diversions	***30,134***	***31,225***
Losses		
Evaporation losses from major storages	1,756	1,372
Losses from small catchment dams	556	556
In-stream infiltration to groundwater, flows to floodplain and evaporation	1,606	1,601
Total losses	***3,918***	***3,529***
Water passed at outlet of basin		
River outflows to Port Phillip Bay and Westernport Bay	612,847	1,013,685
Total water passed at outlet of basin	***612,847***	***1,013,685***
Total outflows	**646,900**	**1,048,438**

Note:

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

6.16.2.2 Storages and flows

The Tarago Reservoir is the only major on-stream storage in the Bunyip basin. It ended the year at 31,355 ML, or 83% of its capacity of 37,580 ML (Table 6.16-3). While the Tarago Reservoir has a capacity of 37,580 ML, in previous years it operated at a temporary capacity of 25,000 ML for dam safety reasons. The volume reported in the 'catchment inflow less regulated releases' column in Table 6.16-3 is the balancing item for each storage. It represents the flow of water in or out of the storage that is not shown as rainfall or evaporation, and may include other minor components influencing the change in storage during the year.

Cardinia Reservoir is an off-channel storage located within the Bunyip basin. It stores water harvested and transferred from the Yarra basin and is therefore not included in the Bunyip basin figures.

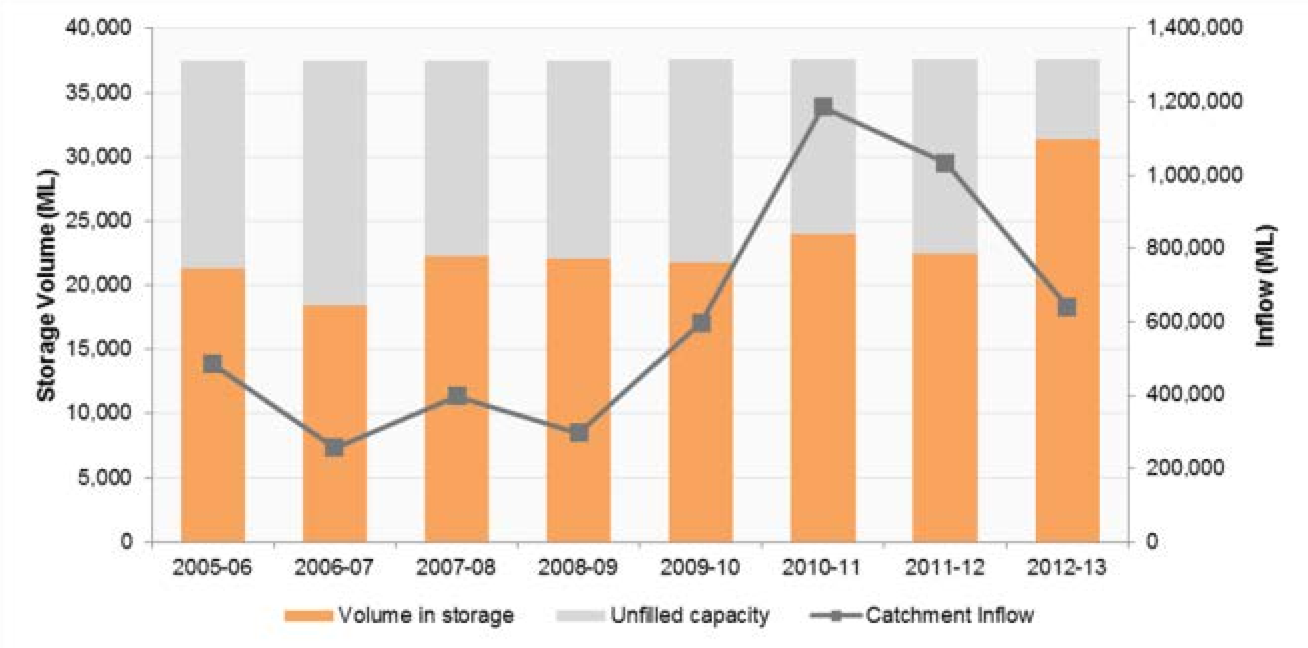
Table 6.16-3 Storage volumes in the Bunyip basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Tarago Reservoir	37,580	22,434	2,290	1,756	8,387	31,355
Total storages	**37,580**	**22,434**	**2,290**	**1,756**	**8,387**	**31,355**

Catchment inflows were 645,007 ML, or 119% of the long-term average (of 541,000 ML), a decrease from 191% of the long-term average in 2011–12 (Figure 6.16-2).

The amount of water flowing from the Bunyip basin into Port Phillip Bay, Westernport Bay and Bass Strait was 612,847 ML in 2012–13, compared to 1,013,685 ML in 2011–12. This represents 96% of the catchment inflows into the basin for 2012–13.

Figure 6.16-2 All major storages and catchment inflows



6.16.2.3 Entitlement volumes and diversions

Melbourne metropolitan retailers (City West Water, South East Water, Western Water and Yarra Valley Water), Gippsland Water and Southern Rural Water hold bulk entitlements to divert surface water in the Bunyip basin. Surface water is also diverted by licence holders and is harvested in small catchment dams.

Entitlements to water in the Bunyip basin include rights granted to individuals (take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the Victorian Environmental Water Holder). Rights to water in the Bunyip basin are outlined in Table 6.16-4.

The Victorian Environmental Water Holder (VEWH) also holds an environmental entitlement in the Bunyip basin, but the water available under the entitlement is used to support streamflows and the water is not diverted out of the waterway.

Table 6.16-4 Entitlement volumes in the Bunyip basin

Water entitlements	Annual Entitlement Volume (ML)
Bulk Entitlement (Tarago River – Gippsland Water) Conversion Order 2009	**4,825**
Bulk Entitlement (Tarago River – Southern Rural Water) Conversion Order 2009	**1,260**
Bulk Entitlement Tarago and Bunyip Rivers – Melbourne Retailers (combined)	
Bulk Entitlement (Tarago and Bunyip Rivers – Melbourne Water for City West Water Limited) Conversion Order 2009	n/a
Bulk Entitlement (Tarago and Bunyip Rivers – Melbourne Water for South East Water Limited) Conversion Order 2009	n/a
Bulk Entitlement (Tarago and Bunyip Rivers – Melbourne Water for Yarra Valley Water Limited) Conversion Order 2009	n/a
Tarago and Bunyip Rivers – Melbourne Retailers (combined)	**30,510**
Tarago and Bunyip Rivers Environmental Entitlement 2009(1)	**n/a**
Take and use licences – unregulated surface water	**19,007**
Total volume of water entitlements in the Bunyip basin	**55,602**

Note:

(1) The Tarago and Bunyip Rivers Environmental Entitlement consists of a 10.9% share of inflows into storage, with the actual volume available in any year varying depending upon inflow conditions.

The *Tarago and Bunyip Rivers Environmental Entitlement 2009* provides the VEWH with a 10.9% share of inflows to Tarago Reservoir up to a maximum volume of 3,000 ML. The water available under the entitlement is used to support streamflows and is not diverted out of the waterway.

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.16-5. The total volume of water diverted by bulk entitlement holders was slightly less in 2012–13 compared to the amount reported in the 2011–12 Victorian Water Accounts.

The volume of water diverted from unregulated streams by licence holders in the Bunyip basin in 2012–13 was similar to the amount reported in the 2011–12 Victorian Water Accounts (Table 6.16-5).

Table 6.16-5 Allocation account balance summary for the Bunyip basin

Water entitlement	Allocation issued	Net trade In / (Out)	Water use	Forfeitures
Tarago River – Gippsland Water	4,825	0	(3,231)	(1,594)
Tarago River – Southern Rural Water[1]	1,260	0	0	(1,260)
Tarago River – Melbourne Metropolitan Retailers	30,510	0	(6,802)	(23,708)
Tarago and Bunyip Rivers Environmental Entitlement[2]	3,000	0	(2,176)	-
Take and use licences – unregulated surface water	19,007	0	(4,577)	(14,430)

Notes:

(1) Southern Rural Water did not take any water under this entitlement for supply to licensed diverters downstream of Tarago Reservoir in 2012–13.

(2) Allocation issued represents the share of available water. Water use reported reflects environmental in-stream use. This amount is not reflected in the water balance in Table 6.16-2 as it does not reflect an actual diversion from the waterway. Unused water is available to carry over in this system. For details refer to Chapter 4, Table 4.1.

The estimated volume of water harvested from small catchment dams represents the largest diversion of water in the Bunyip basin (Table 6.16-6).

Table 6.16-6 Estimated small catchment dam information

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	8,026	4,013	n/a
Registered commercial and irrigation	13,704	11,512	n/a
Total	**21,730**	**15,525**	**16,080**

n/a: Information not available.

6.16.3 Recycled water

Gippsland Water, South East Water and Melbourne Water operate wastewater treatment plants within the Bunyip basin. Overall, 6% of wastewater was recycled for off-site purposes.

The largest treatment plant is the Eastern Treatment Plant operated by Melbourne Water, which recycled 5% of its total wastewater volume of 144,484 ML. The plant's recycled wastewater was predominantly used on-site and this volume has not been included in the percentage of water recycled. However, an increasing amount is being used by the Eastern Irrigation Scheme for horticultural, recreational and residential customers.

Table 6.16-7 shows the volume of water recycled in the Bunyip basin in 2012–13.

Table 6.16-7 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process[2])	End use type for recycled water (ML)					Volume discharged to the environment (ML)	Release to ocean/ Other[3] (ML)
				To retailers	Urban and industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Blind Bight	221	221	75%	0	166	0	0	55	0	0
Boneo	3,312	1,086	33%	0	1,086	0	0	0	2,222	4
Drouin	648	66	10%	0	0	66	0	0	582	0
Eastern Treatment Plant	144,484	21,352	5%	6,973	0	0	0	14,379	0	123,132
Koo Wee Rup	152	0	0%	0	0	0	0	0	0	152
Lang Lang[4]	31	38	122%	0	38	0	0	0	0	(7)
Longwarry	194	112	57%	0	0	112	0	0	0	83
Mt Martha	5,174	667	1%	0	51	0	0	617	4,506	0
Neerim South	43	0	0%	0	0	0	0	0	43	0
Pakenham	2,511	668	24%	0	247	362	0	58	0	1,844
Somers	1,628	314	17%	0	210	67	0	36	1,171	144
Total 2012–13	**158,399**	**24,524**	**6%**	**6,973**	**1,798**	**607**	**0**	**15,146**	**8,524**	**125,351**
Total 2011–12	167,853	20,432	3%	3,808	1,224	87	0	15,313	10,357	137,064

Notes:

(1) ‘Beneficial allocation’ refers to the volume used to deliver specific environmental flow benefits.

(2) ‘Outside process’ refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC’s performance report.

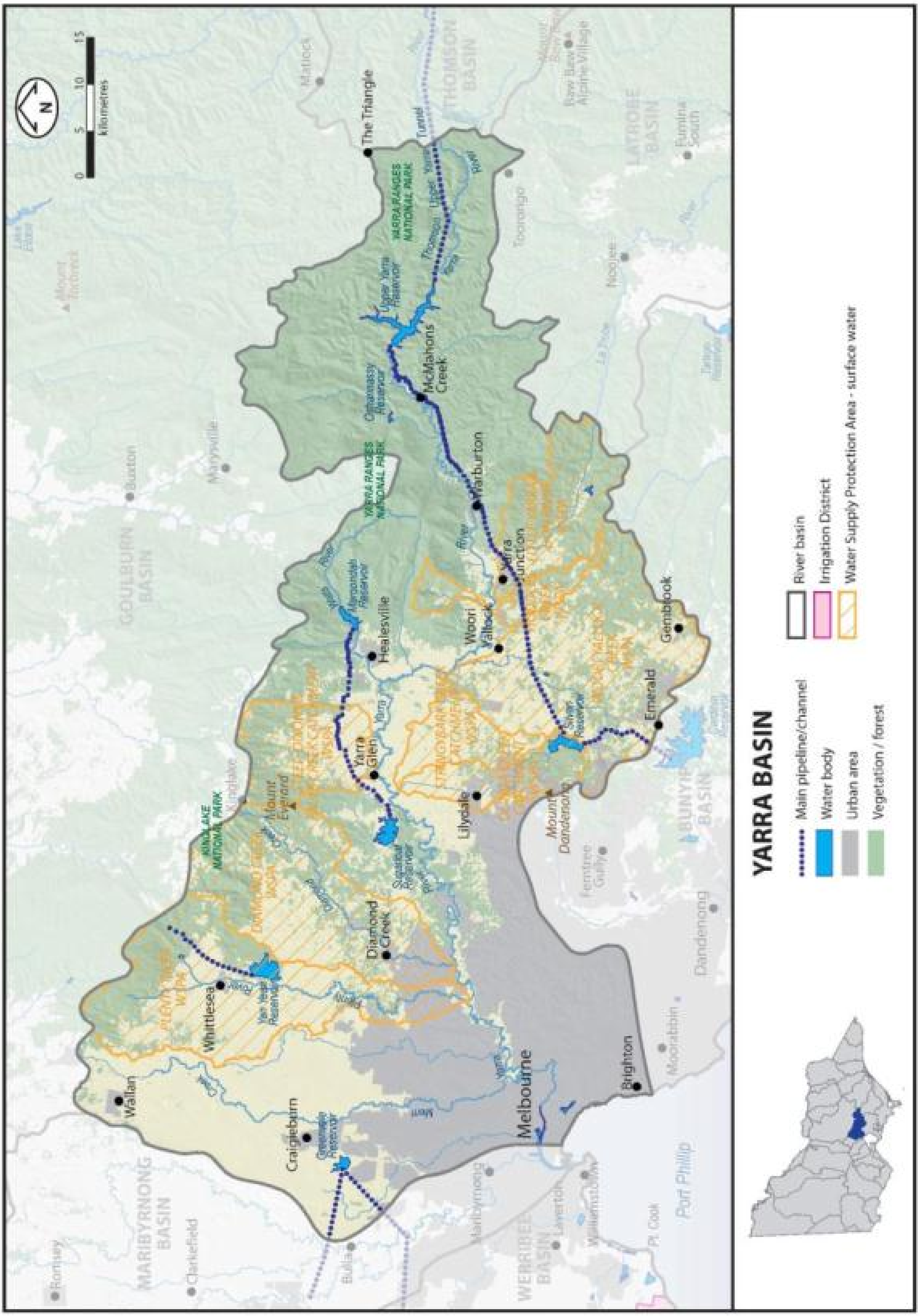
(3) ‘Other’ refers to a change in on-site wastewater storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

(4) Volume recycled greater than volume produced due to water stored on-site carried over from the previous year.

6.17 Yarra basin

The Yarra basin (Figure 6.17-1) is located in south-east Victoria. The Yarra River originates in the Yarra Ranges National Park and flows through the heart of Melbourne before reaching Port Phillip Bay.

Figure 6.17-1 Map of the Yarra basin



6.17.1 Water resources overview

In 2012–13, rainfall across the Yarra basin ranged between 60% and 100% of the long-term average, with drier conditions in the north of the basin. Catchment inflows were 87% of the long-term average. While this was a decrease from the previous year's inflows of 114%, it was the third consecutive year that inflows to the Yarra basin were more than 50% of the long-term average following four years of very low flows.

The volume of water in major storages in the Yarra basin finished the year lower, from 80% of capacity at the start of the year to 66% by the end of June 2013.

Melbourne started 2012–13 with Stage 1 urban water restrictions which were lifted in November 2012. Restrictions applied to private diversions from the Yarra River between December 2012 and June 2013 and the Little Yarra from February to March 2013. An irrigation ban was also in place on Hoddles Creek from December 2012 to June 2013. Table 6.17-1 shows the responsibilities of the authorities within the Yarra basin.

Table 6.17-1 Responsibilities for water resources management

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
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) and is obliged to meet passing flow requirements
Yarra Valley Water		Supplies part of the metropolitan Melbourne area, including Healesville, Yarra Glen and Warburton	
South East Water		Supplies part of the metropolitan Melbourne area	
City West Water		Supplies part of the metropolitan Melbourne area	
Victorian Environmental Water Holder			Holds and manages environmental entitlements in the basin

Note:

(1) Melbourne is also supplied from the Thomson and Bunyip basins.

Environmental Water Reserve

Important environmental assets, such as the Australian Grayling, River Blackfish, Macquarie Perch and numerous billabongs and wetlands, depend on the Yarra basin Environmental Water Reserve (EWR). The Yarra River between Warburton and Warrandyte has been identified as a Victorian heritage river and also depends on the EWR.

In 2012–13, the Yarra basin EWR comprised:

- the *Yarra River Environmental Entitlement 2006* comprising 17,000 ML of high reliability entitlement held by the Victorian Environmental Water Holder (VEWH) and 55 ML of unregulated flows
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by the Melbourne metropolitan retailers
- water set aside for the environment through the operation of Stream Flow Management Plans
- 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.

6.17.2 Surface water resources

6.17.2.1 Water balance

A surface water balance for the Yarra basin is shown in Table 6.17-2.

Table 6.17-2 Balance of surface water in the Yarra basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	196,989	191,140
Volume in storage at end of year	133,113	196,989
Change in storage	**(63,876)**	**5,849**
Inflows		
Catchment inflow(1)	914,537	1,200,267
Rainfall on major storages	10,743	14,539
Transfers from Thomson	25,148	1,062
Transfers from Goulburn (Silver and Wallaby Creeks)	1,071	1,100
Transfers from Goulburn via North-South pipeline(2)	0	0
Treated effluent discharged back to river	0	8,243
Total inflows	**951,499**	**1,225,211**
Outflows		
Diversions		
Urban diversions	325,855	345,600
Licensed diversions from unregulated streams	9,137	12,420
Small catchment dams	15,824	15,824
Total diversions	***350,816***	***373,844***
Losses		
Evaporation losses from major storages	12,496	11,177
Evaporation from small catchment dams	1,268	1,268
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	n/a	n/a
Total losses	***13,765***	***12,445***
Water passed at outlet of basin		
River outflows to Port Phillip Bay	650,795	833,073
Total water passed at outlet of basin	***650,795***	***833,073***
Total outflows	**1,015,375**	**1,219,362**

Notes:

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

(2) There were no transfers from the Goulburn basin via the North-South pipeline in the 2012–13 water year.

(3) No suitable model is available to make an estimate of in-stream losses.

6.17.2.2 Storages and flows

Melbourne Water operates seven major storages within the Yarra basin. Water is harvested by Upper Yarra Reservoir, O'Shannassy Reservoir and Maroondah Reservoir. Sugarloaf Reservoir and Yan Yean Reservoir are off-stream storages but have dual roles to harvest water and to act as seasonal balancing reservoirs. Silvan Reservoir and Greenvale Reservoir are off-stream storages and act as seasonal balancing reservoirs. Another major Melbourne Water storage, Cardinia Reservoir, is an off-stream storage located within the Bunyip basin, although it stores water harvested from the Yarra basin.

Storage levels for all major storages in the basin were 463,871 ML (66% of capacity) by the end of June 2013 compared to 565,861 ML in July 2012 (Table 6.17-3). The volume reported in the 'catchment inflow less regulated releases' column in Table 6.17-3 is the balancing item for each storage. It represents the flow of water in or out of the storage that is not shown as rainfall or evaporation, and may include other minor components influencing the change in storage during the year.

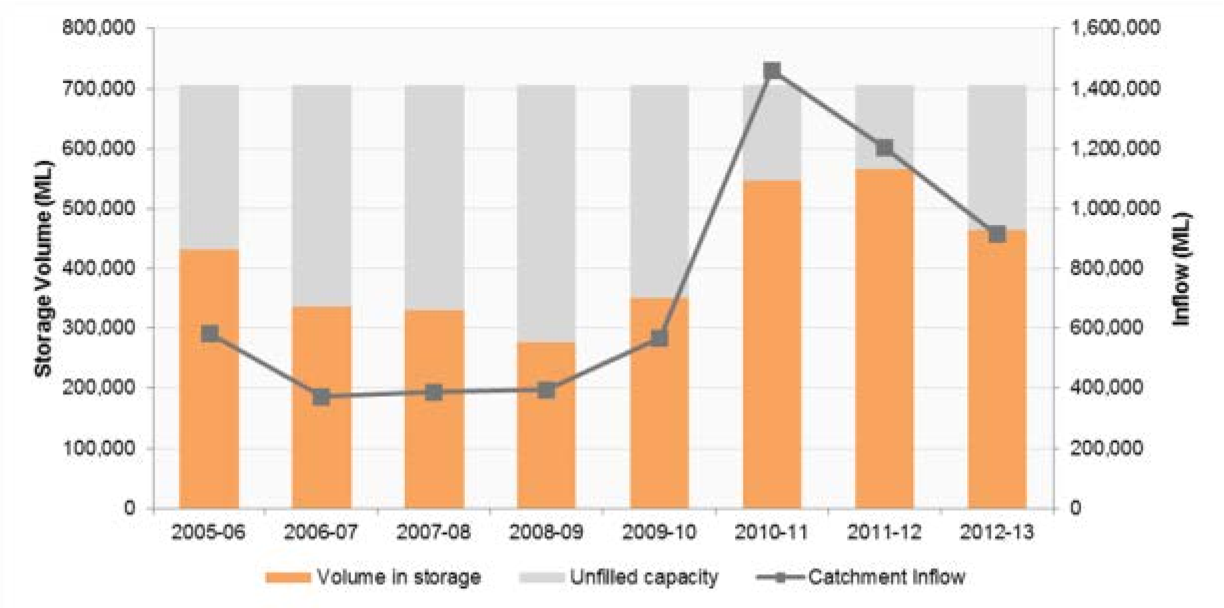
Table 6.17-3 Storage volumes in the Yarra basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Maroondah Reservoir	22,179	22,420	1,766	1,748	(15,134)	7,304
O'Shannassy Reservoir	3,123	3,208	342	257	(954)	2,339
Upper Yarra Reservoir	200,579	143,913	5,278	5,805	(46,662)	96,724
Yan Yean Reservoir	30,266	27,448	3,357	4,685	627	26,746
Total on-stream storages	***256,147***	***196,989***	***10,743***	***12,496***	***(62,123)***	***133,113***
Off-stream storages						
Cardinia Reservoir	286,911	217,739	10,268	0	(19,091)	208,916
Greenvale Reservoir	26,839	20,956	877	1,898	177	20,112
Silvan Reservoir	40,445	36,311	2,772	0	(5,937)	33,146
Sugarloaf Reservoir	96,253	93,866	2,590	3,985	(23,887)	68,584
Total off-stream storages	***450,448***	***368,872***	***16,507***	***5,883***	***(48,738)***	***330,758***
Total storages	**706,595**	**565,861**	**27,250**	**18,379**	**(110,860)**	**463,871**

Catchment inflows to the Yarra basin during 2012–13 were 914,537 ML, or 87% of the long-term average (of 1,054,000 ML). This is lower than 2011–12 when catchment inflows were 1,200,267 ML or 114% of the long-term average (Figure 6.17-2).

The amount of water flowing from the Yarra basin into Port Phillip Bay was 650,795 ML in 2012–13. This represents 71% of the catchment inflows to the basin, compared to 69% in 2011–12.

Figure 6.17-2 All major storages and catchment inflows



Only volumes for major on-stream storages have been included in the water balance: major off-stream storages such as Cardinia, Sugarloaf, Greenvale and Silvan reservoirs have not been included. The volume of water in the major on-stream storages was 133,113 ML in June 2013 compared to 196,989 ML in July 2012.

6.17.2.3 Entitlement volumes and diversions

The Melbourne metropolitan retailers (City West Water, South East Water, Western Water and Yarra Valley Water) hold bulk entitlements to divert surface water in the Yarra basin. Surface water is also diverted out of waterways by licence holders and harvested in small catchment dams.

Entitlements include rights granted to individuals (take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the Victorian Environmental Water Holder). Rights to water in the Yarra basin are outlined in Table 6.17-4.

Table 6.17-4 Entitlement volumes in the Yarra basin

Water entitlements	Annual Entitlement Volume (ML)
Yarra River – Melbourne Retailers (combined)[1]	
Bulk Entitlement (Yarra River – Melbourne Water for City West Water Limited) Conversion Order 2006[1]	n/a
Bulk Entitlement (Yarra River – Melbourne Water for South East Water Limited) Conversion Order 2006[1]	n/a
Bulk Entitlement (Yarra River – Melbourne Water for Yarra Valley Water Limited) Conversion Order 2006[1]	n/a
Yarra River – Melbourne Retailers (combined)	**400,000**
Bulk Entitlement (Melbourne Headworks System – Barwon Water) Order 2010[2]	**16,000**
Bulk Entitlement (Melbourne Headworks System – South Gippsland Water) Order 2010[2]	**5,000**
Bulk Entitlement (Melbourne Headworks System – Western Water) Order 2010[2]	**18,250**
Bulk Entitlement (Melbourne Headworks System – Westernport Water) Order 2010[2]	**1,000**
Bulk Entitlement (Yarra Environment Entitlement) 2006	
High reliability entitlement	17,000
Unregulated surface water	55
Sub-total: Bulk Entitlement (Yarra Environment Entitlement) 2006	**17,055**
Take and use licences – unregulated surface water	**42,986**
Total volume of water entitlements in the Yarra basin	**460,041**

Notes:

(1) The Melbourne retailers hold the bulk entitlements on the Yarra River which are assessed against a 15-year annual volume of 400,000 ML.

(2) These bulk entitlements are not included in the totals for Annual Entitlement Volume as the entitlement volume represents the water authorities' right to take water from the Greater Yarra headworks system (which is supplied by the Yarra River Bulk Entitlement as well as other entitlements in the Thomson and Bunyip basins).

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.17-5. The Victorian Environmental Water Holder (VEWH) holds an environmental entitlement in the Yarra basin, but the water available under the entitlement is not diverted out of the waterway.

The total volume of water diverted from unregulated streams by licence holders in the Yarra basin was lower in 2013-13 compared to the volume reported in the 2011–12 Victorian Water Accounts.

Table 6.17-5 Allocation account balance summary for the Yarra basin

Water entitlement	Allocation issued	Net trade In/(Out)	Water use	End of season forfeitures
Yarra River – Melbourne Retailers[1][2]	400,000	0	(299,636)	(100,364)
Melbourne Headworks System – Barwon Water[3]	16,000	0	0	(16,000)
Melbourne Headworks System – South Gippsland Water[3]	5,000	0	0	(5,000)
Melbourne Headworks System – Western Water[3]	18,250	0	(10,284)	(7,966)
Melbourne Headworks System – Westernport Water[3]	1,000	0	0	(1,000)
Yarra Environment Entitlement[4]	17,000	0	(12,589)	-
Take and use licences – unregulated surface water	42,986	0	(9,137)	(33,849)

Notes:

(1) The volume of water taken by the Melbourne metropolitan retailers under this bulk entitlement is assessed against a 15-year average annual volume of 400,000 ML. The corresponding average annual volume of diversions over the 15 years to 2012–13 was 297,382 ML.

(2) The combined volume of water taken by the Melbourne metropolitan retailers from the Thomson River basin, Yarra River basin and Silver and Wallaby creeks is assessed against a 15-year average annual volume of 555,000 ML. The corresponding average annual volume of diversions over the 15 years to 2012–13 was 411,571 ML.

(3) The volume of water use under these entitlements represents the amount taken from the Greater Yarra headworks system and is not recorded as a diversion from the waterway for the purposes of the water balance in Table 6.17-2.

(4) Water use reported reflects environmental in-stream use. This amount is not reflected in the water balance in Table 6.17-2 as it does not reflect an actual diversion from the waterway. Unused water is available to carry over in this system. Please refer to Chapter 4, Table 4.1.

The estimated volume of water harvested from small catchment dams in the Yarra basin is provided in Table 6.17-6.

Table 6.17-6 Estimated small catchment dam information

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	10,524	5,262	n/a
Registered commercial and irrigation	12,574	10,562	n/a
Total	**23,097**	**15,824**	**17,092**

n/a: No information available.

6.17.3 Recycled water

Yarra Valley Water operates nine wastewater treatment plants within the Yarra basin. A summary of the volume of recycled water is provided below in Table 6.17-7.

Wastewater was reused at six of the plants in 2012–13. Compared with 2011–12, the volume of wastewater entering the treatment plants decreased during the year, while the volume of water recycled increased. Overall, 9% of wastewater was reused in the basin, an increase from the 5% recycled in 2011–12.

Table 6.17-7 shows the volumes of water recycled in the Yarra basin in 2012–13.

Table 6.17-7 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process(2))	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other(3) (ML)
				Urban and industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Aurora	761	89	6%	0	49	0	40	0	672
Brushy Creek	3,915	754	1%	32	0	0	722	0	3,161
Craigieburn	753	359	11%	86	0	0	273	0	394
Healesville	437	117	0%	0	0	0	117	0	319
Lilydale	2,711	675	9%	232	0	0	443	0	2,036
Monbulk	18	0	0%	0	0	0	0	0	18
Upper Yarra	908	167	0%	0	0	0	167	0	741
Wallan	657	385	59%	0	385	0	0	0	272
Whittlesea	289	142	41%	103	16	0	23	0	147
Total 2012–13	**10,447**	**2,687**	**9%**	**453**	**449**	**0**	**1,785**	**0**	**7,760**
Total 2011–12	11,178	2,319	5%	297	262	0	1,761	8,243	616

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

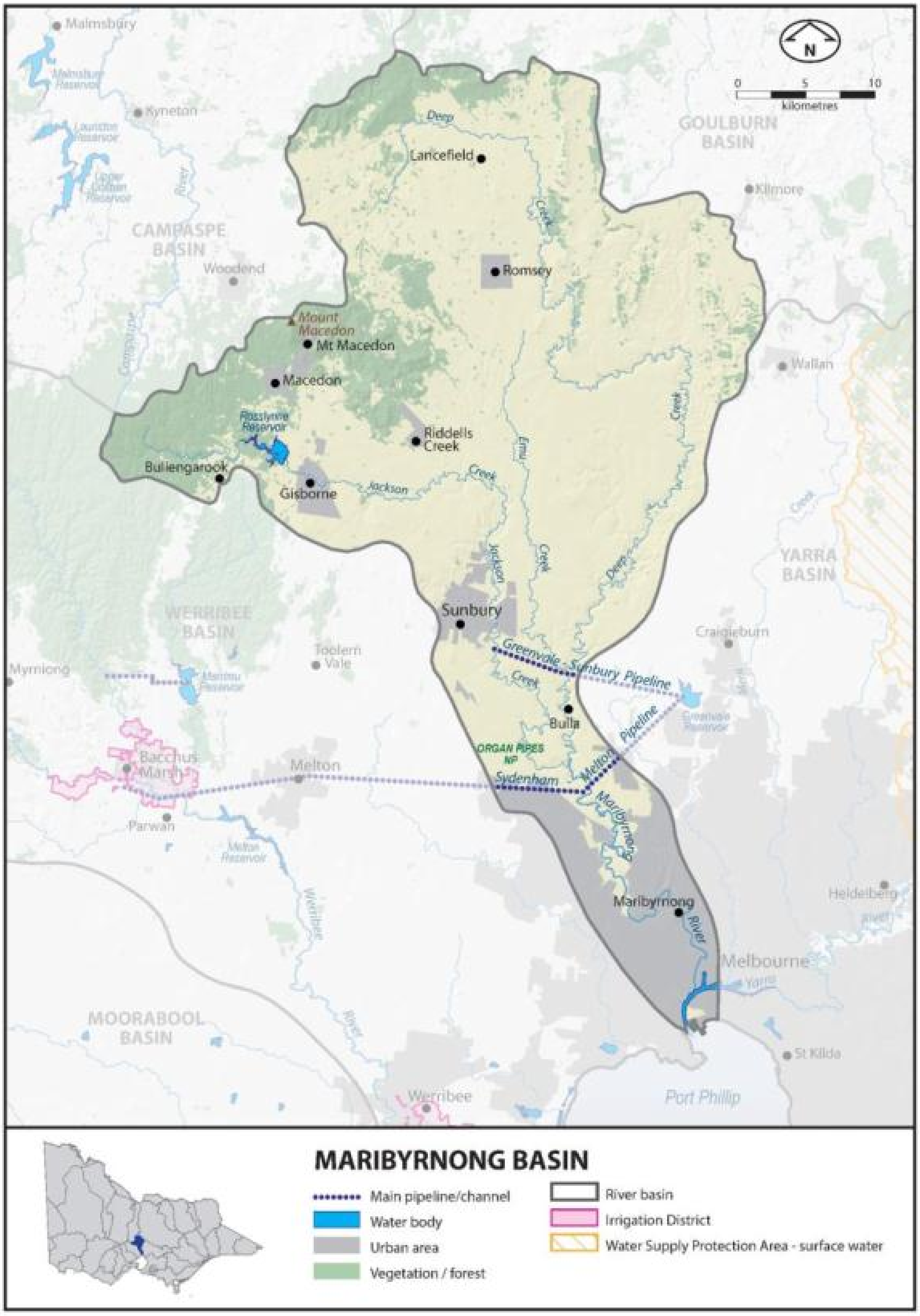
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site wastewater storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.18 Maribyrnong basin

The Maribyrnong basin (Figure 6.18-1) 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 Port Phillip Bay.

Figure 6.18-1 Map of the Maribyrnong basin



6.18.1 Water resources overview

Rainfall in most of the Maribyrnong basin was between 80% and 100% of the long-term average in 2012–13, with drier conditions (60% to 80%) in the northern part of the basin. Catchment inflows were 72% of the long-term average, significantly higher than in 2011–12 which saw inflows at 54% of the long-term average.

The storage volume in Rosslynne Reservoir started the year at 72% of capacity and held 86% at the end of June 2013.

No restrictions to urban water use were in place in 2012–13 in the Maryibyrnong basin. However, Southern Rural Water's licensed surface water users were subject to an irrigation ban on Deep and Riddells creeks between January and June 2013.

Table 6.18-1 shows the responsibilities of the authorities within the Maribyrnong basin.

Table 6.18-1 Responsibilities for water resources management in the Maribyrnong basin

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
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 Yarra/Thomson system)	Manages waterways, drainage and floodplains in part of the Maribyrnong basin
City West Water		Supplies part of metropolitan Melbourne area(1)	
Western Water		Supplies towns in the basin located outside metropolitan Melbourne	Operates Macedon reservoirs Obliged to meet passing flow requirements
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 Obliged to meet passing flow requirements

Note:
(1) Melbourne is mostly supplied from the Yarra and Thomson basins.

Environmental Water Reserve

Important environmental assets such as the Australian Grayling and native grassland depend on the Maribyrnong Environmental Water Reserve (EWR).

In 2012–13, the Maribyrnong basin EWR comprised:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Western Water and Southern Rural Water
- water set aside for the environment through the operation of passing flow conditions on licensed diversions (regulated and unregulated waterways)
- all other water in the basin not allocated for consumptive use.

6.18.2 Surface water resources

6.18.2.1 Water balance

A surface water balance for the Maribyrnong basin is shown in Table 6.18-2.

Table 6.18-2 Balance of surface water in the Maribyrnong basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	18,388	16,715
Volume in storage at end of year	21,716	18,388
Change in storage	**3,328**	**1,673**
Inflows		
Catchment inflow(1)	81,471	60,885
Rainfall on major storages	1,529	1,756
Treated effluent discharged back to river	2,121	2,493
Total inflows	**85,121**	**65,134**
Outflows		

Water account component	2012–13 (ML)	2011–12 (ML)
Diversions		
Urban diversions	1,350	1,375
Licensed diversions from regulated streams	111	52
Licensed diversions from unregulated streams	441	439
Small catchment dams	7,782	7,782
Total diversions	***9,684***	***9,648***
Losses		
Evaporation losses from major storages	1,709	1,455
Evaporation from small catchment dams	4,861	4,861
In-stream infiltration to groundwater, flows to floodplain and evaporation	1,881	1,365
Total losses	***8,451***	***7,681***
Water passed at outlet of basin		
River outflows to Port Phillip Bay	63,658	46,132
Total water passed at outlet of basin	***63,658***	***46,132***
Total outflows	**81,793**	**63,461**

Note:

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

6.18.2.2 Storages and flows

Rosslynne Reservoir, with a capacity of 25,368 ML, is the only major storage located within the basin. The storage volume was 21,716 ML (86% of capacity) at the end of June 2013 compared to 18,388 ML (72% of capacity) at the start of July 2012 (Table 6.18-3). The volume reported in the ‘catchment inflow less regulated releases’ column in Table 6.18-3 is the balancing item for each storage. It represents the flow of water in or out of the storage that is not shown as rainfall or evaporation, and may include other minor components influencing the change in storage during the year.

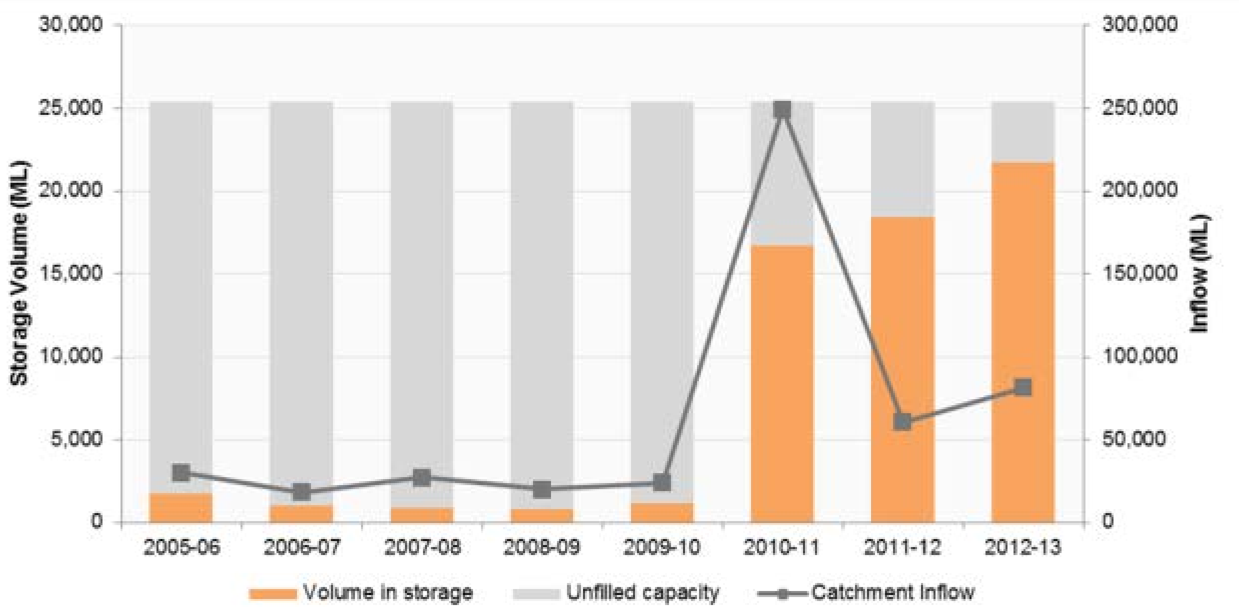
Table 6.18-3 Storage volumes in the Maribyrnong basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
On-stream storage						
Rosslynne Reservoir	25,368	18,388	1,529	1,709	3,508	21,716
Total	**25,368**	**18,388**	**1,529**	**1,709**	**3,508**	**21,716**

Catchment inflows were 81,471 ML, or 72% of the long-term average of 113,000 ML. This was an increase from 2011–12 when inflows were 54% of the long-term average (Figure 6.18-2).

The amount of water flowing into Port Phillip Bay in 2012–13 was 63,658 ML compared to 46,132 ML in 2011–12. This represents 78% of the catchment inflows into the basin.

Figure 6.18-2 All major storages and catchment inflows



6.18.2.3 Entitlement volumes and diversions

Melbourne Water, Western Water and Southern Rural Water hold bulk entitlements to divert surface water in the Maribyrnong basin. Surface water is also diverted out of waterways by licence holders and harvested in small catchment dams.

Entitlements include rights granted to individuals (take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the VEWH). Rights to water in the Yarra basin are outlined in Table 6.18-4.

Table 6.18-4 Entitlement volumes in the Maribyrnong basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Gisborne – Barringo Creek) Conversion Order 2004(1)	585
Bulk Entitlement (Lancefield) Conversion Order 2001	315
Bulk Entitlement (Macedon and Mount Macedon) Conversion Order 2004(2)	873
Bulk Entitlement (Maribyrnong – Melbourne Water) Conversion Order 2000(3)	1,396
Bulk Entitlement (Maribyrnong – Southern Rural Water) Conversion Order 2000(4)	682
Bulk Entitlement (Maribyrnong – Western Water) Conversion Order 2000	6,100
Bulk Entitlement (Riddells Creek) Conversion Order 2001	300
Bulk Entitlement (Romsey) Conversion Order 2001	460
Take and use licences – unregulated surface water	2,098
Total volume of water entitlements in the Maribyrnong basin	**12,809**

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 5-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 5-year period is 3,225 ML (645 ML annual average).

(3) This entitlement supplies water for take and use licences. 1,316 ML of entitlement was allocated for the 2012–13 year.

(4) This entitlement supplies water for take and use licences. 218 ML of entitlement was allocated for the 2012–13 year.

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.18-5. The volume of water diverted from unregulated streams by licence holders in the Maribyrnong basin was similar in 2012–13 compared to the volume reported in the 2011–12 Victorian Water Accounts (Table 6.18-5).

Table 6.18-5 Allocation account balance summary for the Maribyrnong basin

Water entitlement	Allocation issued	Net trade In/(Out)	Water use	Forfeitures
Gisborne – Barringo Creek(1)	585	0	0	(585)
Lancefield	315	0	(95)	(220)
Macedon and Mount Macedon(2)	873	0	(693)	(180)
Maribyrnong – Melbourne Water	1,314	0	(109)	(1,205)
Maribyrnong – Southern Rural Water	218	0	(3)	(216)
Maribyrnong – Western Water	6,100	0	(250)	(5,850)
Riddells Creek	300	0	(37)	(263)
Romsey	460	0	(275)	(185)
Take and use licences – unregulated surface water	2,098	0	(441)	(1,657)

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 5-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 5-year period is 3,225 ML (645 ML annual average).

The estimated volume of water harvested from small catchment dams represents the largest diversion of water in the Maribyrnong basin (Table 6.18-6).

Table 6.18-6 Estimated small catchment dam information

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	5,769	2,884	n/a
Registered commercial and irrigation	5,831	4,898	n/a
Total	**11,600**	**7,782**	**12,644**

n/a: No information available.

6.18.3 Recycled water

All wastewater treatment plants within the basin are operated by Western Water. Overall, 26% of wastewater was reused in 2012–13, an increase of 5% on the proportion reused in 2011–12. There was an increase in the volume of water produced and recycled in 2012–13 compared to 2011–12.

Table 6.18-7 shows the volumes of water recycled in the Maribyrnong basin in 2012–13.

Table 6.18-7 Volume of recycled water in the Maribyrnong basin

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process(2))	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other(3) (ML)
				Urban and industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Gisborne	537	490	7%	40	0	0	450	488	(441)
Riddells Creek	180	61	33%	7	53	0	1	97	22
Romsey	360	176	49%	26	151	0	0	280	(96)
Sunbury	2,129	845	26%	262	295	0	288	1,256	28
Total 2012–13	**3,206**	**1,572**	**26%**	**335**	**499**	**0**	**739**	**2,121**	**(487)**
Total 2011–12	3,198	1,378	21%	308	365	0	706	2,493	(673)

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

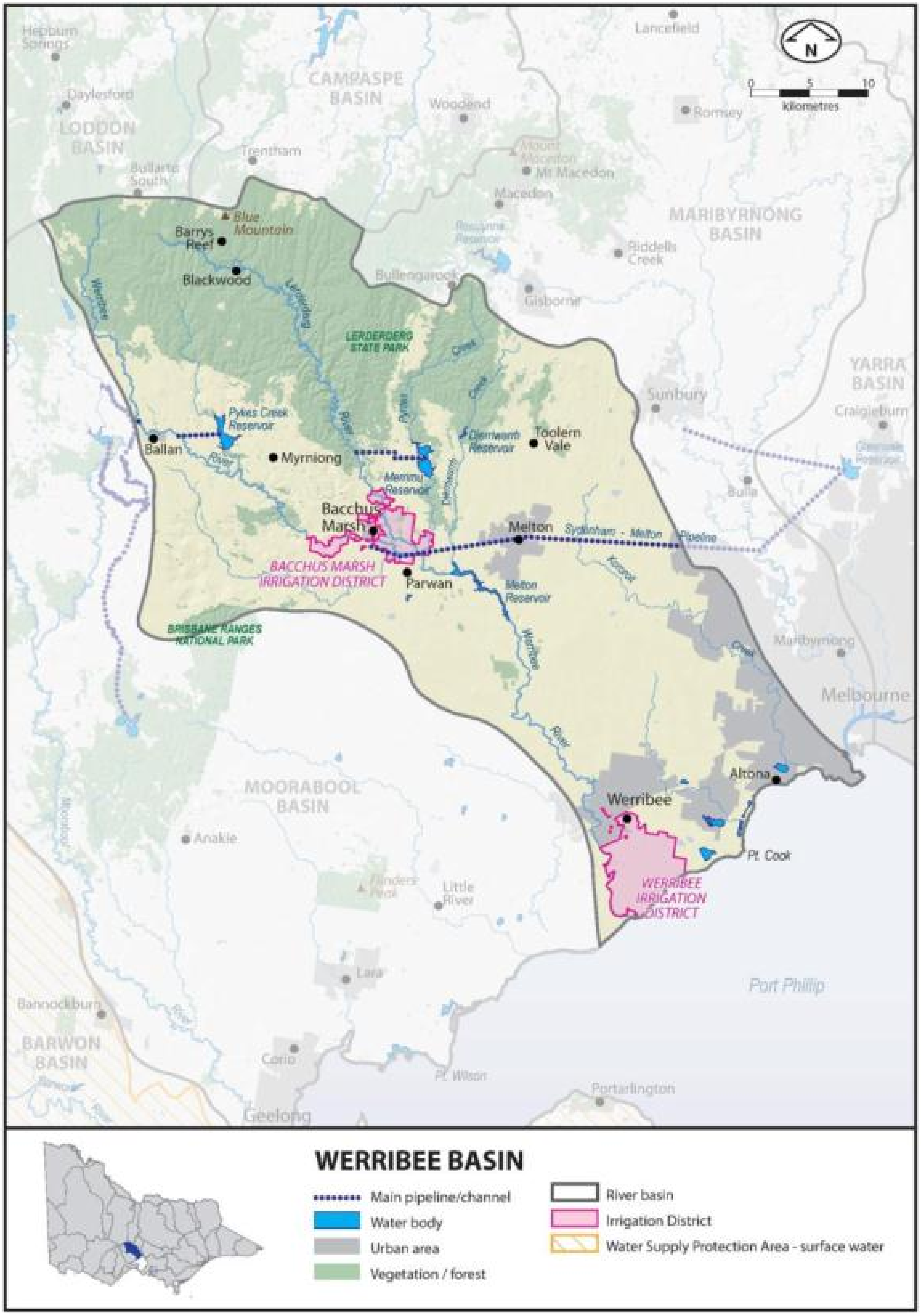
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percent recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site wastewater storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.19 Werribee basin

The Werribee basin (Figure 6.19-1) is located west of Melbourne. The Werribee River and Lerderderg River meet upstream of Melton Reservoir and flow through the township of Werribee before entering Port Phillip Bay.

Figure 6.19-1 Map of the Werribee basin



6.19.1 Water resources overview

Rainfall in the Werribee basin was between 80% and 100% of the long-term average over most of the basin in 2012–13, with the west of the basin being slightly drier, receiving 60% to 80% of the average rainfall. Catchment inflows were 78% of the long-term average, higher than 2011–12 when inflows were 63% of the long-term average. The amount of water flowing from the Werribee basin into Port Phillip Bay represented 63% of the catchment flows into the basin in 2012–13.

Major storages in the Werribee basin started the year at 88% of capacity at the start of the year and finished the year lower at 68% by the end of June 2013, largely due to the Melton reservoir storage dropping considerably.

The year began with a 100% allocation for high reliability water shares for the Werribee system. Low reliability water shares reached 40% by mid-June.

In comparison to numerous urban water restrictions in place in 2011–12, urban water use was unrestricted throughout the year. Licensed diversions from unregulated streams in the Werribee basin were also largely unrestricted throughout the year, with the exception of the Ledederg River, which was subject an irrigation ban from January to June 2013.

Table 6.19-1 shows the responsibilities of the authorities within the Werribee basin.

Table 6.19-1 Responsibilities for water resources management in the Werribee basin

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages Werribee and Bacchus Marsh irrigation districts	Manages licensed diversions		Operates Pykes Creek Reservoir, Melton Reservoir and Merrimu Reservoir Obliged to meet passing flow requirements
Western Water			Supplies towns in the north of the basin including Melton and Bacchus Marsh	Operates Djerriwarrh Reservoir Obliged to meet passing flow requirements
Melbourne Water		Manages surface water licensed diversions for lower reaches of Kororoit Creek	Provides bulk water to City West Water and Western Water from the Thomson–Yarra system 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	Obliged to meet passing flow requirements
Victorian Environmental Water Holder				Holds and manages environmental entitlements in the basin

Environmental Water Reserve

Important environmental assets, such as the Australian Grayling, Tupong and Red Gums, depend on the Werribee basin Environmental Water Reserve (EWR).

In 2012–13, the Werribee basin EWR comprised:

- the *Werribee River Environmental Entitlement 2011* comprising 10% share of inflows (on average 1,500 ML per year) held by the Victorian Environmental Water Holder (VEWH)
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Central Highlands Water, Western Water and Southern Rural Water
- water set aside for the environment through the operation of passing flow conditions on licensed diversions (regulated and unregulated waterways)
- all other water in the basin not allocated for consumptive use.

6.19.2 Surface water resources

6.19.2.1 Water balance

A surface water balance for the Werribee basin is shown in Table 6.19-2. Note that only on-stream storages greater than 1,000 ML capacity and the Djerriwarrh Reservoir have been included in the water balance. In the Werribee basin, major storages include the Melton, Merrimu and Pykes Creek reservoirs.

Table 6.19-2 Balance of surface water in the Werribee basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	61,588	64,380
Volume in storage at end of year	47,676	61,588
Change in storage	**(13,912)**	**(2,792)**
Inflows		
Catchment inflow[(1)]	79,770	64,557
Rainfall on major storages	3,396	4,653
Transfers from other basins	0	0
Return flow from irrigation	63	77
Treated effluent discharged back to river	4,507	4,357
Total inflows	**87,736**	**73,643**
Outflows		
Diversions		
Urban diversions	1,789	5,517
Irrigation district diversions and licensed diversions from regulated streams	20,070	15,938
Licensed diversions from unregulated streams	275	275
Small catchment dams	9,347	9,347
Total diversions	***31,481***	***31,077***
Losses		
Evaporation losses from major storages	8,226	8,215
Evaporation from small catchment dams	5,371	5,371
In-stream infiltration to groundwater, flows to floodplain and evaporation	6,607	5,103
Total losses	***20,204***	***18,688***
Water passed at outlet of basin		
River outflows to Port Phillip Bay	49,963	26,670
Total water passed at outlet of basin	***49,963***	***26,670***
Total outflows	**101,648**	**76,435**

Note:

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

6.19.2.2 Storages and flows

Storage levels for all major storages in the basin were 47,676 ML (68% of capacity) in June 2013 compared to 61,588 ML in July 2012 (Table 6.19-3). The volume reported in the ‘catchment inflow less regulated releases’ column in Table 6.19-3 is the balancing item for each storage. It represents the flow of water in or out of the storage that is not shown as rainfall or evaporation, and may include other minor components influencing the change in storage during the year.

Table 6.19-3 Storage volumes in the Werribee basin

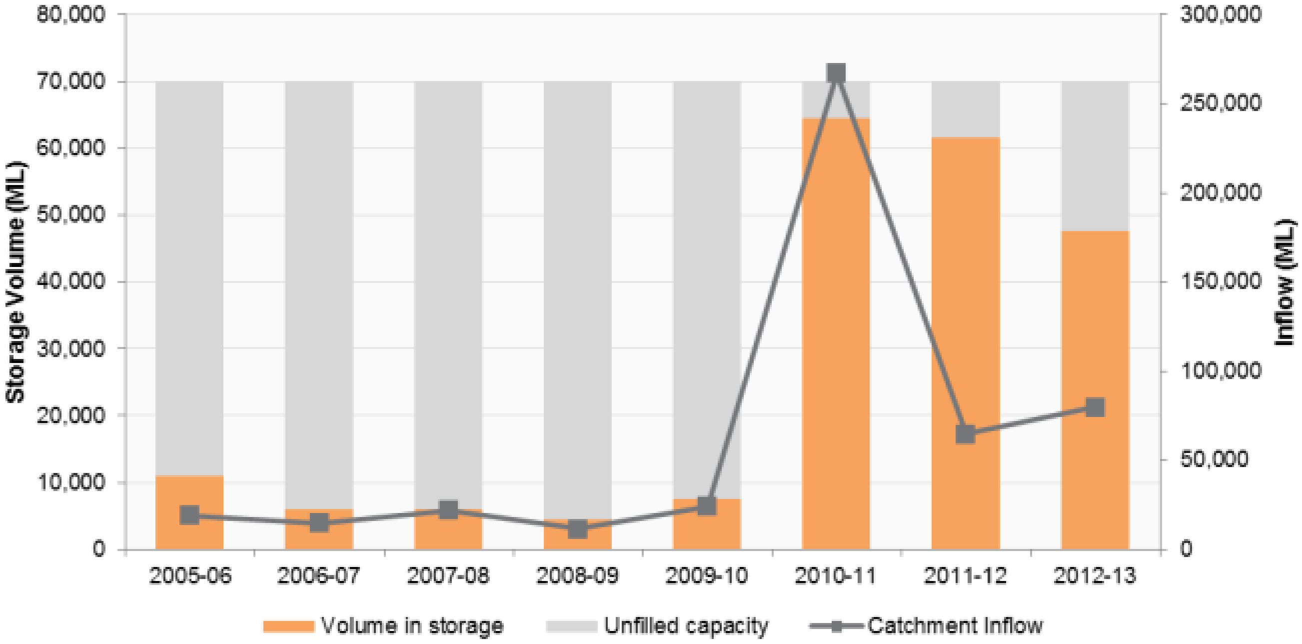
Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Djerriwarrh Reservoir	1,014	965	66	196	(18)	818
Melton Reservoir	14,364	13,985	1,076	2,867	(9,306)	2,888
Merrimu Reservoir	32,516	25,137	1,246	2,787	3,281	26,877
Pykes Creek Reservoir	22,119	21,501	1,008	2,376	(3,040)	17,093
Total storages	**70,013**	**61,588**	**3,396**	**8,226**	**(9,083)**	**47,676**

Werribee basin

Catchment inflows were 79,770 ML, or 78% of the long-term average of 102,000 ML. This was higher than the 2011–12 inflows of 64,557 ML (Figure 6.19-2).

In 2012–13, 49,963 ML of water flowed from the Werribee basin into Port Phillip Bay. This represents 63% of the catchment inflows into the basin. About 26,670 ML flowed into Port Phillip Bay in 2011–12.

Figure 6.19-2 All major storages and catchment inflows in the Werribee basin



6.19.2.3 Entitlement volumes and diversions

In the Werribee basin, surface water is diverted by Central Highlands Water, Western Water, Southern Rural Water and licensed diverters, and surface water is harvested in small catchment dams.

Entitlements include rights granted to individuals (for example water shares and take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the VEWH). Rights to water in the Werribee basin are outlined in Table 6.19-4.

Table 6.19-4 Entitlement volumes in the Werribee basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Werribee system – Irrigation) Conversion Order 1997	
High reliability water shares	15,017
Low reliability water shares	7,026
Bulk Entitlement (Myrniong) Conversion Order 2004	58
Operating provision	4,939
Sub-total: Bulk Entitlement (Werribee system – Irrigation) Conversion Order 1997	**27,040**
Bulk Entitlement (Ballan) Conversion Order 1998	**451**
Bulk Entitlement (Blackwood and Barry's Reef) Conversion Order 1998	**140**
Bulk Entitlement (Werribee system – Western Water) Conversion Order 2004	**9,986**
Werribee River Environment Entitlement 2011(1)	**-**
Take and use licences – unregulated surface water	**1,039**
Total volume of water entitlements in the Werribee basin	**38,656**

Note:

(1) The Werribee River Environmental Entitlement consists of a 10% share of inflows into storage, with the actual volume available in any year varying depending upon inflow conditions.

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.19-5.

The VEWH holds an environmental entitlement in the Werribee basin, but the water available under the entitlement is used to provide environmental flows in the Werribee River and is not diverted out of the waterway.

Southern Rural Water diverted 20,110 ML to supply water share holders in the Werribee and Bacchus Marsh irrigation districts in 2012–13 (Table 6.19-5) compared to 15,938 ML in 2011–12.

The total volume of water diverted from unregulated streams by licence holders in the Werribee basin in 2012–13 was similar to the amount reported in the 2011–12 Victorian Water Accounts.

Table 6.19-5 Allocation account balance summary for the Werribee basin

Water entitlement	Allocation issued	Net trade In / (Out)	Water use	End of season forfeitures
Werribee system – Irrigation – SRW				
Water shares	17,828	0	(11,770)	(6,058)
Myrniong	58	0	(39)	(19)
Operating provision(1)	-	-	(8,300)	-
Diversion: Werribee system – Irrigation – SRW(2)			**(20,110)**	
Ballan	451	0	0	(451)
Blackwood and Barry's Reef	140	0	(42)	(98)
Werribee system – Western Water	9,986	0	(1,707)	(8,279)
Werribee River Environment Entitlement(3)	3,218	849	(2,149)	-
Take and use licences – unregulated surface water	1,039	0	(275)	(764)

Notes:

(1) This reflects use of water to manage the system. It includes any loss incurred in supplying the primary entitlements.

(2) The water use reported in this line item represents the bulk diversion to supply primary entitlements and fulfil other operating requirements under the Werribee system bulk entitlement.

(3) Allocation issued represents the share of available water. Water use reported reflects environmental in-stream use. This amount is not reflected in the water balance in Table 6.19-2 as it does not reflect an actual diversion from the waterway. Unused water is available to carry over in this system. For details refer to Chapter 4, Table 4.1.

The estimated volume of water harvested from small catchment dams represents a significant portion of the total volume of surface water diverted in the Werribee basin (Table 6.19-6).

Table 6.19-6 Estimated small catchment dam information for the Werribee basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	5,868	2,934	n/a
Registered commercial and irrigation	7,634	6,413	n/a
Total	**13,503**	**9,347**	**14,718**

n/a: No information available.

6.19.3 Recycled water

Five wastewater treatment plants operate within the Werribee basin. The volume of wastewater produced in 2012–13 was 168,849 ML, a decrease of 10,333 ML compared to 2011–12. Around 18% of wastewater was reused in 2012–13.

The majority of water recycling in the basin occurs at Melbourne Water's Western Treatment Plant, which reused 17% of wastewater. This included 8,438 ML for on-site irrigation and environmental management and 15,784 ML for habitat management at Ramsar-listed wetlands.

Table 6.19-7 shows the volumes of water recycled in the Weeibee basin in 2012–13.

Werribee basin

Table 6.19-7 Volume of recycled water in the Werribee basin

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process[2])	End use type for recycled water (ML)					Volume discharged to the environment (ML)	Release to ocean/ Other[3] (ML)
				To retailers	Urban and industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Altona	4,718	828	15%	0	728	0	0	100	3,488	402
Ballan	72	72	100%	0	0	72	0	0	0	0
Melton	3,386	2,825	74%	0	321	2,187	0	317	878	(317)
Parwan (Bacchus Marsh)	651	427	66%	0	0	427	0	0	141	83
Western Treatment Plant	160,022	26,865	17%	2,643	0	8,438	15,784	0	0	133,157
Total 2012–13	**168,849**	**31,017**	**18%**	**2,643**	**1,049**	**11,124**	**15,784**	**417**	**4,507**	**133,325**
Total 2011–12	179,182	35,238	20%	161	1,458	16,878	16,467	274	4,357	139,587

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

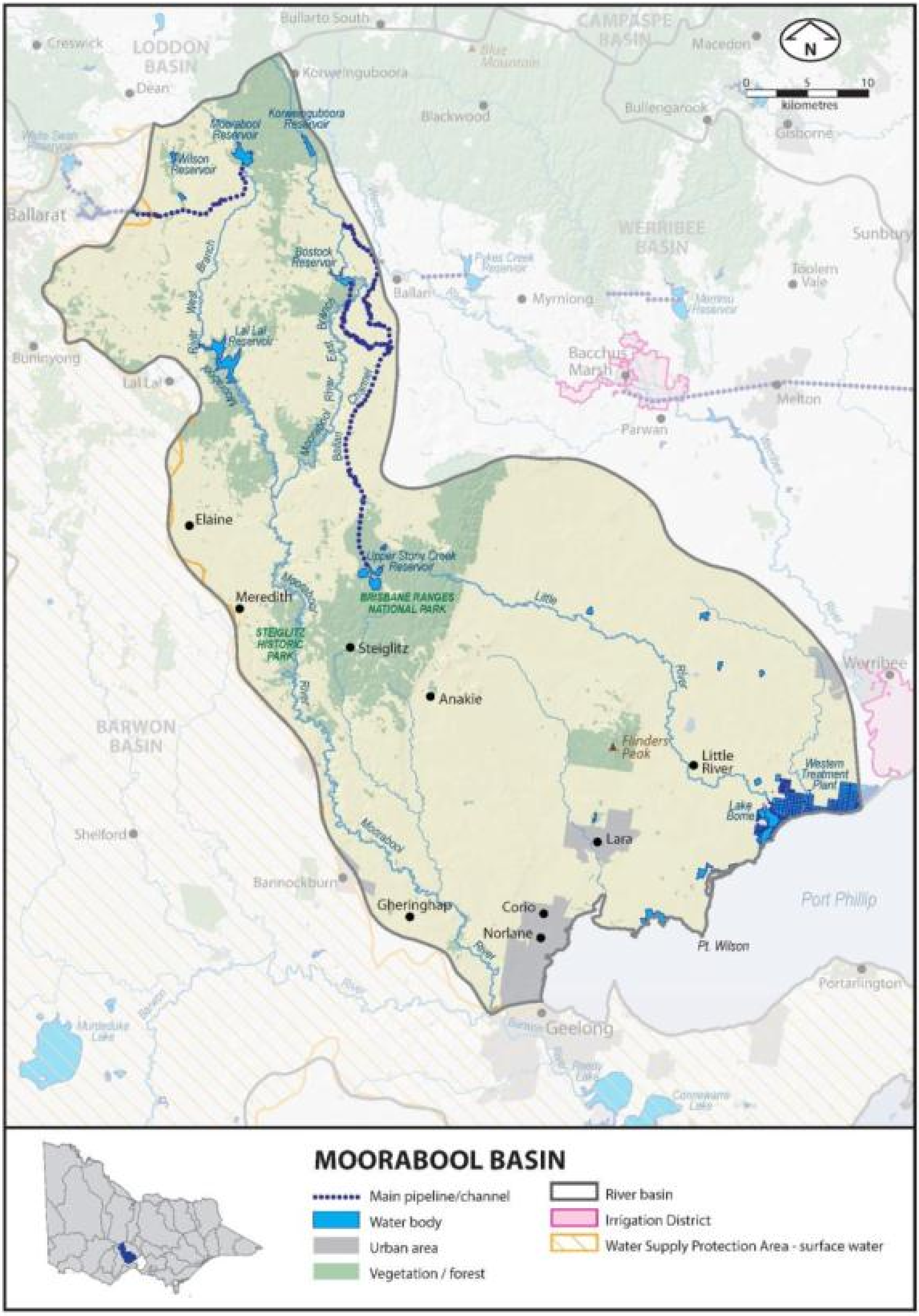
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site wastewater storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.20 Moorabool basin

The Moorabool basin (Figure 6.20-1) 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 6.20-1 Map of the Moorabool basin



6.20.1 Water resources overview

Rainfall in the Moorabool basin in 2012–13 was generally between 60% and 100% of the long-term average, with slightly lower rainfall in the uppermost part of the catchment. Inflows were 97% of the long-term average, which was lower than 2011–12 when inflows were 112% of the long-term average.

Storage levels for the major storages in the basin started the year at 88% of capacity and held 77% at the end of June 2013. Geelong's storages in the Barwon basin finished the year at 64% of capacity. Diversion volumes were similar to 2011–12, with licensed diversions unrestricted for most of the year. The only restriction on diversions in the Moorabool basin for 2012–13 was an irrigation ban for the Moorabool River during January.

Table 6.20-1 shows the responsibilities of the authorities within the Moorabool basin.

Table 6.20-1 Responsibilities for water resources management in the Moorabool basin

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages licensed diversions		
Barwon Water		Supplies Geelong and surrounding towns(1)	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 Obligation to meet passing flow requirements
Central Highlands Water		Supplies Ballarat and surrounding towns(2)	Manages reservoirs on the West Moorabool River and has two-thirds of the share of Lal Lal Reservoir Obliged to meet passing flow requirements
Corangamite Catchment Management Authority			Responsible for waterway management in Moorabool basin
Victorian Environmental Water Holder			Holds and manages environmental entitlements in the basin

Notes:

(1) Geelong's water supply is mainly sourced from the Barwon basin.

(2) Ballarat's water supply is sourced from both the Barwon and Moorabool basins.

Environmental Water Reserve

Important environmental assets such as River Blackfish and Australian Grayling between Lal Lal Reservoir and She Oakes Weir, as well as the Hovells Creek Estuary, which is part of Port Phillip Bay and Bellarine Peninsula Ramsar site, depend on the Moorabool basin Environmental Water Reserve (EWR).

In 2012–13, the Moorabool basin EWR comprised:

- the *Moorabool River Environmental Entitlement 2010* comprising 11.9% of inflows (on average 2,500 ML per year) held by the Victorian Environmental Water Holder (VEWH)
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Barwon Water
- 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.

6.20.2 Surface water resources

6.20.2.1 Water balance

A surface water balance for the Moorabool basin is shown in Table 6.20-2.The majority of water used for consumptive purposes in the basin was sourced from small catchment dams.

Table 6.20-2 Balance of surface water in the Moorabool basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	69,855	70,191
Volume in storage at end of year	60,820	69,855
Change in storage	**(9,035)**	**(336)**

Water account component	2012–13 (ML)	2011–12 (ML)
Inflows		
Catchment inflow[1]	94,386	109,037
Rainfall on major storages	4,041	5,547
Treated effluent discharged back to river[2]	0	n/a
Total inflows	**98,427**	**114,584**
Outflows		
Diversions		
Urban diversions[3]	8,662	9,518
Transfers to Barwon basin (White Swan Reservoir)[4]	5,187	2,724
Licensed diversions from unregulated streams	1,276	1,220
Small catchment dams	22,197	22,197
Total diversions	***37,322***	***35,660***
Losses		
Evaporation losses from major storages	7,864	6,961
Evaporation from small catchment dams	7,266	7,266
In-stream infiltration to groundwater, flows to floodplain and evaporation	4,231	7,270
Total losses	***19,362***	***21,497***
Water passed at outlet of basin		
River outflows to Port Phillip Bay (Little River) and other small coastal streams	16,186	30,098
River outflows to the Barwon River (Moorabool River)	34,593	27,665
Total water passed at outlet of basin	***50,779***	***57,763***
Total outflows	**107,462**	**114,920**

Notes:

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

(2) 2012–13 is the first year the Northern Water Treatment Plant has been reported. It did not return any water to waterways in 2012–13.

(3) The urban diversions figure represents water diverted from waterways in the Moorabool basin to directly supply urban customers in both the Barwon and Moorabool basins.

(4) The 5,187 ML transfer represents water that is 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).

6.20.2.2 Storages and flows

The Moorabool basin has six main storages: the Bostock, Korweinguboora, Lal Lal, Moorabool, Upper Stony Creek and Wilson reservoirs. Lal Lal Reservoir accounts for about two-thirds of total storage capacity in the basin. Storage levels for all major storages (greater than 1,000 ML) in the basin were 66,048 ML (77% of capacity) at the end of June 2013 compared to 75,370 ML (88% of capacity) at the beginning of the year (Table 6.20-3).

Only volumes for major on-stream storages have been included in the water balance; Upper Stony Creek Reservoir has not been included. The volume of water in the basin's major on-stream storages started the year at 69,855 ML and ended at 60,820 ML in June 2013.

Table 6.20-3 Storage volumes in the Moorabool basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Bostock Reservoir	7,455	7,455	629	952	(1,020)	6,112
Korweinguboora Reservoir	2,091	2,091	402	608	(1,675)	210
Lal Lal Reservoir	59,549	53,976	1,967	4,353	(1,430)	50,160
Moorabool Reservoir	6,192	5,910	880	1,657	(1,093)	4,040
Wilsons Reservoir	1,010	423	163	294	7	299
Total on-stream storages	***76,297***	***69,855***	***4,041***	***7,864***	***(5,211)***	***60,820***

Moorabool basin

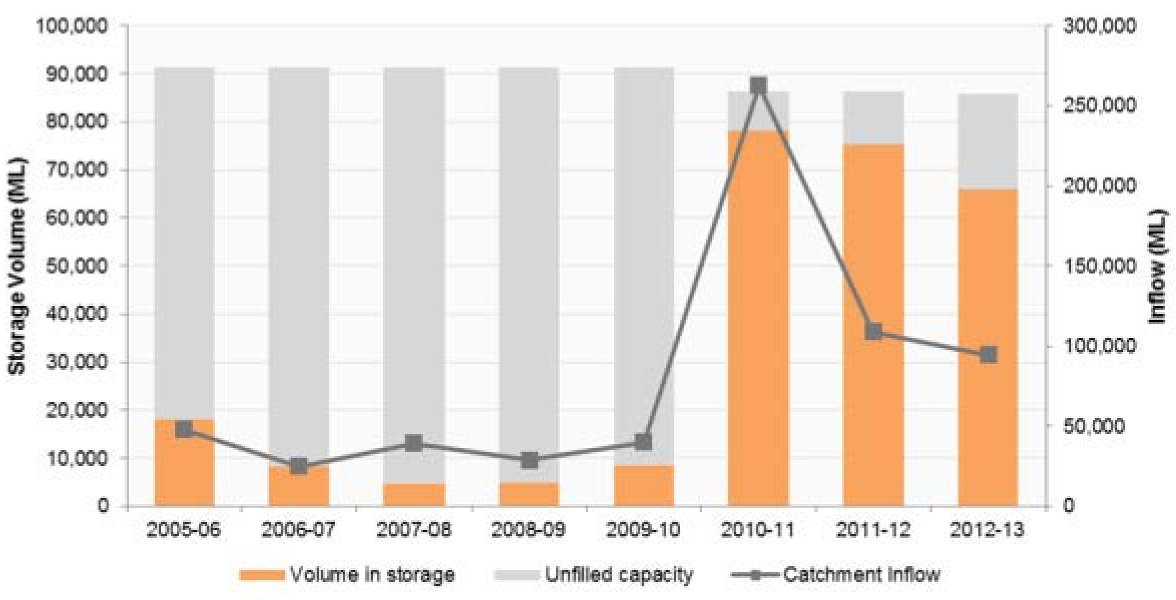
Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
Off-stream storages						
Upper Stony Creek Reservoir	9,494	5,515	n/a	n/a	(287)	5,228
Total off-stream storages	***9,494***	***5,515***	***n/a***	***n/a***	***(287)***	***5,228***
Total storages	**85,791**	**75,370**	**n/a**	**n/a**	**(5,498)**	**66,048**

n/a: Information not available.

Catchment inflows were 94,386 ML or 97% of the long-term average of 97,000 ML. This was lower than the 2011–12 inflows of 109,037 ML (Figure 6.20-2).

The amount of water flowing from the Moorabool basin into Port Phillip Bay and the Barwon River was 50,779 ML in 2012–13, or 54% of the catchment inflows.

Figure 6.20-2 All major storages and catchment inflows



6.20.2.3 Entitlement volumes and diversions

In the Moorabool basin, surface water is diverted by Barwon Water, Central Highlands Water and licensed diverters. Surface water is also harvested in small catchment dams. The Victorian Environmental Water Holder (VEWH) holds an environmental entitlement in the Moorabool basin however the water available under the entitlement is used to support streamflows and is not diverted out of the waterway.

Entitlements in the Moorabool basin include rights granted to individuals (take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the VEWH). Rights to water in the Moorabool basin are outlined in Table 6.20-4.

Table 6.20-4 Entitlement volumes in the Moorabool basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Lal Lal – Barwon) Conversion Order 1995[(1)]	5,925
Bulk Entitlement (Lal Lal – Central Highlands) Conversion Order 1995 [(2)]	12,575
Bulk Entitlement (Meredith) Conversion Order 1995	600
Bulk Entitlement (She Oaks) Conversion Order 1995	2,000
Bulk Entitlement (Upper East Moorabool System) Conversion Order 1995	9,000
Bulk Entitlement (Upper West Moorabool System) Conversion Order 1995	10,500
Moorabool River Environment Entitlement 2010[(3)]	n/a
Take and use licences – unregulated surface water	3,600
Total volume of water entitlements in Moorabool basin	**44,200**

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.

(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.

(3) The Moorabool River Environmental Entitlement consists of an 11.9% share of inflows into storage, with the actual volume available in any year varying depending upon inflow conditions.

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.20-5. The total volume of water diverted by bulk entitlement holders was slightly greater in 2012–13 compared to the volume reported in the 2011–12 Victorian Water Accounts.

The volume of water diverted from unregulated streams by licence holders in the Moorabool basin in 2012–13 was similar to the volume reported in the 2011–12 Victorian Water Accounts (Table 6.20-5).

Table 6.20-5 Allocation account balance summary for the Moorabool basin

Water entitlement	Allocation issued	Net trade In/(Out)	Water use	Forfeitures
Lal Lal – Barwon	5,925	0	(1,106)	(4,819)
Lal Lal – Central Highlands	12,575	0	(4,391)	(8,184)
Meredith	600	0	0	(600)
She Oaks	2,000	0	0	(2,000)
Upper East Moorabool system	9,000	0	(3,165)	(5,835)
Upper West Moorabool system	10,500	0	(5,187)	(5,313)
Moorabool River Environment Entitlement[(1)]	1,696	0	(2,399)	-
Take and use licences – unregulated surface water	3,600	0	(1,276)	(2,324)

Note:

(1) Allocation issued reflects the share of available water. Water use reported reflects environmental in-stream use, however this amount is not included in the water balance in Table 6.20-2 as it is not an actual diversion from the waterway. Unused water is available to carry over in this system and was available to support flows from the previous water year, hence water use in 2012–13 exceeded the annual allocation volume. For details refer to Chapter 4, Table 4.1.

The estimated volume of water harvested from small catchment dams represents the largest diversion of water in the Moorabool basin (Table 6.20-6).

Table 6.20-6 Estimated small catchment dam information

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	6,079	3,040	n/a
Registered commercial and irrigation	22,807	19,158	n/a
Total	**28,886**	**22,197**	**29,464**

n/a: No information available.

6.20.3 Recycled water

Within the Moorabool basin, Barwon Water operates the Northern Water Recycling Plant which was commissioned in April 2013. The recycled water is mainly used by a refinery. Table 6.20-7 shows the volumes of water recycled in the Moorabool basin in 2012–13.

Table 6.20-7 Volume of recycled water in the Moorabool basin

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process[(2)])	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other[(3)] (ML)
				Urban and industrial	Agriculture	Beneficial allocation[(1)]	Within process[(2)]		
Northern Water Recycling Plant	204	204	100%	204	0	0	0	0	0
Total 2012–13	204	204	100%	204	0	0	0	0	0
Total 2011–12	0	0	0%	0	0	0	0	0	0

Notes:

(1) ‘Beneficial allocation’ refers to the volume used to deliver specific environmental flow benefits.

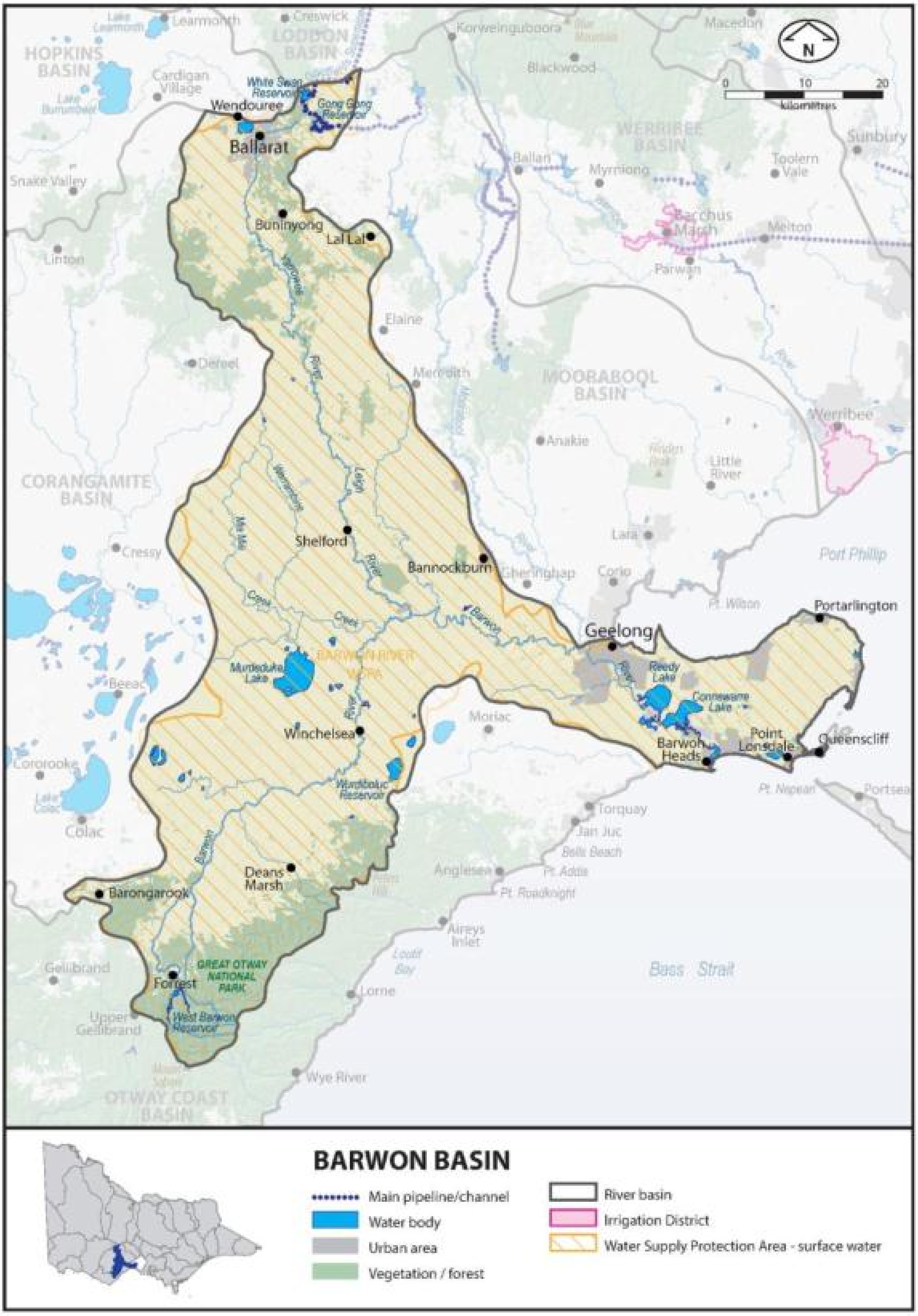
(2) ‘Within process’ refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC’s performance report.

(3) ‘Other’ refers to a change in on-site wastewater storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.21 Barwon basin

The Barwon basin (Figure 6.21-1) is located in western Victoria. It originates in the Otway Ranges and receives inflows from the Leigh River and the Moorabool River before it flows into the ocean at Barwon Heads.

Figure 6.21-1 Map of the Barwon basin



6.21.1 Water resources overview

In 2012–13, rainfall in the Barwon basin generally ranged between 60% and 80% of the long-term average, compared to 80% to 100% in the previous year. Catchment inflows in the Barwon basin in 2012–13 were 43% of the long-term average, a further decrease from 53% in 2011–12 and less than half the inflow volume seen in 2010–11.

As a result of reduced inflows, storage levels in the Barwon basin decreased from 69% to 64% of total capacity over the course of the year. Urban water use in the Barwon basin was unrestricted throughout 2012–13. Licensed diversions were restricted for a few rivers and creeks during January, but were unrestricted throughout the rest of the year. There were no restrictions on diversions from the Barwon River between July and December 2012, however restrictions were put in place in January and February 2013 and the river was subject to an irrigation ban during March and April.

Table 6.21-1 shows the responsibilities of the authorities within the Barwon basin.

Table 6.21-1 Responsibilities for water resources management in the Barwon basin

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages licensed diversions		
Barwon Water		Geelong and surrounding towns(1)	Operates West Barwon Reservoir and Lake Wurdee Boluc Obliged to meet passing flow requirements
Central Highlands Water		Ballarat and surrounding towns(2)	Operates White Swan and Gong Gong reservoirs Obliged to meet passing flow requirements
Victorian Environmental Water Holder			Holds and manages environmental entitlements in the basin
Corangamite Catchment Authority			Manages waterways for the whole of the Barwon basin

Notes:
(1) Geelong's water supply is also sourced from the Moorabool basin.
(2) Ballarat's water supply is mainly sourced from the Moorabool basin.

Environmental Water Reserve

The Bellarine Peninsula contains internationally significant wetlands listed under the Ramsar Convention which rely on freshwater inputs from the Barwon basin to function ecologically. Other important environmental assets include:

- Lake Connewarre complex, which is part of the Port Phillip Bay (western shoreline), and Bellarine Peninsula Ramsar site
- the native fish community, particularly Australian Grayling and Yarra Pygmy Perch (which are listed in the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*), Australian Mudfish and Tupong
- the native water bird population, particularly the Greenshank, Eastern Golden Plover, Curlew Sandpiper and Red-necked Stint
- platypus.

In 2012–13, the Barwon basin Environmental Water Reserve comprised:

- the *Barwon River Environmental Entitlement 2011*
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Barwon Water and Central Highlands Water
- 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.

6.21.2 Surface water resources

6.21.2.1 Water balance

A surface water balance for the Barwon basin is shown in Table 6.21-2.

The major on-stream storages in the Barwon basin are the West Barwon Reservoir operated by Barwon Water, and the White Swan and Gong Gong reservoirs operated by Central Highlands Water.

Transfers from the Moorabool basin to the Barwon basin increased from 2,724 ML in 2011–12 to 5,187 ML in 2012–13. This water was transferred to White Swan Reservoir and used to supply the Ballarat system. The Goldfields Superpipe was used to transfer 43 ML from the Campaspe basin to White Swan Reservoir to augment supplies to

Ballarat. The Greater Geelong area, serviced by Barwon Water, is a major water user in the Barwon basin. Water supplied to Geelong is also sourced from the Moorabool basin.

Table 6.21-2 Balance of surface water in the Barwon basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	32,611	25,686
Volume in storage at end of year	25,519	32,611
Change in storage	**(7,092)**	**6,925**
Inflows		
Catchment inflow(1)	155,726	191,647
Rainfall on major storages	2,514	3,015
Inflows from the Moorabool River	34,593	27,665
Transfers from the Corangamite basin via Woady Yaloak Channel	0	160
Transfers from Moorabool basin to White Swan Reservoir(2)	5,187	2,724
Transfers from Campaspe basin to White Swan Reservoir	43	110
Treated wastewater discharged back to river	26,975	26,121
Total inflows	**225,038**	**251,443**
Outflows		
Diversions		
Urban diversions	33,260	30,225
Licensed diversions from unregulated streams	1,370	1,668
Small catchment dams	30,898	30,898
Total diversions	***65,528***	***62,791***
Losses		
Evaporation losses from major storages	3,710	3,153
Evaporation from small catchment dams	12,543	12,543
In-stream infiltration to groundwater, flows to floodplain and evaporation	8,229	10,654
Total losses	***24,482***	***26,350***
Water passed at outlet of basin		
River outflows to the ocean	142,120	155,376
Total water passed at outlet of basin	***142,120***	***155,376***
Total outflows	**232,130**	**244,517**

Notes:

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

(2) The 5,187 ML transfer represents water that is transferred to White Swan Reservoir from the Moorabool basin before being supplied to urban customers in the Ballarat area (which is located within both the Barwon and Moorabool basins).

6.21.2.2 Storages and flows

Storage levels for all major storages in the basin started the year at 61,885 ML in July 2012 and were 50,079 ML (64% of capacity) at the end of June 2013. Only volumes for on-stream storages have been included in the water balance, therefore Wurdee Boluc Reservoir has not been included. The volume reported in the ‘catchment inflow less regulated releases’ column of Table 6.21-3 is the balancing item for each storage. It represents the flow of water in or out of the storage that is not shown as rainfall or evaporation, and may include other minor components influencing the change in storage during the year.

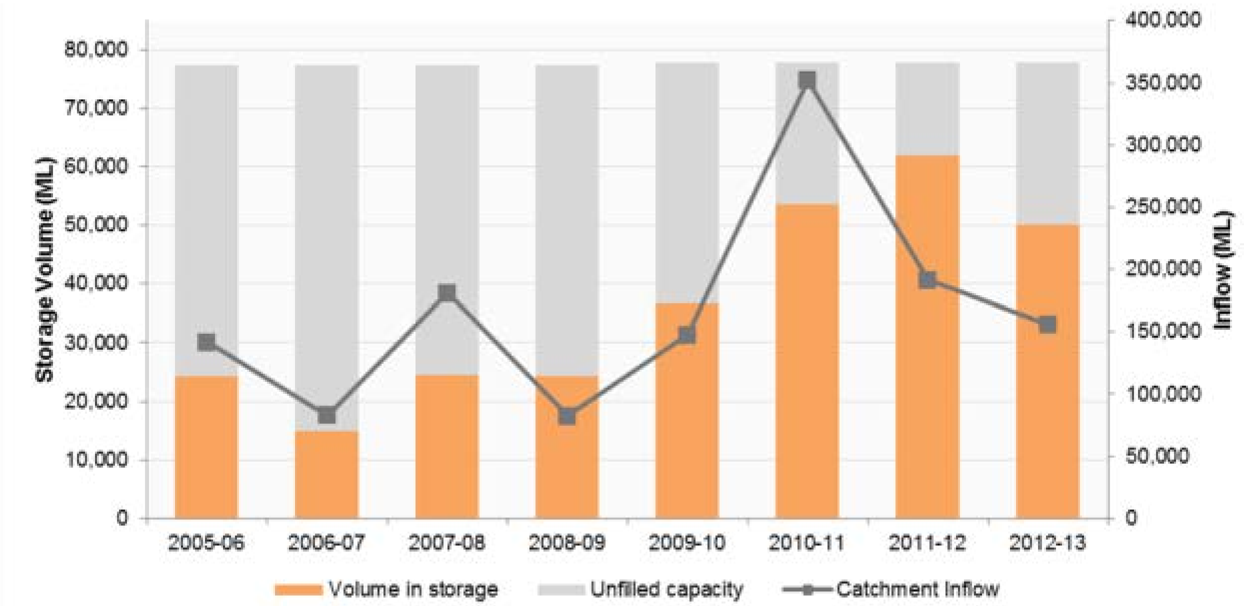
Table 6.21-3 Storage volumes in the Barwon basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Gong Gong Reservoir	1,902	844	145	278	1,056	1,767
West Barwon Dam	21,504	21,504	1,619	2,086	(6,747)	14,290
White Swan Reservoir	14,107	10,263	750	1,346	(206)	9,462
Total on-stream storages	***37,513***	***32,611***	***2,514***	***3,710***	***(5,897)***	***25,519***
Off-stream storages						
Wurdee Boluc Reservoir	40,431	29,274	n/a	n/a	(4,714)	24,560
Total off-stream storages	***40,431***	***29,274***	***n/a***	***n/a***	***(4,714)***	***24,560***
Grand total	**77,944**	**61,885**	**2,514**	**3,710**	**(10,611)**	**50,079**

Catchment inflows to the Barwon basin amounted to 155,726 ML in 2012–13, which is 43% of the long-term average (of 360,000 ML). This is a decrease from inflows of 53% of the long-term average in 2011–12 (Figure 6.21-2).

The amount of water flowing from the Barwon basin into Corio Bay and Bass Strait was 142,120 ML in 2012–13. This represents 91% of the catchment inflows to the basin.

Figure 6.21-2 All major storages and catchment inflows in the Barwon basin



6.21.2.3 Entitlement volumes and diversions

In the Barwon basin, surface water is diverted by Barwon Water, Central Highlands Water and licensed diverters, and water is harvested in small catchment dams.

Entitlements in the Barwon basin include rights granted to individuals (for example water shares and take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the Victorian Environmental Water Holder). Rights to water in the Barwon basin are outlined in Table 6.21-4.

Table 6.21-4 Entitlement volumes in the Barwon basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlements (Upper Barwon System) Conversion Order 2002	43,467
Bulk Entitlement (Yarrowee–White Swan System) Conversion Order 2002(1)	12,267
Barwon River Environmental Entitlement 2011(2)	n/a
Take and use licences – unregulated surface water	5,639
Total volume of water entitlements in the Barwon basin	**61,373**

Notes:

(1) This bulk entitlement 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.

(2) Use of this entitlement is dependent on suitable river heights as specified in the entitlement.

Barwon basin

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.21-5. The total volume of water diverted by bulk entitlement holders was greater in 2012–13 compared to the volume reported in the 2011–12 Victorian Water Accounts.

The *Barwon River Environmental Entitlement 2011* provides for unregulated flows to be diverted to floodplain wetlands. The volume of unregulated flow available for diversion varies depending on seasonal conditions. No use was recorded against this entitlement in 2012–13.

Table 6.21-5 Allocation account balance summary for the Barwon basin

Water entitlement	Allocation issued	Net trade In/(Out)	Water use	End of season forfeitures
Upper Barwon system	43,467	0	(26,279)	(17,188)
Yarrowee–White Swan system	12,267	0	(6,981)	(5,286)
Barwon River Environmental Entitlement(1)	-	-	-	-
Take and use licences – unregulated surface water	5,639	0	(1,370)	(4,269)

Note:

(1) Use under this entitlement is dependent on suitable river heights. No water was available under it during 2012–13.

The estimated volume of water harvested from small catchment dams represents a significant portion of the total surface water diversions in the Barwon basin (Table 6.21-6).

Table 6.21-6 Estimated small catchment dam information

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	10,374	5,187	n/a
Registered commercial and irrigation	30,609	25,711	n/a
Total	**40,983**	**30,898**	**43,442**

n/a: No information available.

6.21.3 Recycled water

Both Barwon Water and Central Highlands Water operate wastewater treatment plants within the Barwon basin.

In 2012–13, 11% of wastewater in the Barwon basin was recycled. This is an increase from 8% in 2011–12.

Table 6.21-7 shows the volumes of water recycled in the Barwon basin in 2012–13.

Table 6.21-7 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process(2))	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other(3) (ML)
				Urban and industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Ballarat North	2,713	906	21%	0	0	564	342	1,808	0
Ballarat South	7,176	70	0%	0	0	0	70	7,105	0
Bannockburn	90	90	45%	0	40	0	49	0	0
Black Rock	20,667	3,550	13%	1,109	1,497	0	945	18,062	(945)
Portarlington	1,192	1,192	23%	0	277	0	916	0	0
Winchelsea	35	35	25%	0	9	0	26	0	0
Total 2012–13	31,873	5,843	11%	1,109	1,823	564	2,348	26,975	(945)
Total 2011–12	29,291	3,978	8%	867	1,198	341	1,573	26,121	(808)

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

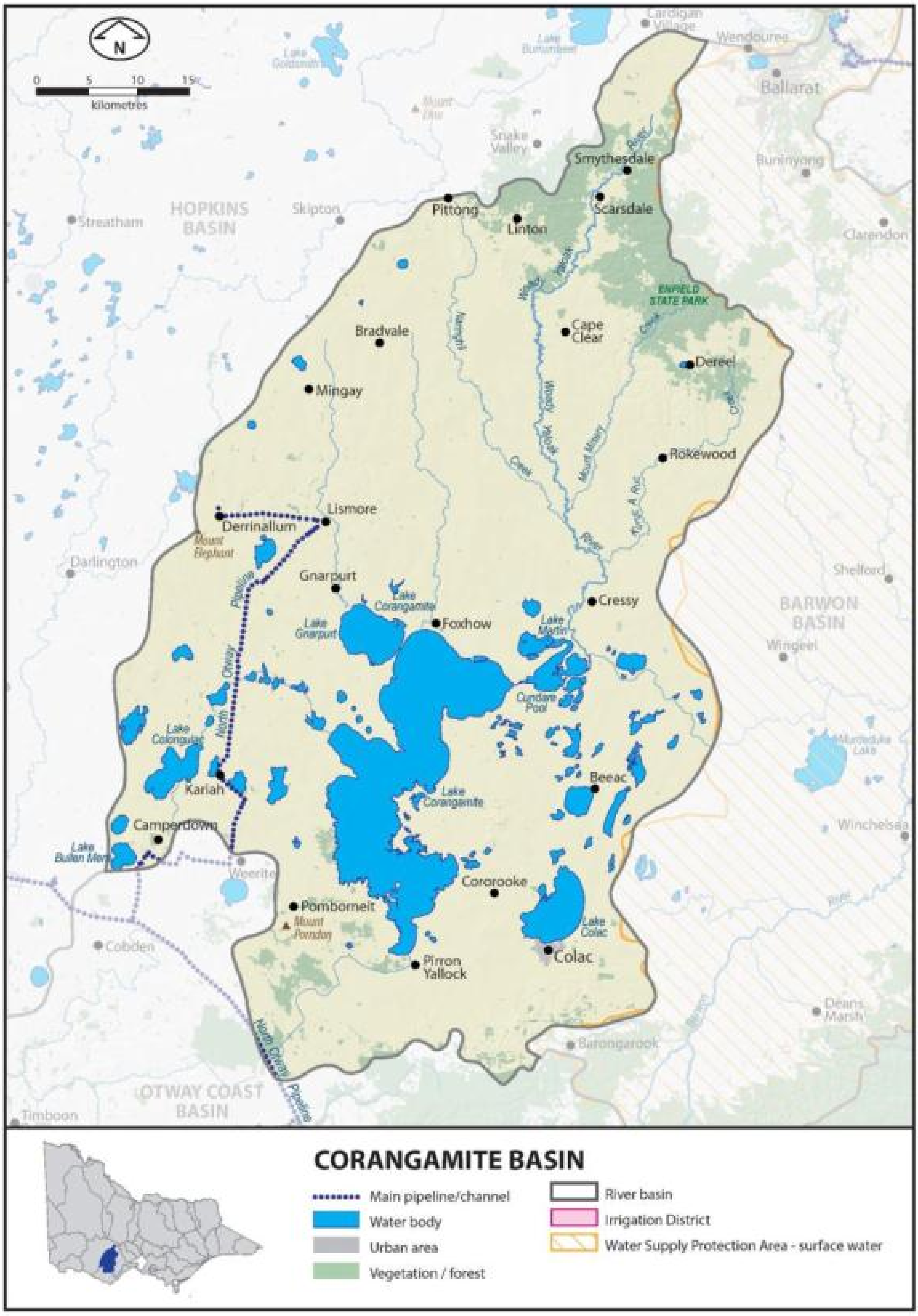
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site wastewater storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.22 Corangamite basin

The Corangamite basin (Figure 6.22-1) is located in western Victoria. Rivers and streams within the basin terminate in a series of inland lakes, the largest of which is Lake Corangamite.

Figure 6.22-1 Map of the Corangamite basin



6.22.1 Water resources overview

In 2012–13, rainfall in the Corangamite basin was generally below average, ranging from 60% to 80% of the the long-term average. Inflows across the basin were 46% of the long-term average, lower than 2011–12 when the inflows were 52% of the long-term average. The amount of water flowing from the Corangamite basin into the Ramsar-listed Western District Lakes represented 88% of the catchment inflows in the basin in 2012–13.

Water availability for urban customers is not diversions were unrestricted during the year.

Table 6.22-1 shows the responsibilities of the authorities within the Corangamite basin.

Table 6.22-1 Responsibilities for water resources management in the Corangamite basin

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
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 (1)	
Wannon Water		Provides urban water supply to Camperdown, Lismore and Derrinallum (from the Otway Coast basin)	
Corangamite Catchment Management Authority			Manages waterways for the whole of the Corangamite basin

Note:

(1) Ballarat's water supply is mainly sourced from the Barwon and Moorabool basins.

Environmental Water Reserve

The Western District Lakes are internationally significant wetlands listed under the Ramsar Convention and rely on the freshwater inputs from the Corangamite basin to function ecologically. These lakes include Corangamite, Gnarpurt, Milangil, Terangpom, Beeac, Colongulac and Cundare. Wetlands of national importance include the Kooraweera Lakes, Lough Calvert, Lake Thurrumbong and Cundare Pool. The native fish community and the Corangamite Water Skink also rely on the Environmental Water Reserve (EWR).

In 2012–13, the Corangamite basin EWR comprised:

- the component of water in the basin not allocated for consumptive use
- water set aside for the environment through the operation of passing flow conditions on licensed diversions.

6.22.2 Surface water resources

6.22.2.1 Water balance

A surface water balance for the Corangamite basin is shown in Table 6.22-2. Urban water use within the Corangamite basin is supplied from the Otway Coast basin due to the better quality water available. No storage information is recorded in the water balance as there are no major on-stream storages in the Corangamite basin.

Table 6.22-2 Balance of surface water in the Corangamite basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	-	-
Volume in storage at end of year	-	-
Change in storage	**-**	**-**
Inflows		
Catchment inflow(1)	145,591	164,247
Rainfall on major storages	-	-
Treated effluent discharged back to river	1,691	2,116
Total inflows	**147,282**	**166,362**
Outflows		

Water account component	2012–13 (ML)	2011–12 (ML)
Diversions		
Urban diversions	-	-
Licensed diversions from unregulated streams	142	185
Small catchment dams	12,366	12,366
Total diversions	***12,508***	***12,551***
Losses		
Evaporation losses from major storages	-	-
Evaporation from small catchment dams	6,534	6,534
In-stream infiltration to groundwater, flows to floodplain and evaporation	n/a	n/a
Total losses	***6,534***	***6,534***
Water passed at outlet of basin		
River outflows to the Corangamite Lakes	128,241	147,117
River outflows to Barwon basin via Woady Yaloak Channel	0	160
Total water passed at outlet of basin	***128,241***	***147,277***
Total outflows	**147,282**	**166,362**

Notes:
(1) Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows and the known inflows.
(2) No suitable model is available to make an estimate of in-stream losses.
n/a: Information not available.

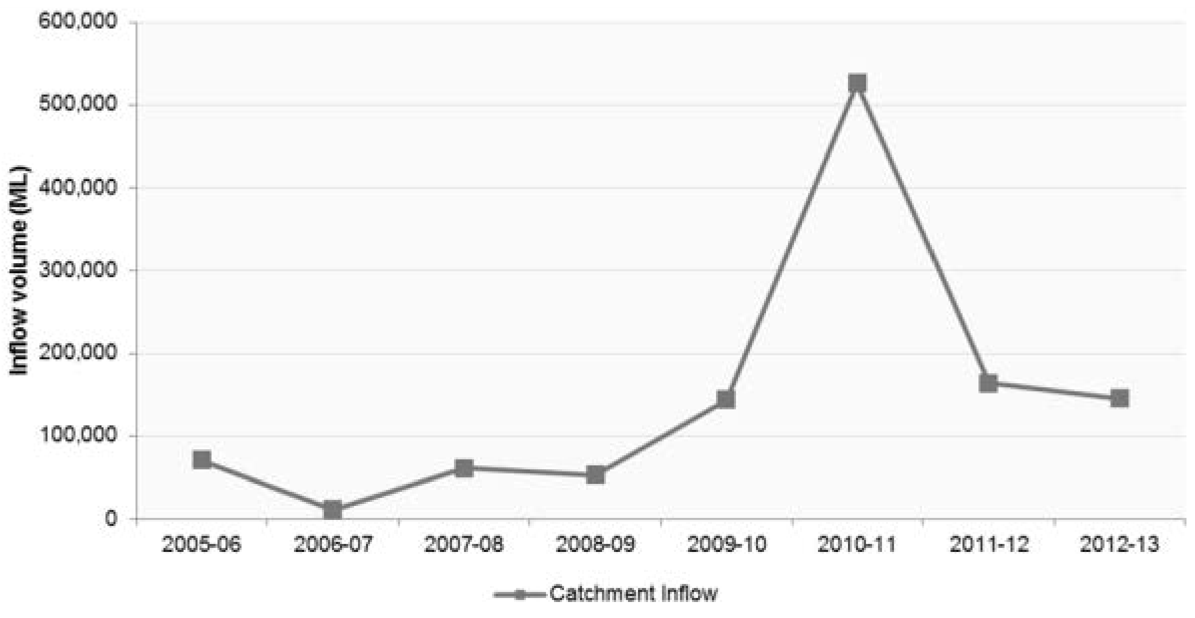
6.22.2.2 Storages and flows

Inflows across the basin were 46% of the long-term average of 316,000 ML, which is lower than 2011–12 where the inflows were 52% of the long-term average (Figure 6.22-2).

Outflows from the Corangamite basin into the Western District Lakes were 128,241 ML in 2012–13, or 88% of the catchment inflows.

There are no major water supply storages in the Corangamite basin.

Figure 6.22-2 Catchment inflows



6.22.2.3 Entitlement volumes and diversions

In the Corangamite basin, surface water is diverted from unregulated streams by licence holders and surface water is harvested in small catchment dams. No water corporations divert surface water in this basin.

The estimated volume of water diverted by licence holders was lower in 2012–13 compared to 2011–12. The total licensed volume in the basin was similar to the volume reported in the 2011–12 Victorian Water Accounts (Table 6.22-3).

Corangamite basin

Table 6.22-3 Entitlement volumes in the Corangamite basin

Water entitlements	Annual entitlement volume (ML)
Take and use licences – unregulated surface water	1,237
Total volume of water entitlements in the Corangamite basin	**1,237**

Allocation available under take and use licences in the Corangamite basin for 2012–13 is presented in Table 6.22-4.

Table 6.22-4 Allocation account balance summary for the Corangamite basin

Water entitlement	Allocation issued	Net trade In/(Out)	Water use	End of season forfeitures
Take and use licences – unregulated surface water	1,237	0	(142)	(1,096)

The estimated volume of water harvested from small catchment dams represents the largest diversion of surface water in the Corangamite basin (Table 6.22-5).

Table 6.22-5 Estimated small catchment dam information for the Corangamite basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	8,100	4,050	n/a
Registered commercial and irrigation	9,900	8,316	n/a
Total	**18,000**	**12,366**	**18,900**

n/a: No information available.

6.22.3 Recycled water

Wastewater treatment plants in the Corangamite basin are at Colac, operated by Barwon Water, and Camperdown, operated by Wannon Water. Recycled water was primarily used for agricultural purposes. Compared to 2011–12 the volume and percentage of water recycled increased in 2012–13 to around 20% recycled.

Table 6.22-6 shows the volumes of water recycled in the Corangamite basin in 2011–12.

Table 6.22-6 Volume of recycled water in the Corangamite basin

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process(2))	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other(3) (ML)
				Urban and industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Camperdown Industrial	0	0	0%	0	0	0	0	0	0
Camperdown Municipal	357	407	114%	15	392	0	0	0	(50)
Colac	1,691	58	0%	0	0	0	58	1,691	(58)
Total 2012–13	**2,048**	**464**	**20%**	**15**	**392**	**0**	**58**	**1,691**	**(108)**
Total 2011–12	2,294	333	13%	13	276	0	44	2,116	364

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

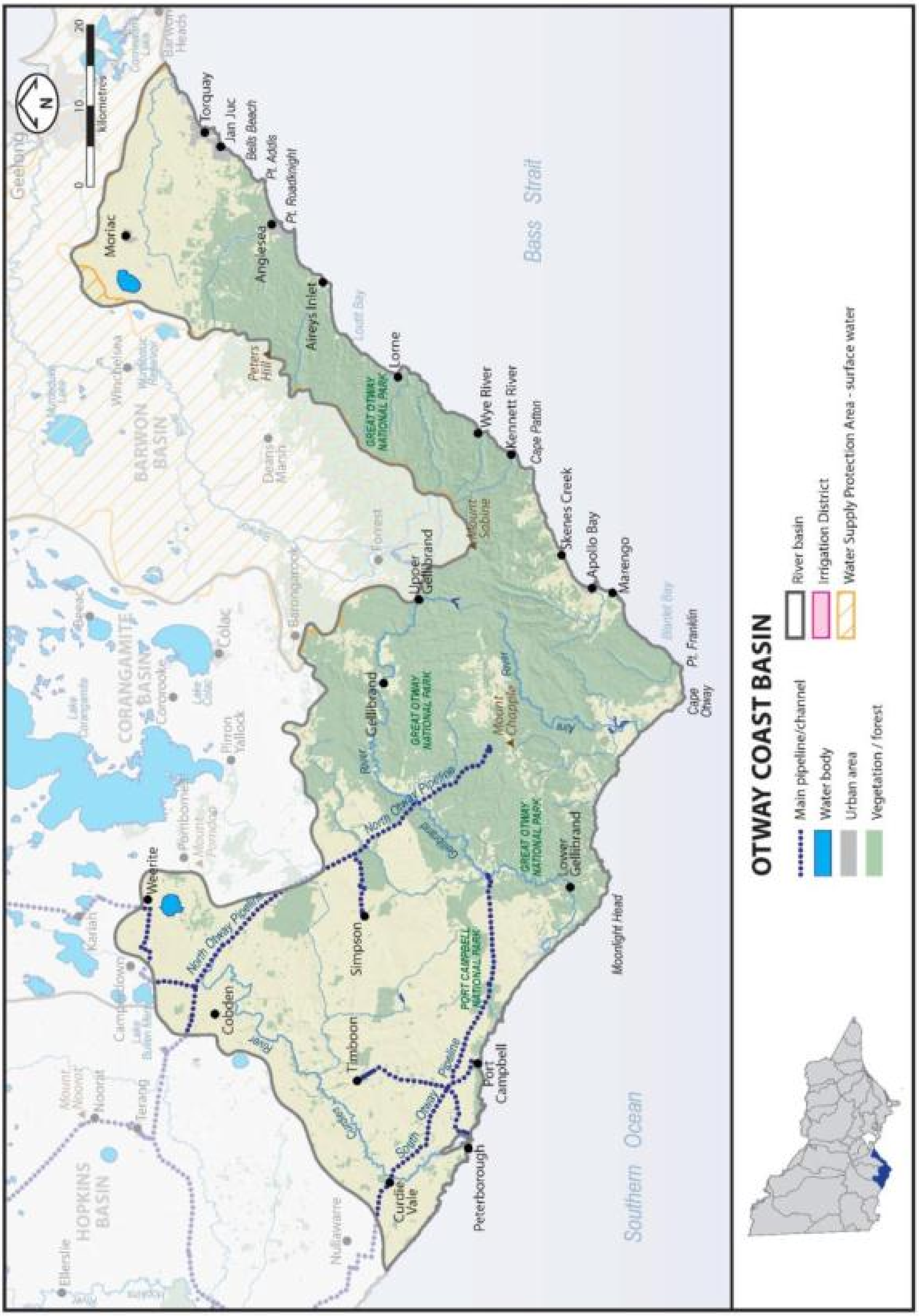
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site wastewater storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.23 Otway Coast basin

The Otway Coast basin (Figure 6.23-1) is located in south-western Victoria. It encompasses the numerous small creeks and rivers that flow to the coast from the Otway Ranges between Torquay and Peterborough.

Figure 6.23-1 Map of the Otway Coast basin



6.23.1 Water resources overview

In 2012–13, rainfall in the Otway Coast basin was generally below average, ranging between 60% and 100% of the long-term average, with the higher rainfall seen in the southern half of the basin. Inflows in the Otway Coast basin in 2012–13 were 76% of the long-term average, compared to 88% in 2011–12. The amount of water flowing into Bass Strait represented 95% of the catchment inflows in the basin in 2012–13.

The storage level in West Gellibrand Reservoir began and ended the year at full capacity. Urban water supplies in Apollo Bay, Skenes Creek and Marengo were subject to mandatory summer restrictions, with Stage 2 restrictions imposed between November 2013 and February 2014 and increasing to Stage 4 in March and April. The only restriction on licensed diversions was an irrigation ban on Curdies River between January and June 2013.

Table 6.23-1 shows the responsibilities of the authorities within the Otway Coast basin.

Table 6.23-1 Responsibilities for water resources management in the Otway Coast basin

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages licensed diversions		
Wannon Water			Obliged to meet passing flow requirements
Barwon Water		Supplies the majority of towns in the basin including Lorne, Aireys Inlet, Apollo Bay and part of the Geelong area. Also transfers to Colac	Operates West Gellibrand Reservoir Obliged to meet passing flow requirements
Corangamite Catchment Management Authority			Manages waterways for the whole of the Otway Coast basin

Environmental Water Reserve

Several important environmental assets in the Otway basin depend on the Environmental Water Reserve (EWR), including:

- Aire River (a heritage river), and more specifically the Lower Aire wetlands which are of national significance
- the Aire River estuary, which is of state significance
- the Upper Aire River, which is a representative river
- Elliot River, Parker River, Grey River, Carisbrook Creek and Smythes Creek, which are ecologically healthy
- native fish community, e.g. River Blackfish and the Australian Grayling and their habitat, 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 rare or threatened species), Cape Barren Goose and Australasian Bittern
- native mammals including platypus and Swamp Antechinus
- macroinvertebrate communities in areas such as Elliot River, St Georges River and Wye River.

In 2012–13, the Otway Coast basin EWR comprised:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Barwon Water and Wannon Water
- 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.

6.23.2 Surface water resources

6.23.2.1 Water balance

A surface water balance for the Otway Coast basin is shown in Table 6.23-2

Table 6.23-2 Balance of surface water in the Otway Coast basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	1,856	1,856
Volume in storage at end of year	1,856	1,856
Change in storage	**0**	**0**
Inflows		

Water account component	2012–13 (ML)	2011–12 (ML)
Catchment inflow[1]	668,930	780,800
Rainfall on major storages	164	175
Treated effluent discharged back to river	991	1,084
Total inflows	**670,085**	**782,059**
Outflows		
Diversions		
Urban diversions	13,395	14,194
Licensed diversions from unregulated streams	845	2,078
Small catchment dams	12,728	12,728
Total diversions	***26,967***	***28,999***
Losses		
Evaporation losses from major storages	242	225
Evaporation from small catchment dams	3,455	3,455
In-stream infiltration to groundwater, flows to floodplain and evaporation[2]	n/a	n/a
Total losses	***3,697***	***3,680***
Water passed at outlet of basin		
River outflows to the ocean	639,420	749,379
Total water passed at outlet of basin	***639,420***	***749,379***
Total outflows	**670,085**	**782,059**

Notes:

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

(2) No suitable model is available to make an estimate of in-stream losses.

6.23.2.2 Storages and inflows

The only major storage in the basin is the West Gellibrand Reservoir, which began and ended the year at full capacity (Table 6.23-3).The volume reported in the 'catchment inflow less regulated releases' column of Table 6.23-3 is the balancing item for each storage. It represents the flow of water in or out of the storage that is not shown as rainfall or evaporation, and may include other minor components influencing the change in storage during the year.

Table 6.23-3 Storage volumes in the Otway Coast basin

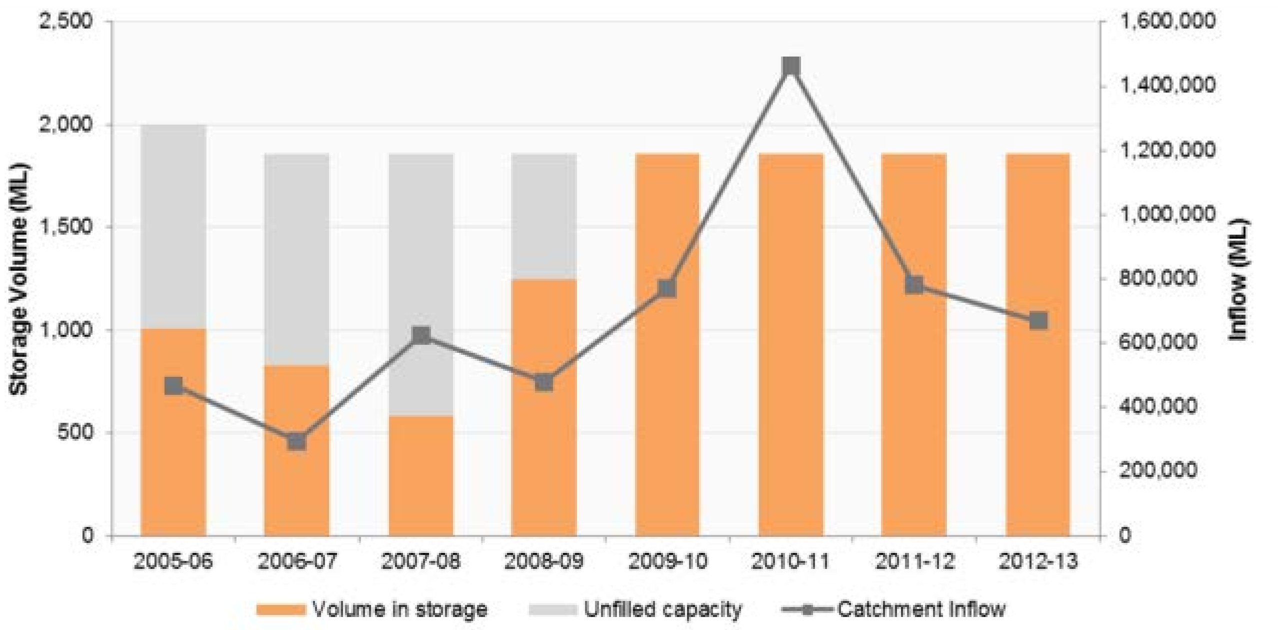
Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
On-stream storages						
West Gellibrand Reservoir	1,856	1,856	164	242	(78)	1,856
Total storages	**1,856**	**1,856**	**164**	**242**	**(78)**	**1,856**

Catchment inflows in 2012–13 were 76% of the long-term average of 884,000 ML, compared to 88% in 2011–12 (Figure 6.23-2).

The amount of water flowing from the Otway Coast basin into Bass Strait decreased to 639,420 ML in 2012–13. This represented 95% of the catchment inflows into the basin, compared to 96% in 2011–12.

Otway Coast basin

Figure 6.23-2 All major storages and catchment inflows



6.23.2.3 Entitlement volumes and diversions

In the Otway Coast basin, surface water is diverted by Barwon Water, Wannon Water and licensed diverters, and surface water is also harvested in small catchment dams.

Entitlements in the Otway Coast basin include rights granted to individuals (take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the Victorian Environmental Water Holder). Rights to water in the Otway Coast basin are outlined in Table 6.23-4.

Table 6.23-4 Entitlement volumes in the Otway Coast basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Aireys Inlet) Conversion Order 1997	317
Bulk Entitlement (Apollo Bay) Order 2010	800
Bulk Entitlement (Colac) Amendment Order 2003	5,400
Bulk Entitlement (Gellibrand) Conversion Order 1997	60
Bulk Entitlement (Lorne) Conversion Order 1997	510
Bulk Entitlement (Otway Coast) Conversion Order 1998	12,580
Take and use licences – unregulated surface water	6,740
Total volume of water entitlements in Otway Coast basin	**26,407**

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.23-5. The volume of water diverted from unregulated streams by licence holders in the Otway Coast basin was also less in 2012–13 compared to the volume reported in the 2011–12 Victorian Water Accounts.

Table 6.23-5 Allocation account balance summary for the Otway Coast basin

Water entitlement	Allocation issued	Net trade In/(Out)	Water use	Forfeitures
Aireys Inlet	317	0	(206)	(111)
Apollo Bay	800	0	(379)	(421)
Colac	5,400	0	(3,825)	(1,575)
Gellibrand	60	0	(20)	(40)
Lorne	510	0	(408)	(102)
Otway System	12,580	0	(8,557)	(4,024)
Take and use licences – unregulated surface water	6,740	0	(845)	(5,896)

The estimated volume of water harvested from small catchment dams represents a significant portion of the total diversions in the Otway Coast basin (Table 6.23-6.

Table 6.23-6 Estimated small catchment dam information

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	10,736	5,368	n/a
Registered commercial and irrigation	8,762	7,360	n/a
Total	**19,498**	**12,728**	**16,183**

n/a: Information not available.

6.23.3 Recycled water

Wastewater treatment plants within the Otway Coast basin are operated by Barwon Water and Wannon Water, with the largest plants located at Lorne and Apollo Bay. Across the basin, 12% of wastewater was reused, similar to 2011–12 (Table 6.23-7).

Table 6.23-7 Volume of recycled water in the Otway Coast basin

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process(2))	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other(3) (ML)
				Urban and industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Aireys Inlet	86	86	0%	0	0	0	86	0	0
Anglesea	306	91	26%	0	81	0	10	226	(10)
Apollo Bay	394	15	0%	0	0	0	15	394	(15)
Cobden	153	42	27%	0	42	0	0	56	56
Lorne	311	7	0%	0	0	0	7	311	(7)
Peterborough	0	0	0%	0	0	0	0	0	0
Port Campbell	28	4	13%	0	4	0	0	0	24
Simpson	20	0	0%	0	0	0	0	4	16
Timboon(4)	23	36	159%	0	36	0	0	0	(13)
Total 2012–13	**1,322**	**281**	**12%**	**0**	**163**	**0**	**118**	**991**	**50**
Total 2011–12	1,343	273	12%	0	155	0	117	1,084	(13)

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

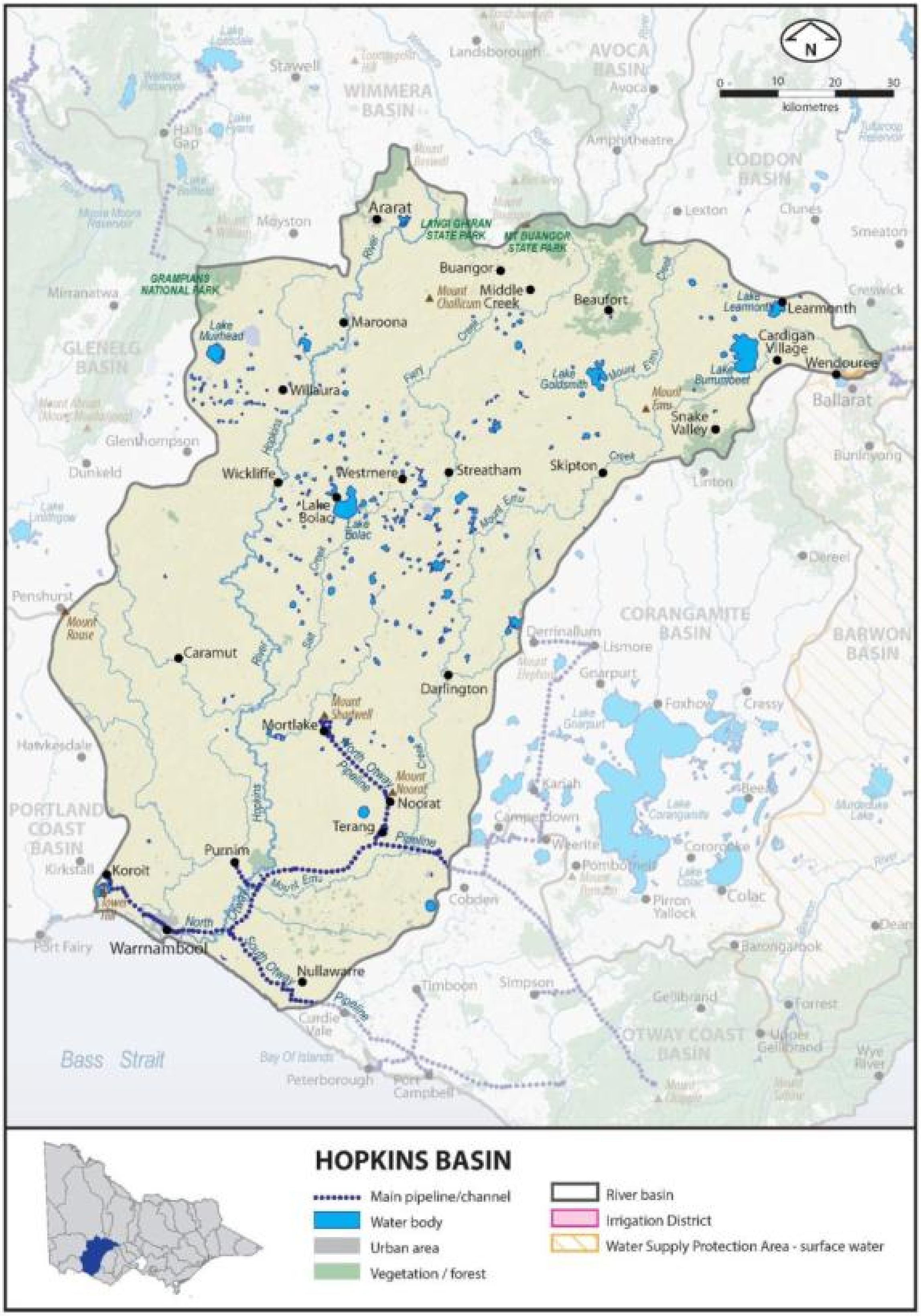
(3) 'Other' refers to a change in on-site wastewater storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

(4) Volume recycled greater than volume produced due to water stored on-site carried over from previous year.

6.24 Hopkins basin

The Hopkins basin (Figure 6.24-1) is located in south-western Victoria. The two major rivers within the basin are the Merri River and the Hopkins River.

Figure 6.24-1 Map of the Hopkins basin



6.24.1 Water resources overview

In 2012–13, rainfall in the Hopkins basin ranged between 60% and 100% of the long-term average, with the northern basin experiencing drier conditions (60% to 80%) compared to the south (80% to 100%). Catchment inflows in 2012–13 were 37% of the long-term average, significantly less than 2011–12 which saw inflow volumes at 48% of the long-term average. The volume of water flowing from the Hopkins basin into Bass Strait represented 58% of the catchment inflows, compared to 70% in 2011–12.

Urban water use in the Hopkins basin was unrestricted throughout 2012–13. Licensed diversions were from the Hopkins River and Mt Emu Creek between January and June 2013. Additionally, during March and April 2013 Merri River was subject to Stage 5 water restrictions, meaning that diversions were reduced by 75% and limits were placed on domestic and stock use. Despite this, urban water use was unrestricted in 2012–13.

Table 6.24-1 shows the responsibilities of the authorities within the Hopkins basin.

Table 6.24-1 Responsibilities for water resources management

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
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 in the south of the basin including Warrnambool	
GWMWater		Supplies towns in the north of the basin including Ararat	
Central Highlands Water		Supplies towns in the north-east of the basin including Beaufort and Skipton	Obliged to meet passing flow requirements
Glenelg Hopkins Catchment Management Authority			Manages waterways in the whole of the Hopkins basin

Environmental Water Reserve

Important environmental assets, such as the coastal salt marsh wetlands and the wetlands associated with the Merri River Estuary, depend on the Hopkins basin Environmental Water Reserve (EWR).

In 2012–13, the EWR for the Hopkins basin comprised:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Central Highlands Water and GWMWater
- water set aside for the environment through the operation of licensed diversions in passing flow conditions, particularly for Cudgee Creek and Mt Emu Creek
- all other water in the basin not allocated for consumptive use.

6.24.2 Surface water resources

6.24.2.1 Water balance

A water balance for the Hopkins basin is shown in Table 6.24-2. No storage information is recorded in the water balance as there are no major on-stream storages in the Hopkins basin. Small catchment dams harvest most of the water used for consumptive purposes.

Table 6.24-2 Balance of surface water in the Hopkins basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	-	-
Volume in storage at end of year	-	-
Change in storage	**-**	**-**

Hopkins basin

Water account component	2012–13 (ML)	2011–12 (ML)
Inflows		
Catchment inflow[1]	235,182	303,486
Rainfall on major storages	-	-
Treated effluent discharged back to river	91	5,356
Total inflows	**235,274**	**308,842**
Outflows		
Diversions		
Urban diversions	179	200
Licensed diversions from unregulated streams	3,484	2,693
Small catchment dams	64,538	64,538
Total diversions	***68,201***	***67,430***
Losses		
Evaporation losses from major storages	-	-
Evaporation from small catchment dams	30,166	30,166
In-stream infiltration to groundwater, flows to floodplain and evaporation[2]	n/a	n/a
Total losses	***30,166***	***30,166***
Water passed at outlet of basin		
River outflows to the ocean	136,907	211,246
Total water passed at outlet of basin	***136,907***	***211,246***
Total outflows	**235,274**	**308,842**

Notes:

(1) Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows and the known inflows.

(2) No suitable model is available to make an estimate of in-stream losses.

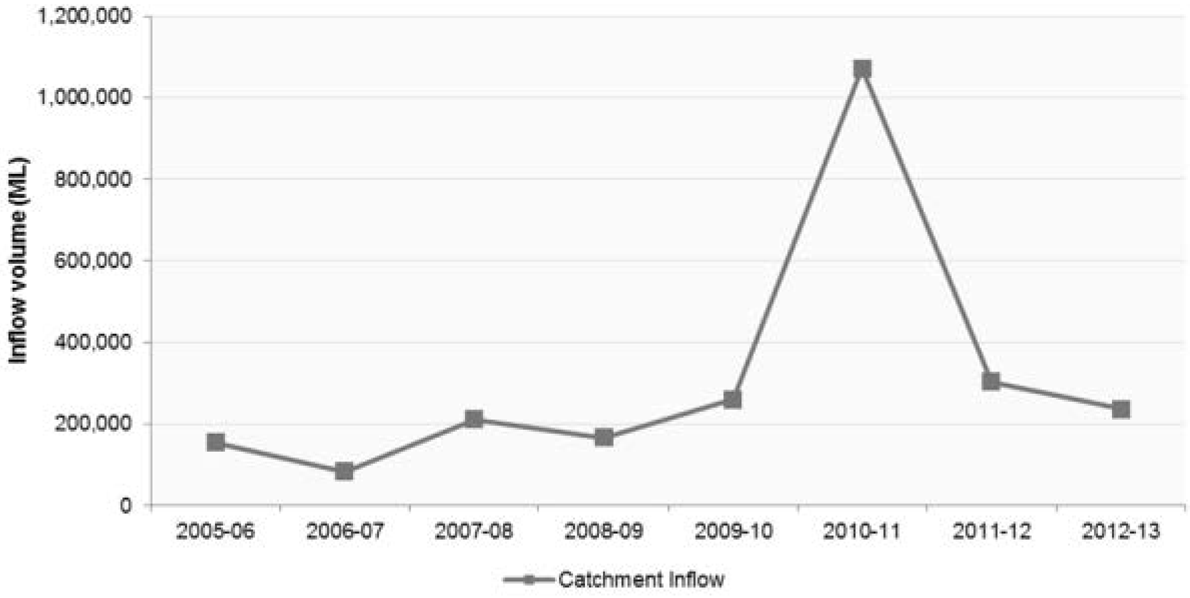
6.24.2.2 Storages and flows

Catchment inflows in 2012–13 were 37% of the long-term average (of 635,000 ML), compared to 48% in 2011–12 (Figure 6.24-2).

The volume of water flowing from the Hopkins basin into Bass Strait was 136,907 ML in 2012–13, which represented 58% of the catchment inflows. This is a decrease from 211,246 ML in 2011–12, which represented 70% of catchment inflows.

There are no major storages in the Hopkins basin.

Figure 6.24-2 Catchment inflows in the Hopkins basin



6.24.2.3 Entitlement volumes and diversions

In the Hopkins basin, bulk entitlements to surface water are held by Central Highlands Water and licensed diverters. Surface water is diverted by licensed diverters and is also harvested into small catchment dams.

Entitlements include rights granted to individuals (take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the Victorian Environmental Water Holder). Rights to water in the Hopkins basin are outlined in Table 6.24-3.

The Hopkins basin (Masons Creek) based also supplies the Willuara, Elmhurst and Buangor systems bulk entitlement. This entitlement and its use is reported in the Wimmera basin as the majority of the water for this entitlement is sourced from the Wimmera basin.

Table 6.24-3 Entitlement volumes in the Hopkins basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Beaufort) Conversion Order 2005	419
Bulk Entitlement (Skipton) Conversion Order 2005[(1)]	210
Take and use licences – unregulated surface water	11,423
Total volume of water entitlements in the Hopkins basin	**12,052**

Note:

(1) Central Highlands Water has not diverted any water under its Skipton bulk entitlement for a number of years. The town is now supplied from the Ballarat system.

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.24-4. The total volume of water diverted by bulk entitlement holders was similar to the volume reported in the 2011–12 Victorian Water Accounts.

The volume of water diverted from unregulated streams by licence holders in the Hopkins basin was 3,484 ML which was higher than the 2011–12 volume of 2,693 ML (Table 6.24-4). The total volume of licences in the basin has also increased from 11,253 ML in 2011–12 to 11,423 ML in 2012–13.

Table 6.24-4 Allocation account balance summary for the Hopkins basin

Water entitlements	Allocation issued	Net trade In/(Out)	Water use	Forfeitures
Beaufort	419	0	(179)	(240)
Skipton	210	0	0	(210)
Take and use licences – unregulated surface water	11,423	0	(3,484)	(7,940)

The estimated volume of water harvested from small catchment dams represents the largest diversion of water in the Hopkins basin (Table 6.24-5).

Table 6.24-5 Estimated small catchment dam information for the Hopkins basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	30,913	15,456	n/a
Registered commercial and irrigation	58,430	49,082	n/a
Total	**89,343**	**64,538**	**94,704**

n/a: No information available.

6.24.3 Recycled water

Three water authorities operate wastewater treatment plants in the Hopkins basin. The largest volume of water is from the Warrnambool Treatment Plant. The percentage of water recycled in 2012–13 rose slightly compared to 2011–12.

Table 6.24-6 shows the volumes of water recycled in the Hopkins basin in 2012–13.

Hopkins basin

Table 6.24-6 Volume of recycled water in the Hopkins basin

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process[2])	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other[3] (ML)
				Urban and industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Ararat	473	481	100%	195	279	0	7	0	(8)
Beaufort	91	0	0%	0	0	0	0	91	0
Cardigan Village	0	0	0%	0	0	0	0	0	0
Mortlake	59	15	25%	8	7	0	0	0	44
Skipton	0	0	0%	0	0	0	0	0	0
Terang[4]	144	176	122%	0	176	0	0	0	(32)
Warrnambool	4,682	0	0%	0	0	0	0	0	4,682
Willaura	21	0	0%	0	0	0	0	0	21
Total 2012–13	**5,470**	**672**	**12%**	**204**	**461**	**0**	**7**	**91**	**4,707**
Total 2011–12	6,065	647	11%	128	512	0	7	5,356	62

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site wastewater storage or items affecting the annual water balance for recycled water that are not otherwise accounted for.

(4) Volume recycled greater than volume produced due to water stored on-site carried over from previous year.

6.25 Portland Coast basin

The Portland Coast basin (Figure 6.25-1) is located in south-western Victoria. Major rivers within the basin include the Moyne River, Eumeralla River, Fitzroy River and the Surry River.

Figure 6.25-1 Map of the Portland Coast basin

6.25.1 Water resources overview

In 2012–13, rainfall across much of the Portland Coast basin ranged between 80% and 100% of the long-term average, with the northernmost part of the basin receiving between 60% and 80% of the average. Inflows in 2012–13 were 94% of the long-term average, compared to 121% in 2011–12. The amount of water flowing from the Portland Coast basin into Bass Strait represented 94% of the catchment inflows in the basin in 2012–13.

Irrigation bans were in place for licensed diversions between January and June 2013 on the Moyne, Surrey, Fitzroy and Eumeralla rivers, which comprise most of the major waterways in the basin.

Table 6.25-1 shows the responsibilities of the authorities within the Portland Coast basin.

Table 6.25-1 Responsibilities for water resources management

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages licensed diversions		
Wannon Water		Supplies groundwater to Koroit, Port Fairy, Heywood and Portland	
Glenelg Hopkins Catchment Management Authority			Manages waterways in the whole Portland Coast basin

Environmental Water Reserve

In 2012–13, the Portland Coast basin Environmental Water Reserve comprised:

- water in the basin not otherwise allocated for consumptive use
- water set aside for the environment through the operation of passing flow conditions on licensed diversions, particularly for the Condah Drain, Darlot Creek and the Fitzroy, Moyne and Surry rivers.

6.25.2 Surface water resources

6.25.2.1 Water balance

A water balance for the Portland Coast basin is shown in Table 6.25-2. Of the total inflows, approximately 5% were diverted for consumptive use, mainly from small catchment dams. All towns serviced by Wannon Water in this basin are either supplied by groundwater or directly from other river basins. No storage information is recorded in the water balance as there are no major on-stream storages in the Portland Coast basin.

Table 6.25-2 Balance of surface water in the Portland Coast basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	-	-
Volume in storage at end of year	-	-
Change in storage	**-**	**-**
Inflows		
Catchment inflow(1)	338,902	437,172
Rainfall on major storages	-	-
Treated effluent discharged back to river	177	2,796
Total inflows	**339,079**	**439,968**
Outflows		
Diversions		
Licensed diversions from unregulated streams	73	125
Small catchment dams	16,135	16,135
Total diversions	***16,208***	***16,260***
Losses		
Evaporation losses from major storages	-	-
Evaporation from small catchment dams	4,484	4,484
In-stream infiltration to groundwater, flows to floodplain and evaporation(2)	n/a	n/a
Total losses	***4,484***	***4,484***

Water account component	2012–13 (ML)	2011–12 (ML)
Water passed at outlet of basin		
River outflows to the ocean	318,387	419,224
Total water passed at outlet of basin	***318,387***	***419,224***
Total outflows	**339,079**	**439,968**

Notes:

(1) Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows and the known inflows.

(2) No suitable model is available to make an estimate of in-stream losses.

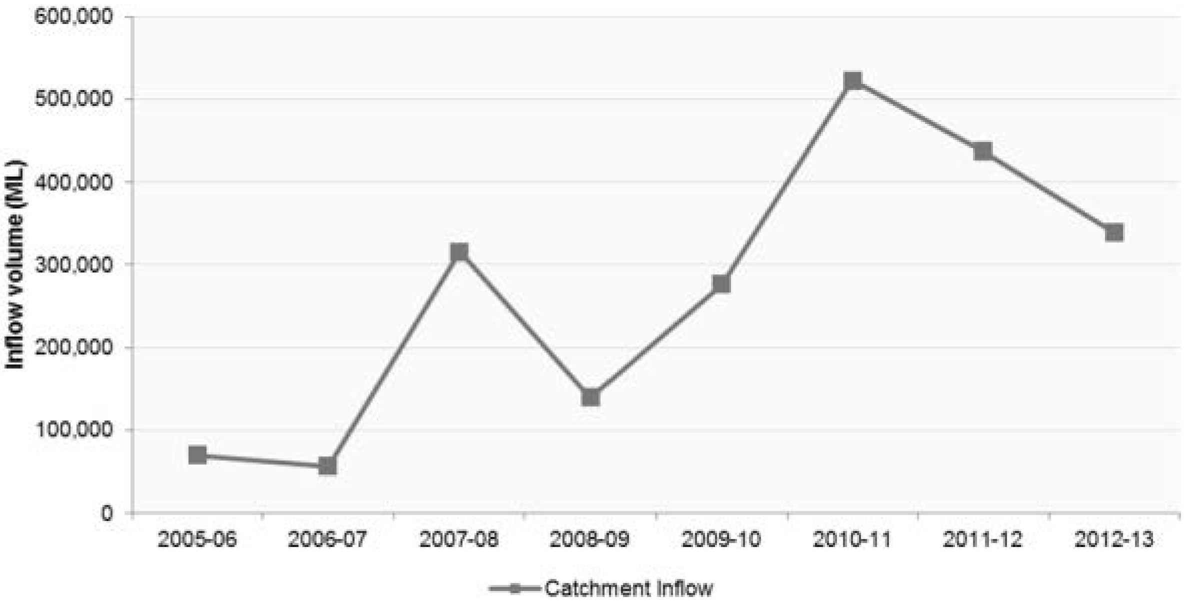
6.25.2.2 Storages and flows

There are no major storages in the Portland Coast basin.

Catchment inflows in 2012–13 were 94% of the long-term average of 361,000 ML, compared to 121% in 2011–12 (Figure 6.25-2).

The amount of water flowing from the Portland Coast basin into Bass Strait was 318,387 ML in 2012–13, a decrease from the previous year. This represents 94% of catchment inflows.

Figure 6.25-2 Catchment inflows in the Portland basin



6.25.2.3 Entitlement volumes and diversions

In the Portland Coast basin, surface water is diverted from unregulated streams by licence holders and surface water is harvested in small catchment dams. No water corporations divert surface water in this basin.

Entitlements include rights granted to individuals (take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the Victorian Environmental Water Holder). Rights to water in the Portland Coast basin are outlined in Table 6.25-3.

Table 6.25-3 Entitlement volumes for the Portland Coast basin

Water entitlements	Annual entitlement volume (ML)
Take and use licences – unregulated surface water	1,081
Total volume of water entitlements in the Portland Coast basin	**1,081**

Allocation available under licences for 2012–13 is presented in Table 6.25-4. In 2012–13, out of a total licence volume of 1,081 ML, about 73 ML was diverted for use in the basin, an amount similar to the 78 ML reported in the 2011–12 Victorian Water Accounts.

Table 6.25-4 Allocation account balance summary for the Portland Coast basin

Water entitlement	Allocation issued	Net trade In/(Out)	Water use	Forfeitures
Take and use licences – unregulated surface water	1,081	0	(73)	(1,009)

Portland Coast basin

The estimated volume of water harvested from small catchment dams represents the largest diversion of surface water in the Portland Coast basin (Table 6.25-5).

Table 6.25-5 Estimated small catchment dam information for the Portland Coast basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	4,524	2,262	n/a
Registered commercial and irrigation	16,516	13,873	n/a
Total	**21,040**	**16,135**	**20,619**

n/a: Information not available.

6.25.3 Recycled water

Wannon Water operates all treatment plants within the Portland Coast basin. In 2012–13, 7% of the total wastewater produced in the basin was reused, including 43% of the total wastewater at the Heywood treatment plant which was used for wood lot irrigation (an increase from 20% in 2011–12).

Table 6.25-6 shows the volumes of water recycled in the Portland Coast basin in 2011–12.

Table 6.25-6 Volume of recycled water in the Portland Coast basin

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process[2])	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other[3] (ML)
				Urban and industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Heywood	364	158	43%	0	158	0	0	177	29
Port Fairy	975	0	0%	0	0	0	0	0	975
Portland	1,074	0	0%	0	0	0	0	0	1,074
Total 2012–13	**2,412**	**158**	**7%**	**0**	**158**	**0**	**0**	**177**	**2,077**
Total 2011–12	3,016	113	4%	0	113	0	0	2,796	107

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

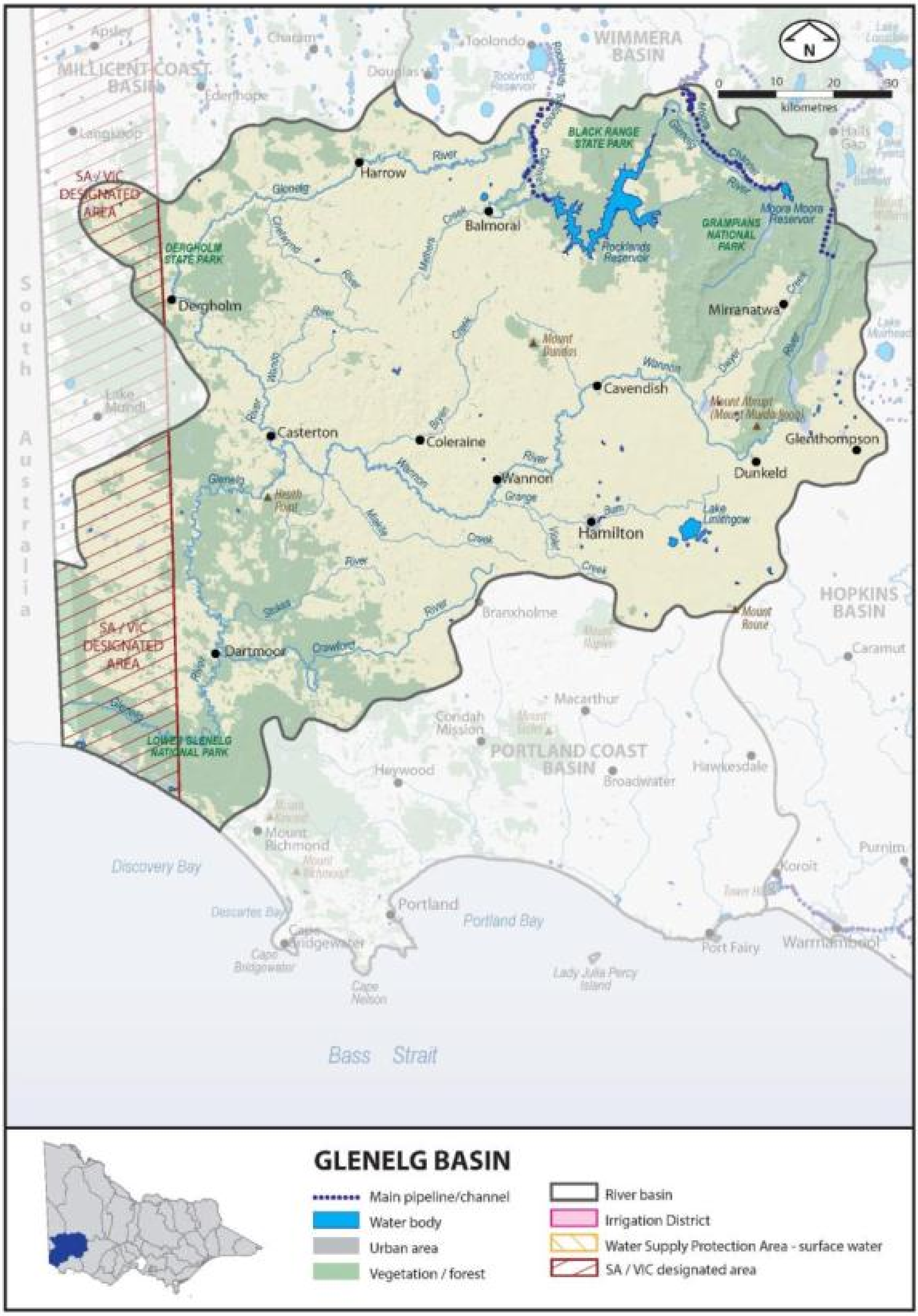
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site wastewater storage or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.26 Glenelg basin

The Glenelg basin (Figure 6.26-1) is located in the far west of Victoria. It has four on-stream storages, the largest of which is Rocklands Reservoir.

Figure 6.26-1 Map of the Glenelg basin



6.26.1 Water resources overview

In 2012–13, rainfall in the Glenelg basin was between 80% and 100% of the long-term average in the south-west of the basin, and between 60% and 80% in north-east. Catchment inflows in the Glenelg basin in 2012–13 were approximately 30% lower than in 2011–12. The basin's largest water storage, Rocklands Reservoir, started the year at 31% of capacity, and finished at 23% by the end of June 2013.

Stage 1 restrictions for urban water use in the town of Harrow continued throughout 2012–13 due to the capacity constraints of the existing groundwater bore. No other towns in the Glenelg basin were subject to restrictions. Licensed diversions in the Glenelg basin were restricted in most major waterways in 2012–13 with Glenelg, Wannon, Grange Burn and Crawford rivers all subject to irrigation bans between January and June 2013.

Table 6.26-1 shows the responsibilities of the authorities within the Glenelg basin.

Table 6.26-1 Responsibilities for water resources management

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages licensed diversions for the entire basin except the Glenelg River north of the bridge on the Casterton–Harrow Road		
Grampians Wimmera Mallee Water	Manages licensed diversions for the Glenelg River north of the bridge on the Casterton–Harrow Road	Supplies Harrow	Operates the Wimmera–Mallee supply 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 Obliged to meet passing flow requirements
Victorian Environmental Water Holder			Holds and manages environmental entitlements in the basin
Glenelg–Hopkins Catchment Management Authority			Manages waterways in the whole of the Glenelg basin

Environmental Water Reserve

The Lower Glenelg River is a heritage river and dependent on the Glenelg basin Environmental Water Reserve (EWR) to function ecologically. Other important environmental assets that also rely on the EWR of this basin are:

- Glenelg Spiny Crayfish (threatened under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) and only found in the Glenelg River basin)
- Yarra and Ewens Pygmy Perch (vulnerable under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and threatened under the FFG Act)
- Variegated Pygmy Perch (vulnerable under the EPBC Act and threatened under the FFG Act)
- a new subspecies of the Wimmera Bottlebrush (*Callistemon wimmerensis*), discovered on the Glenelg River. This species appears to have similar characteristics to the Wimmera subspecies, which is very dependent on flows. This species is listed as threatened under the FFG Act and has been nominated for listing under the EPBC Act.

In 2012–13, the Glenelg basin EWR comprised:

- the *Wimmera and Glenelg Rivers Environmental Entitlement 2010* comprising 41,560 ML of high reliability entitlement held by the Victorian Environmental Water Holder (VEWH)
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by GWMWater and Wannon Water
- water set aside for the environment through the operation of passing flow conditions on licensed diversions, particularly Crawford River, Glenelg River, Grange Burn and Wannon River
- all other water in the basin not allocated for consumptive use.

6.26.2 Surface water resources

6.26.2.1 Water balance

A water balance for the Glenelg basin is shown in Table 6.26-2. A volume of 652 ML was diverted to the Wimmera–Mallee system in 2012–13.

Table 6.26-2 Balance of surface water in the Glenelg basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	113,903	141,839
Volume in storage at end of year	84,841	113,903
Change in storage	**(29,062)**	**(27,936)**
Inflows		
Catchment inflow(1)	426,508	648,620
Rainfall on major storages	10,603	18,227
Treated effluent discharged back to river	295	623
Total inflows	**437,406**	**667,469**
Outflows		
Diversions		
Urban diversions	1,361	1,523
Transfers to the Wimmera basin(2)	652	1,259
Licensed diversions from unregulated streams	348	253
Small catchment dams	55,483	55,483
Total diversions	***57,843***	***58,518***
Losses		
Evaporation losses from major storages	38,819	16,494
Evaporation from small catchment dams	24,622	24,622
In-stream infiltration to groundwater, flows to floodplain and evaporation	54,674	38,640
Total losses	***118,115***	***79,755***
Water passed at outlet of basin		
River outflows to the ocean	290,509	557,131
Total water passed at outlet of basin	***290,509***	***557,131***
Total outflows	**466,467**	**695,405**

Notes:

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

(2) Transfers from the Glenelg basin to the Brimpaen storages in the Wimmera basin, via the Moora Channel.

6.26.2.2 Storages and flows

Four major storages are located within the basin. Rocklands Reservoir, which accounts for 97% of the total capacity of Glenelg basin storages, was holding 23% of capacity at the end of 2012–13. The volume reported in the 'catchment inflow less regulated releases' column of Table 6.26-3 is the balancing item for each storage. It represents the flow of water in or out of the storage that is not shown as rainfall or evaporation, and may include other minor components influencing the change in storage during the year.

Table 6.26-3 Storage volumes in the Glenelg basin

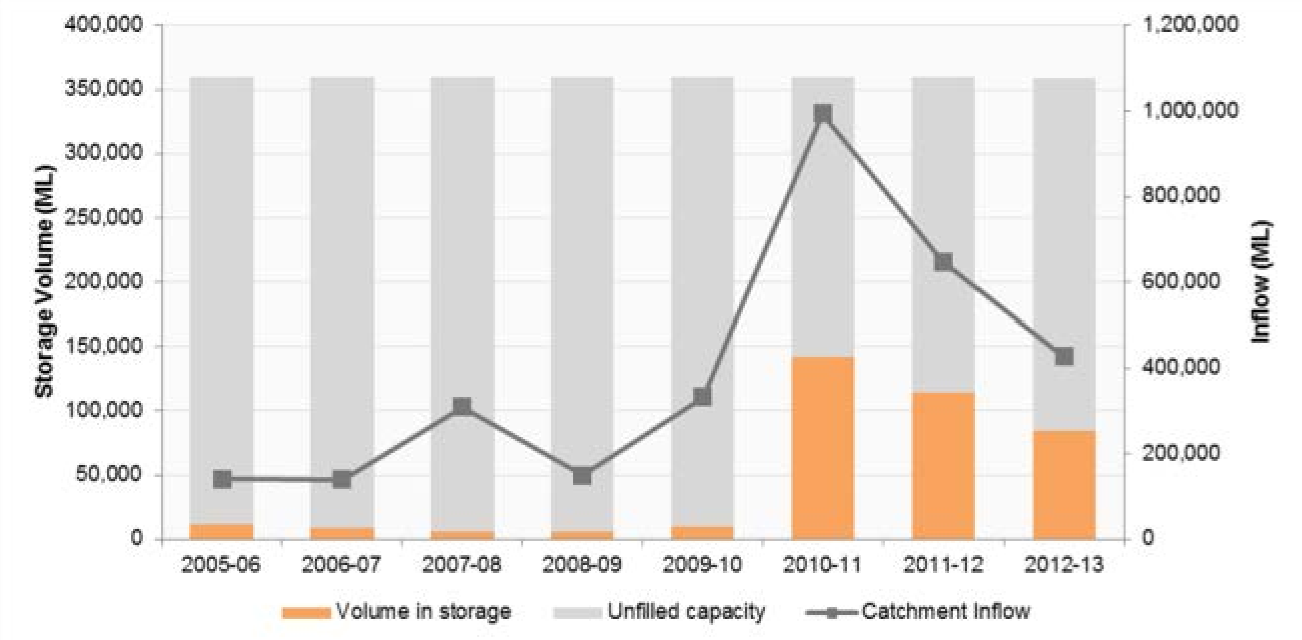
Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Hamilton system reservoirs	2,654	2,174	209	376	(310)	1,697
Konongwootong Reservoir	1,920	695	360	618	186	623
Moora Moora Reservoir	6,300	3,070	0	0	(1,110)	1,960
Rocklands Reservoir	348,300	107,964	10,034	37,825	388	80,561
Total storages	**359,174**	**113,903**	**10,603**	**38,819**	**(845)**	**84,841**

Glenelg basin

Catchment inflows across the basin were 426,549 ML. This was 44% of the long-term average, significantly lower than the volume of inflow in 2011–12 (Figure 6.26-2).

The volume of water flowing from the Glenelg basin into Bass Strait was 290,509 ML in 2012–13, a decrease from the previous year (Figure 6.26-2). This represented 68% of the catchment inflows into the basin, compared to 86% in 2011–12.

Figure 6.26-2 All major storages and catchment inflows in the Glenelg basin



6.26.2.3 Entitlement volumes and diversions

In the Glenelg basin, bulk entitlements to surface water are held by GWMWater, Central Highlands Water, Coliban Water and Wannon Water. Surface water is also diverted by licensed diverters, and surface water is harvested in small catchment dams.

Entitlements include rights granted to individuals (take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the Victorian Environmental Water Holder). Rights to water in the Glenelg basin are outlined in Table 6.26-4.

Under GWMWater's Wimmera and Glenelg Rivers bulk entitlement, the water corporation operates the Grampians Headworks system to supply water to towns and customers connected to the Wimmera–Mallee Pipeline, and also to supply entitlements held by Coliban Water and Wannon Water, and the Victorian Environmental Water Holder.

The Grampians Headworks system harvests 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 the Wimmera basin chapter in Table 6.28-4.

Wannon Water also holds four other bulk entitlements for supply to towns within the Glenelg basin.

Table 6.26-4 Entitlement volumes for the Glenelg basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Coleraine, Casterton, Sandford) Conversion Order 1997	855
Bulk Entitlement (Dunkeld System) Conversion Order 1997	170
Bulk Entitlement (Glenthompson) Conversion Order 1997	94
Bulk Entitlement (Hamilton) Conversion Order 1997	3,435
Take and use licences – unregulated surface water	1,068
Total volume of water entitlements in Glenleg basin	**5,622**

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.26-5

The volume of water diverted from unregulated streams by licence holders in the Glenelg basin in 2012–13 was similar to the volume reported in the 2011–12 Victorian Water Accounts.

The *Wimmera and Glenelg Rivers Environmental Entitlement 2010* provides the Victorian Environmental Water Holder with water from the Grampians Headworks system 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. The allocation available for use under this entitlement for 2012–13 is presented in the Wimmera basin chapter in Table 6.28-5.

Table 6.26-5 Allocation account balance summary for the Glenelg basin

Water entitlement	Allocation issued	Net trade In/(Out)	Water use	End of season forfeitures
Coleraine, Casterton, Sandford	855	0	(144)	(711)
Dunkeld system	170	0	(8)	(162)
Glenthompson	94	0	(25)	(69)
Hamilton	3,435	0	(1,183)	(2,252)
Take and use licences – unregulated surface water	1,068	0	(348)	(720)

The estimated volume of water harvested from small catchment dams makes up a significant portion of total surface water diversions in the Glenelg basin (Table 6.26-6).

Table 6.26-6 Estimated small catchment dam information for the Glenelg basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	27,109	13,555	n/a
Registered commercial and irrigation	49,915	41,928	n/a
Total	**77,024**	**55,483**	**80,105**

n/a: No information available.

6.26.3 Recycled water

Wannon Water operates four wastewater treatment plants in the Glenelg basin. The volume of wastewater produced in 2012–13 decreased compared to 2011–12, but more was recycled. In 2012–13, 74% of wastewater was recycled, compared to 38% in 2011–12.

Table 6.26-7 shows the volumes of water recycled in the Glenelg basin in 2012–13.

Table 6.26-7 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process[2])	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other[3] (ML)
				Urban and industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Casterton	44	21	49%	0	21	0	0	82	(59)
Coleraine	7	4	52%	0	4	0	0	0	3
Dunkeld	30	27	90%	27	0	0	0	0	3
Hamilton	799	601	75%	126	475	0	0	213	(15)
Total 2012–13	880	653	74%	153	500	0	0	295	(68)
Total 2011–12	1,277	483	38%	192	291	0	0	623	171

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

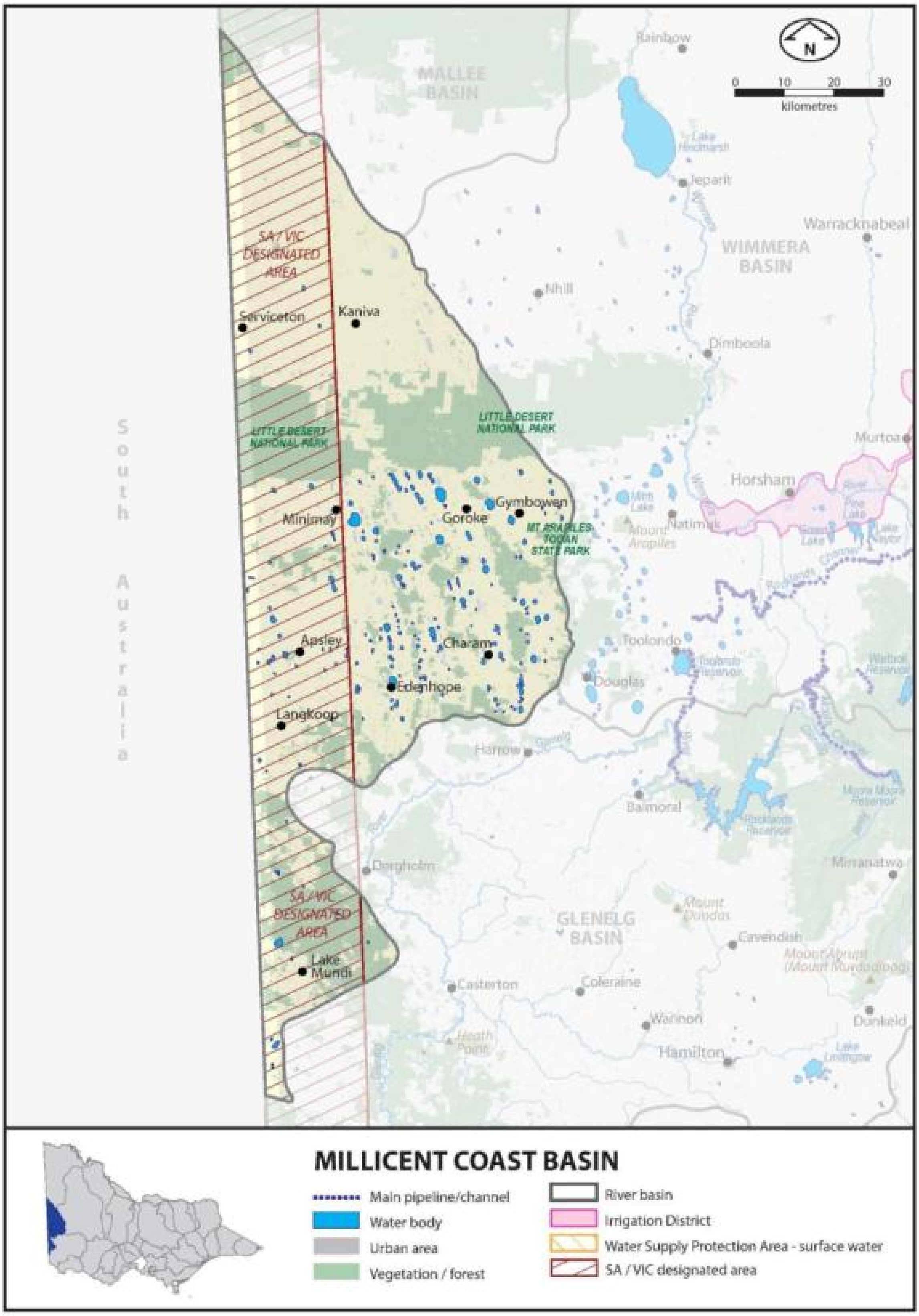
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site wastewater storage or items affecting the annual water balance for recycled water that are not otherwise accounted for, such as Wannon Water holding wastewater in storage for the next year.

6.27 Millicent Coast basin

The Millicent Coast basin (Figure 6.27-1) spans parts of both Victoria and South Australia. The Victorian section of the basin comprises numerous internally draining inter-dune 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 6.27-1 Map of the Millicent Coast basin



6.27.1 Water resources overview

In 2012–13, rainfall across the Millicent Coast basin was slightly lower than the preceding year and generally ranged between 60% and 80% of the long-term average except at the northern tip of the basin where it was in the range 80% to 100%.

Groundwater is the main source of water supply in the Millicent Coast basin and this is covered by the West Wimmera GMA, which was created in 2011–12 by amalgamating a number of existing GMAs and WSPAs. Information about groundwater licences and use in this area can be found in the West Wimmera groundwater catchment chapter 7.24.

Edenhope was the only town to be subject to urban water restrictions during 2012–13 and remained on Stage 1 from July 2012 to January 2013. Towns that rely solely on groundwater for their water supply were not subject to urban restrictions. Licensed diversions from unregulated streams were also unrestricted throughout the year.

Table 6.27-1 shows the responsibilities of the authorities within the Millicent Coast basin.

Table 6.27-1 Responsibilities for water resources management

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
GWMWater	Manages licensed diversions within the Millicent Coast basin	Supplies all towns including Kaniva and Edenhope	
Wimmera Catchment Management Authority			Manages waterways in the whole of the Millicent Coast basin

Environmental Water Reserve

The Millicent Coast basin contains numerous wetlands dependent on the basin's Environmental Water Reserve (EWR). 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 2012–13, the Millicent Coast basin EWR comprised all water in the basin not allocated for consumptive use.

6.27.2 Surface water resources

6.27.2.1 Water balance

Limited information is currently available for surface water availability and use, so a water balance has not been included for the Millicent Coast basin.

6.27.2.2 Storages and flows

No reliable streamflow data exists for the Millicent Coast basin. As such, an estimate of the volume of water leaving the basin was not made. Any surface water not diverted flows to South Australia.

6.27.2.3 Entitlement volume and diversions

There are no bulk entitlements to surface water in the Millicent Coast basin. All water is diverted from unregulated streams under licences. At the end of 2012–13, the licensed volume totalled 4.4 ML and use was estimated to be 4.4 ML.

6.27.2.4 Small catchment dams

No information regarding small catchment dams is readily available within the Millicent Coast basin.

6.27.3 Recycled water

GWMWater operates wastewater treatment plants in three towns within the Millicent Coast basin. Wastewater from Edenhope was reused for a variety of urban and industrial purposes, including pasture improvement and watering recreational facilities and parks. Wastewater produced at Kaniva and Serviceton treatment plants was evaporated on-site and is not included in Table 6.27-2.

Millicent Coast basin

Table 6.27-2 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process[2])	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ other[3] (ML)
				Urban and industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Edenhope	37	11	30%	11	0	0	0	0	26
Kaniva North	0	0	0%	0	0	0	0	0	0
Kaniva South	0	0	0%	0	0	0	0	0	0
Serviceton	0	0	0%	0	0	0	0	0	0
Total 2012–13	**37**	**11**	**30%**	**11**	**0**	**0**	**0**	**0**	**26**
Total 2011–12	14	67	469%	67	0	0	0	0	(53)

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site wastewater storage or items affecting the annual water balance for recycled water that are not otherwise accounted for.

6.28 Wimmera basin

The Wimmera basin (Figure 6.28-1) is the largest landlocked river basin in Victoria. The Wimmera River's headwaters are near Mt Cole in the Pyrenees Ranges. It flows westwards across the foothills of the Grampians and at Horsham it turns north and flows for about 150 kilometres, terminating at Lake Hindmarsh.

Figure 6.28-1 Map of the Wimmera basin

6.28.1 Water resources overview

In 2012–13, rainfall across most of the Wimmera basin ranged between 60% and 80% of the long-term average. Rainfall in the central western region of the basin was closer to average (80% to 100%) while the north of the basin was much drier (40% to 60%). Consequently, catchment inflows in the Wimmera basin in 2012–13 were also much lower than the previous year; only 23% of the long-term average, compared to 46% in 2011–12.

After beginning the year at 45% of capacity, storages in the Wimmera basin finished the year lower at 33% of capacity at the end of June 2013. While storage levels were still significantly lower than total capacity, there were no restrictions to urban water supplies or licensed diversions from streams. GWMWater has not delivered irrigation supplies for around 10 years.

Table 6.28-1 shows the responsibilities of the authorities within the Wimmera basin.

Table 6.28-1 Responsibilities for water resources management in the Wimmera basin

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
GWMWater	Manages the Wimmera–Mallee supply system which delivers water to farms in the Wimmera basin(1)	Manages licensed diversions	Supplies most towns in the Wimmera basin(1) Provides bulk supply to some of Coliban Water's towns in the Loddon basin	Operates the Wimmera–Mallee water supply system.
Central Highlands Water			Supplies Landsborough and Navarre	Obliged to meet passing flow requirements
Coliban Water			Supplies Borung, Korong Vale, Wedderburn and Wychitella	
Goulburn–Murray Water	Provides GWMWater with bulk supplies for domestic and stock use from the Goulburn system via the Waranga Main Channel			
Victorian Environmental Water Holder				Holds and manages environmental entitlements in the basin
Wimmera Catchment Management Authority				Manages waterways in the Wimmera River catchment
North Central Catchment Management Authority				Manages waterways in the Avon and Richardson river catchments

Note:
(1) Also supplies farms and towns located in the Avoca and Mallee basins.

Environmental Water Reserve

The Wimmera River is a heritage river that depends on the Environmental Water Reserve (EWR). Important environmental assets in the Wimmera basin include platypus, Freshwater Catfish and River Blackfish. Several priority river reaches have been identified and include:

- MacKenzie River Reach 2, which contains regionally threatened populations of native fish (River Blackfish, Southern Pygmy Perch, Mountain Galaxias) and platypus (of which there are believed to be less than 10, with this the only population in the catchment)
- MacKenzie River Reach 3, which contains the only known population of the Wimmera Bottlebrush (*Melaleuca wimmerensis,* formerly known as *Callistemon wimmerensis*) which has recently been classified under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act). This species depends on flows in the MacKenzie River for its survival and recruitment
- Lower Wimmera River, which is listed under the Heritage River Act and which flows into Lake Hindmarsh (listed as a nationally significant wetland) and Lake Albacutya (a Ramsar 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 2012–13, the EWR in the Wimmera basin contained the following components:

- the *Wimmera and Glenelg Rivers Environmental Entitlement 2010* comprising 41,560 ML of high reliability entitlement held by the Victorian Environmental Water Holder (VEWH)
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by GWMWater and conditions on licensed diversions
- all other water in the basin not allocated for consumptive use.

6.28.2 Surface water resources

6.28.2.1 Water balance

A surface water balance for the Wimmera basin is shown in Table 6.28-2.

Table 6.28-2 Balance of surface water in the Wimmera basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	177,776	184,056
Volume in storage at end of year	128,902	177,776
Change in storage	**(48,874)**	**(6,280)**
Inflows		
Catchment inflow[1]	71,509	145,567
Rainfall on major storages	16,762	33,292
Transfer from Glenelg basin	652	1,259
Treated effluent discharged back to river	0	0
Total inflows	**88,923**	**180,118**
Outflows		
Diversions		
Urban diversions and domestic and stock use	16,509	18,792
Diversions for irrigation	0	0
Licensed diversions from unregulated streams	454	466
Environmental water diversions to wetlands	161	22
Small catchment dams	14,337	14,337
Total diversions	***31,462***	***33,617***
Losses		
Evaporation losses from major storages	46,897	74,894
Evaporation from small catchment dams	8,642	8,642
In-stream infiltration to groundwater, flows to floodplain and evaporation	21,962	21,890
Total losses	***77,501***	***105,426***
Water passed at outlet of basin		
River outflows to Lake Buloke	63	1,146
River outflows to Lake Hindmarsh (measured at Tarranyurk)	28,770	46,209
Total water passed at outlet of basin	***28,834***	***47,355***
Total outflows	**137,797**	**186,398**

Note:

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

6.28.2.2 Storages and flows

Levels for all major storages in the basin started the year at 177,776 ML and finished at 128,902 ML (33% of capacity) at the end of June 2013 (Table 6.28-3). Only volumes for major on-stream storages have been included in the water balance. The volume reported in the ‘catchment inflow less regulated releases’ column in Table 6.28-3 is the balancing item for each storage. It represents the flow of water in or out of the storage that is not shown as rainfall or evaporation, and may include other minor components influencing the change in storage during the year.

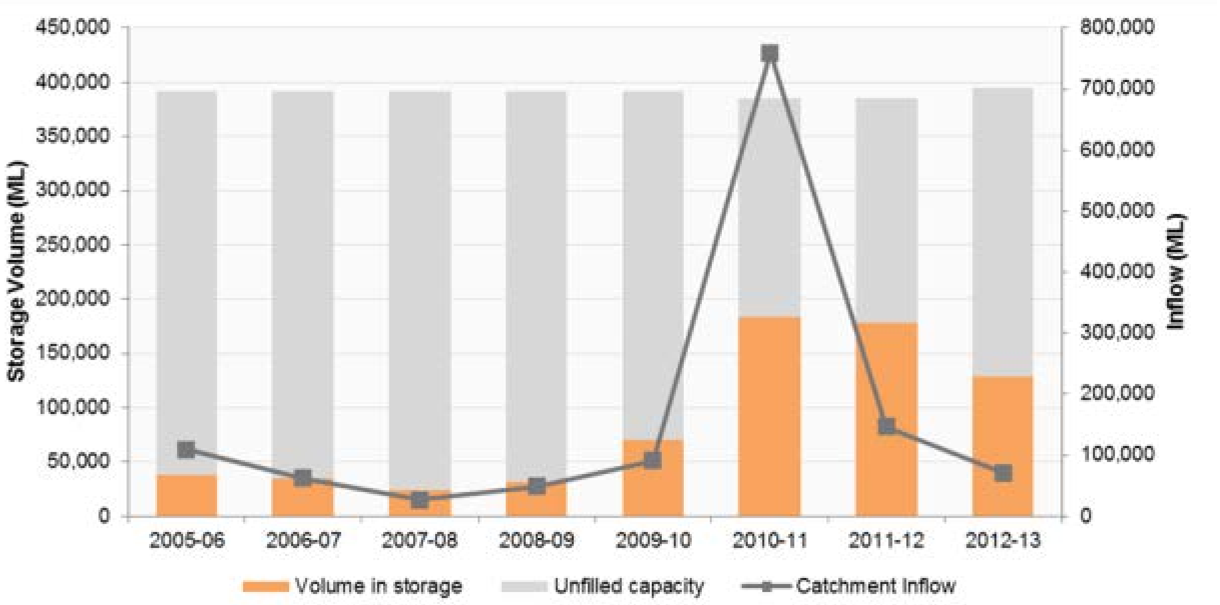
Table 6.28-3 Storage volumes in the Wimmera basin

Storage	Total capacity (ML)	Start volume in store (ML)	Rainfall (ML)	Evaporation (ML)	Catchment inflow less regulated releases (ML)	End volume in store (ML)
On-stream storages						
Lake Batyo Catyo	3,590	470	270	1,243	523	20
Dock Lake	3,850	0	0	0	0	0
Lake Fyans	18,460	12,530	658	2,096	1,362	12,455
Green Lake	5,350	3,570	515	0	(1,335)	2,750
Lake Bellfield	78,560	66,491	2,957	6,100	(2,124)	61,224
Lake Lonsdale	65,480	28,350	4,408	16,663	(10,185)	5,910
Pine Lake(1)	62,000	7,830	n/a	n/a	(3,800)	4,030
Taylors Lake(1)	35,770	13,570	n/a	n/a	(3,467)	10,103
Toolondo Reservoir	92,430	24,480	2,817	10,673	696	17,320
Wartook Reservoir	29,300	20,485	5,136	10,122	(409)	15,090
Total storages	**394,790**	**177,776**	**16,762**	**46,897**	**(18,739)**	**128,902**

Note:
(1) Reliable information for rainfall and evaporation is not available for Pine Lake and Taylors Lake.

Catchment inflows were 23% of the long-term average of 316,400 ML. This was lower compared to 2011–12, when inflows were 46% of the long-term average (Figure 6.28-2). The volume of water flowing from the Wimmera basin into the terminal lakes in 2012–13 was 28,834 ML.

Figure 6.28-2 All major storages and catchment inflows in the Wimmera basin



6.28.2.3 Entitlement volumes and diversions

In the Wimmera basin, surface water is diverted by Central Highlands Water, Coliban Water, GWMWater, Wannon Water and licensed diverters, and also harvested in small catchment dams. Entitlements in the Wimmera basin include rights granted to individuals (for example, water allowances and take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or VEWH). Rights to water in the Wimmera basin are outlined in Table 6.28-4.

Under GWMWater's Wimmera and Glenelg Rivers bulk entitlement, the water corporation operates the Grampians headworks system to supply water to towns and customers connected to the Wimmera–Mallee Pipeline, and also to supply entitlements held by Coliban Water and Wannon Water, and the VEWH.

Under GWMWater's Willaura system bulk entitlement, the water corporation operates the Mt William system in the Wimmera basin to supply water to the township of Willaura and also to supply water to Wannon Water for Glenthompson.

Table 6.28-4 Entitlement volumes for the Wimmera basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Landsborough – Navarre) Conversion Order 2003	**60**
Bulk Entitlement (Willaura, Elmhurst and Buangor systems – GWMWater) Conversion Order 2012(1)	
Urban commitments – GWMWater	408
Bulk Entitlement (Willaura system – Wannon Water) Conversion Order 2012	58
Sub-total: Bulk Entitlement (Willaura, Elmhurst and Buangor systems – GWMWater) Conversion Order 2012	**466**
Bulk Entitlement (Wimmera and Glenelg Rivers – GWMWater) Conversion Order 2010(2)	
Water allowances	5,721
Urban commitments – GWMWater	26,999
Supply by agreements – pipeline	12,000
Supply by agreement – Commonwealth Environmental Water Holder	28,000
Glenelg compensation flow	3,300
Recreation	2,590
Loss provision	2,960
Bulk Entitlement (Wimmera and Glenelg Rivers – Coliban Water) Conversion Order 2010	300
Bulk Entitlement (Wimmera and Glenelg Rivers – Wannon Water) Conversion Order 2010	2,120
Wimmera and Glenelg Rivers Environmental Entitlement 2010	41,560
Sub-total: Bulk Entitlement (Wimmera and Glenelg Rivers – GWMWater) Conversion Order 2010	**125,550**
Take and use licences – unregulated surface water	**2,582**
Total volume of water entitlements in the Wimmera basin	**128,658**

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 the township of Willaura and also to supply water to Wannon Water for Glenthompson. This bulk entitlement also includes the Elmhurst and Buangor systems which are physically located in the Hopkins basin.

(2) Under GWMWater's Wimmera and Glenelg Rivers bulk entitlement, the water corporation operates the Grampians headworks system to supply its own customers, and also Coliban Water, Wannon Water and the VEWH and Commonwealth Environmental Water Holder.

The *Wimmera and Glenelg Rivers Environmental Entitlement 2010* provides the VEWH with up to 1,000 ML for wetlands from the Wimmera–Mallee Pipeline each year. It supplies wetlands throughout the region that used to receive water from the channel system before it was decommissioned. In 2012–13, 161 ML of water was delivered to Roselyn Wetland and Barbers Swamp, which are the first two wetlands to be connected to the pipeline system. Other water available under the environmental entitlement is used to support streamflows and is not diverted out of waterways.

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.28-5. The total volume of licences in the Wimmera basin includes licences for irrigation as well as for domestic and stock purposes. There were no irrigation diversions from unregulated streams in 2012–13; the diversion reported is an estimate of licensed domestic and stock use.

Table 6.28-5 Allocation account balance summary for the Wimmera basin

Water entitlement	Opening carryover	Allocation issued	Net trade In/(Out)	Water use	End of season forfeitures	Carried forward to 2013–14
Landsborough – Navarre	-	60	0	0	(60)	-
Willaura, Elmhurst and Buangor systems – GWMWater						
Urban commitments – GWMWater	-	406	0	(349)	(57)	-
Willaura system – Wannon Water	-	58	0	(21)	(38)	-
Diversion: Willaura, Elmhurst and Buangor systems – GWMWater				**(369)**		
Wimmera and Glenelg Rivers – GWMWater						
Water allowances	0	5,721	(4,457)	(1,264)	0	0
Urban commitments – GWMWater	83,198	22,411	4,457	(10,450)	(16,068)	83,548
Supply by agreements – Pipeline	12,305	9,840	0	0	(3,322)	18,823
Supply by agreement – CEWH	0	0	0	0	0	
Glenelg compensation flow	2,384	921	0	(1,602)	(255)	1,448
Recreation	2,509	723	0	(1,398)	(275)	1,559
Loss provision	3,692	2,960	0	(1,165)	(823)	4,664
Wimmera and Glenelg Rivers – Coliban Water	257	246	0	(177)	(49)	277
Wimmera and Glenelg Rivers – Wannon Water	3,195	1,738	0	(85)	(733)	4,116
Wimmera and Glenelg Rivers Environmental Entitlement(1)	43,217	39,079	0	(50,277)	(4,803)	27,216
Diversion: Wimmera and Glenelg Rivers(2)				**(16,301)**		
Take and use licences – unregulated surface water	–	454	0	(454)	0	–

Notes:

(1) Water use of 50,227 ML reported reflects environmental in-stream use. This amount is not included in the water balance in Table 6.28-2 as it does not reflect an actual diversion from the waterway. Unused water is available to carry over in this system. Please refer to Chapter 4, Table 4.1.

(2) 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.

The estimated volume of water harvested from small catchment dams makes up a significant portion of total surface water diversions in the Wimmera basin (Table 6.28-6).

Table 6.28-6 Estimated small catchment dam information for the Wimmera basin

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	12,950	6,475	n/a
Registered commercial and irrigation	9,360	7,863	n/a
Total	**22,310**	**14,337**	**22,979**

n/a: No information available.

6.28.3 Recycled water

GWMWater operates 16 wastewater treatment plants in the Wimmera basin and reuses all wastewater at nine of these plants for purposes that include irrigation of pasture, horticulture and vineyards and for urban and industrial uses.

Table 6.28-7 shows the volumes of water recycled in the Wimmera basin in 2012–13.

Table 6.28-7 Volume of recycled water in the Wimmera basin

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process[2])	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other[3] (ML)
				Urban and industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Birchip	30	30	100%	0	30	0	0	0	0
Dimboola	116	0	0%	0	0	0	0	0	116
Donald	107	107	100%	0	107	0	0	0	0
Halls Gap[4]	117	147	126%	7	140	0	0	0	(30)
Hopetoun	0	0	0%	0	0	0	0	0	0
Horsham	761	708	93%	154	554	0	0	0	53
Jeparit	0	0	0%	0	0	0	0	0	0
Minyip	11	0	0%	0	0	0	0	0	11
Murtoa	44	44	100%	0	44	0	0	0	0
Natimuk	0	0	0%	0	0	0	0	0	0
Nhill[4]	64	113	178%	0	113	0	0	0	(49)
Ouyen	33	0	0%	0	0	0	0	0	33
Rainbow	0	0	0%	0	0	0	0	0	0
Stawell[4]	276	411	149%	218	193	0	0	0	(135)
Warracknabeal	103	103	100%	103	0	0	0	0	0
Wycheproof	18	18	100%	0	18	0	0	0	0
Total 2012–13	**1,678**	**1,680**	**100%**	**482**	**1,198**	**0**	**0**	**0**	**(2)**
Total 2011–12	1,507	1,724	114%	259	1,465	0	0	0	(217)

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

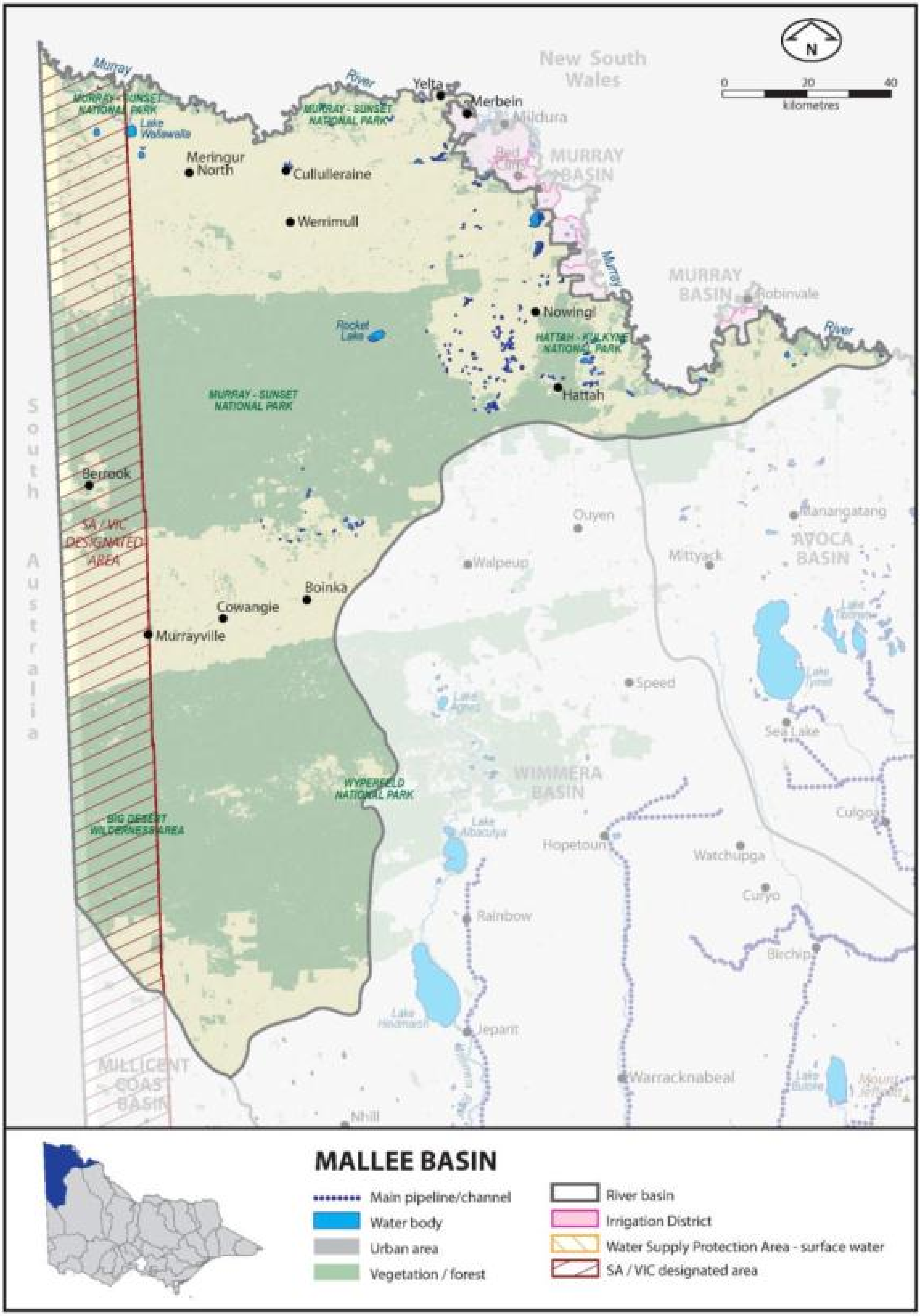
(3) 'Other' refers to a change in on-site wastewater storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

(4) The volume of water recycled exceeded the volume produced as water stored on-site carried over from the previous year.

6.29 Mallee basin

The Mallee basin (Figure 6.29-1) has few well-defined waterways. While the Murray River runs along the northern boundary of the basin, for water accounting purposes it is only included in the water balance of the Murray basin (Chapter 6.2).

Figure 6.29-1 Map of the Mallee basin



6.29.1 Water resources overview

In 2012–13, rainfall across the Mallee basin generally ranged between 60% and 80% of the long-term average, with some isolated parts of the basin counted amongst the driest parts of the state receiving between 40% and 60% of the long-term average. Despite this, some areas in the southern part of the basin received between 80% and 100% of the long-term average.

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

In 2012–13 the Mallee basin Environmental Water Reserve comprised all water in the basin not allocated for consumptive use.

Table 6.29-1 shows the responsibilities of the authorities within the Mallee basin.

Table 6.29-1 Responsibilities for water resources management

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
GWMWater			Supplies water to Murrayville and Cowangie	
Lower Murray Water	Supplies water from the Murray River to the Millewa Waterworks District, Carwarp and Yelta			
Mallee Catchment Management Authority				Manages waterways in the whole of the Mallee basin

6.29.2 Surface water resources

6.29.2.1 Water balance

A water balance for the Mallee basin has not been presented. All surface water supplies are sourced from outside the basin.

6.29.2.2 Storages and flows

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 the Murray surface water reporting is covered 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.

6.29.2.3 Small catchment dams

While there are some small catchment dams in the Mallee basin, no information on them is available and they are not a significant source of water to the region. Given the lack of information, the capacity of small catchment dams is assumed to be zero.

6.29.2.4 Entitlement volumes and diversions

No bulk entitlements are supplied from surface water sourced from within the Mallee basin. The volume diverted under bulk entitlements for water supplied to the Mallee basin is presented in the water accounts for the adjacent river basins.

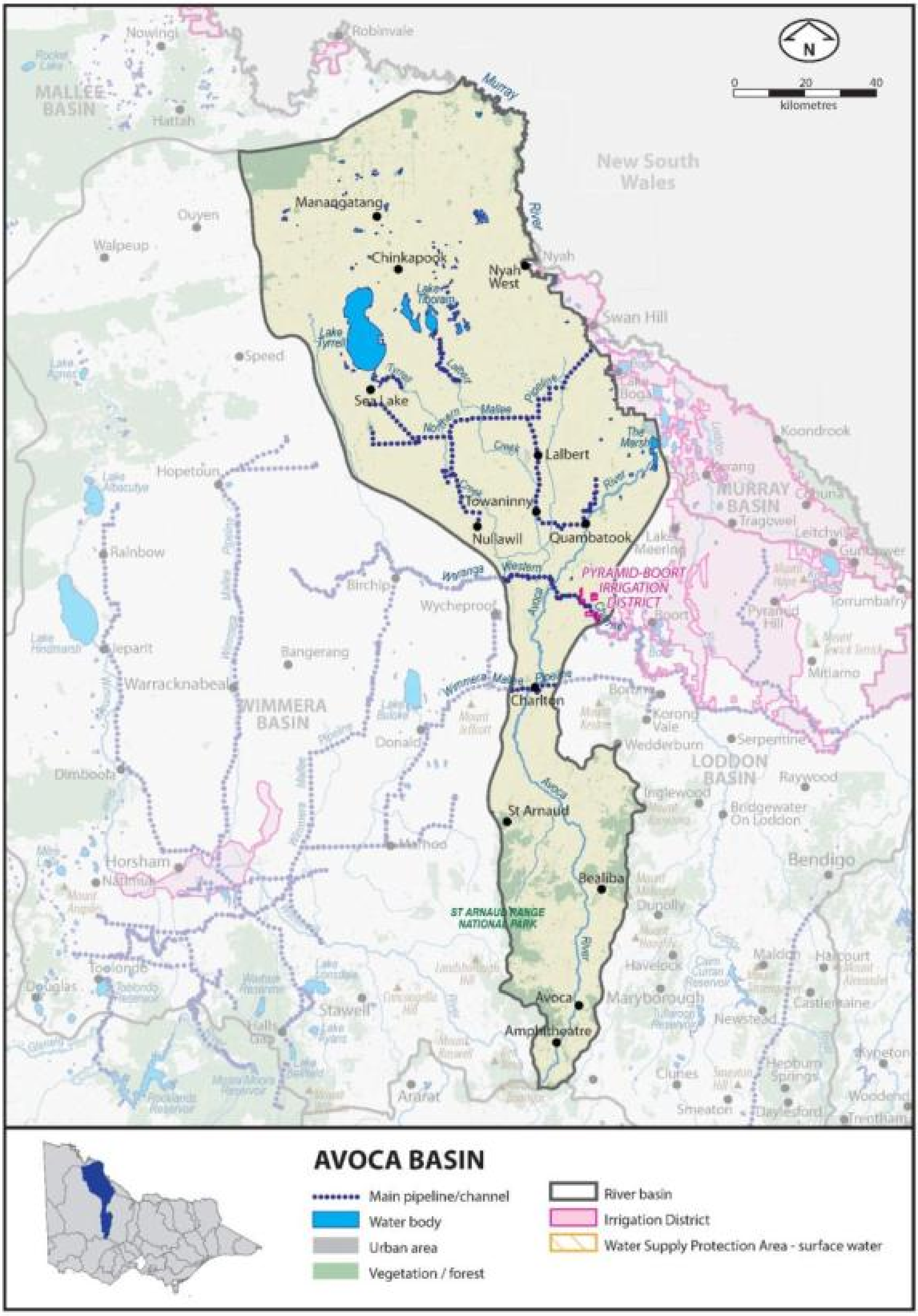
6.29.3 Recycled water

There are no wastewater treatment plants within the Mallee basin.

6.30 Avoca basin

The Avoca basin (Figure 6.30-1) includes the Avoca River plus a number of small tributaries such as Strathfillan Creek and Cherry Tree Creek. The Avoca River flows into the Kerang Lakes at Lake Bael Bael.

Figure 6.30-1 Map of the Avoca basin



6.30.1 Water resources overview

In 2012–13, rainfall across the Avoca basin was generally between 60% and 80% of the long-term average, with drier conditions in the southern tip of the basin. Catchment inflows were 18% of the long-term average, similar to the previous year. The associated outflows into the terminal lakes in the north of the basin decreased in comparison to the previous year.

Towns in the Avoca basin are predominantly supplied by groundwater or by surface water from the Wimmera, Glenelg and Murray basins. Hence only a limited volume of surface water from within the basin is used for urban supply. There were no urban water restrictions applied to towns in the basin in 2012–13 and all towns in the basin remained on permanent water saving rules. Licensed surface water users were unrestricted during the year.

Surface water use was a similar volume to that used in 2011–12.

Table 6.30-1 shows the responsibilities of the authorities within the Avoca basin.

Table 6.30-1 Responsibilities for water resources management

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Central Highlands Water			Supplies towns in the southern part of the Avoca basin, including Avoca and Redbank	Obliged to meet passing flow requirements
GWMWater	Provides domestic and stock supplies to farms via the Wimmera–Mallee Channel system, the Northern Mallee pipeline, the western end of the Waranga Western Channel and diversions from rivers	Manages licensing	Supplies towns in the northern part of the Avoca basin, including Quambatook, St Arnaud, Charlton and Sea Lake(1)	
Goulburn–Murray Water	Supplies water from the Goulburn basin in bulk to GWMWater for domestic and stock use via the Waranga Main Channel		Supplies water from the Goulburn basin in bulk to GWMWater for towns via the Waranga Main Channel and to Quambatook via the Normanville supply system	
North Central Catchment Management Authority				Manages waterways in the Avoca basin

Note:
(1) Water for these towns is sourced from outside the Avoca basin.

Environmental Water Reserve

In 2012–13 the Environmental Water Reserve for the Avoca basin comprised:

- water set aside for the environment through flow-sharing arrangements set out in consumptive bulk entitlements held by Central Highlands Water
- 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.

6.30.2 Surface water resources

6.30.2.1 Water balance

A surface water balance for the Avoca basin is shown in Table 6.30-2. No storage information is recorded in the water balance as there are no major on-stream storages in the Avoca basin.

There are no known inflows into the Avoca basin; the total inflow reported is an assumed amount equal to the sum of known and estimated outflows. Volumes recorded for surface water availability and usage in 2012–13 remained similar to 2011–12 (Table 6.30-2).

Table 6.30-2 Balance of surface water in the Avoca basin

Water account component	2012–13 (ML)	2011–12 (ML)
Major on-stream storage		
Volume in storage at start of year	-	-
Volume in storage at end of year	-	-
Change in storage	**-**	**-**
Inflows		
Catchment inflow[(1)]	23,942	26,975
Rainfall on major storages	-	-
Treated wastewater discharged back to river	-	-
Total inflows	**23,942**	**26,975**
Outflows		
Diversions		
Urban diversions	97	116
Licensed diversions from unregulated streams	35	37
Small catchment dams	12,693	12,693
Total diversions	***12,825***	***12,846***
Losses		
Evaporation losses from major storages	-	-
Losses from small catchment dams	9,772	9,772
In-stream infiltration to groundwater, flows to floodplain and evaporation	1,317	3,771
Total losses	***11,089***	***13,543***
Water passed at outlet of basin		
Avoca River flow at Sandhill Lake Road (outflow to terminal lakes)	28	586
Avoca River overflow from the terminal lakes to the Kerang Lakes	0	0
Total water passed at outlet of basin	***28***	***586***
Total outflows	**23,942**	**26,975**

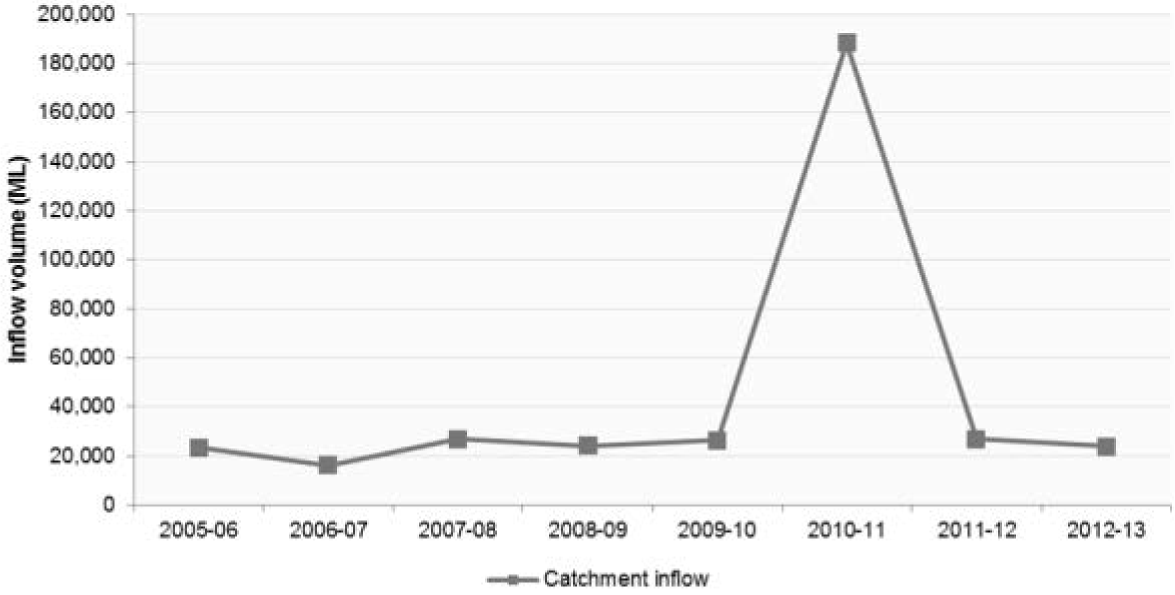
Note:

(1) Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows and the known inflows.

6.30.2.2 Storages and flows

In 2012–13, the catchment inflows were 18% of the long-term average of 136,200 ML. This is similar to the previous year's inflow (Figure 6.30-2). The volume of water that flowed into the terminal lakes (Lake Bael Bael and The Marsh) was 28 ML compared to 586 ML in 2011–12. There are no major storages in the Avoca basin.

Figure 6.30-2 Catchment inflows



6.30.2.3 Entitlement volumes and diversions

In the Avoca basin, water is diverted by Central Highlands Water and licensed diverters, and harvested in small catchment dams. The total volume of take and use licences in the Avoca basin includes licences for irrigation as well as for domestic and stock purposes. Entitlements include rights granted to individuals (take and use licences) and rights granted to authorities (for example, bulk entitlements granted to water authorities or the Victorian Environmental Water Holder). Rights to water in the Avoca basin are outlined in Table 6.30-3.

Table 6.30-3 Entitlement volumes for the Avoca basin

Water entitlements	Annual entitlement volume (ML)
Bulk Entitlement (Amphitheatre) Conversion Order 2003	25
Bulk Entitlement (Avoca) Conversion Order 2003	233
Bulk Entitlement (Redbank) Conversion Order 2003	20
Take and use licences – unregulated surface water	3,029
Total volume of water entitlements in the Avoca basin	**3,307**

Allocation available under bulk entitlements and licences for 2012–13 is presented in Table 6.30-4. There were no diversions for irrigation in 2012–13; the water use reported for take and use licences is an estimate of licensed domestic and stock use (Table 6.30-4.

Table 6.30-4 Allocation account balance summary for the Avoca basin

Water entitlement	Allocation issued	Net trade In/(Out)	Water use	Forfeitures
Amphitheatre	25	0	(14)	(11)
Avoca	233	0	(80)	(153)
Redbank	20	0	(3)	(17)
Take and use licences – unregulated surface water	3,029	0	(35)	(2,994)

The estimated volume of water harvested from small catchment dams represents the largest diversion of water in the Avoca basin (Table 6.30-5).

Table 6.30-5 Estimated small catchment dam information

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	10,514	5,257	n/a
Registered commercial and irrigation	8,852	7,436	n/a
Total	**19,366**	**12,693**	**22,465**

n/a: No information available.

6.30.3 Recycled water

GWMWater operates most wastewater treatment plants in the Avoca basin with the exception of the Avoca plant, which is operated by Central Highlands Water.

The volume of wastewater produced in 2012–13 was similar to that produced in 2011–12. The proportion of wastewater recycled in the Avoca basin treatment plants increased to 142% in 2012–13. The recycled water was used for urban, industrial and agricultural purposes.

Table 6.30-6 shows the volumes of water recycled in the Avoca basin in 2012–13.

Table 6.30-6 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process(2))	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other(3) (ML)
				Urban and industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Avoca	30	30	100%	0	30	0	0	0	0
Charlton	32	0	0%	0	0	0	0	0	32
Sea Lake	1	0	0%	0	0	0	0	0	1
St Arnaud(4)	95	194	203%	59	135	0	0	0	(98)
Total 2012–13	158	224	142%	59	165	0	0	0	(66)
Total 2011–12	159	155	98%	46	109	0	0	0	4

Notes:

(1) 'Beneficial allocation' refers to the volume used to deliver specific environmental flow benefits.

(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(3) 'Other' refers to a change in on-site wastewater storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

(4) The volume of water recycled exceeded the volume produced as water stored on-site carried over from the previous year.

7 Groundwater catchment accounts

7.1 Overview of methodology

7.1.1 Introduction

This methodology section outlines the basis for the information presented in the groundwater catchment accounts. As it explains some assumptions and limitations of the data in the accounts, it should be read in conjunction with the information in the catchment accounts.

In 2012, the Victorian Government developed a new framework for the management and reporting of groundwater resources. The framework comprises the groundwater basins and catchments that cover all groundwater resources in Victoria. Aligning groundwater management boundaries with groundwater catchments, its focus is to manage connected groundwater resources and reflect the geology beneath the ground. The framework was developed in collaboration with rural water corporations and stakeholders to enable consistent management of groundwater resources across the state.

Historically, information on groundwater resources in the Victorian Water Accounts has been presented together with surface water resources according to river basin boundaries. In most cases these boundaries did not properly align with Groundwater Management Unit (GMU) boundaries or the underlying groundwater systems, which presented a number of reporting difficulties. Groundwater volumes were apportioned according to the surface area of the GMU within a given basin. The concentration of bores and groundwater use varies considerably within each GMU, meaning that apportioning groundwater entitlements and use by surface area is unlikely to be an accurate reflection of groundwater availability and use in Victoria's regions. Under the new framework, the boundaries for groundwater catchments, GMUs and groundwater systems are aligned with catchment boundaries, which allows the entitlements and use of groundwater within each GMU to be more accurately managed and reported.

The *Victorian Water Accounts 2012–2013* presents the groundwater accounts by these catchment boundaries to reflect Victoria's new approach to groundwater management.

The groundwater catchment accounts are compiled from information obtained from:

- responses to requests for data to water businesses, catchment management authorities, Department of Environment and Primary Industries (DEPI) and major users of water
- hydrogeologic information from selected groundwater monitoring sites
- estimated relationships between water use and hydrologic data, which is produced by water supply system modelling
- water businesses' groundwater catchment statements, annual reports and related documents.

7.1.2 Victoria's groundwater management framework

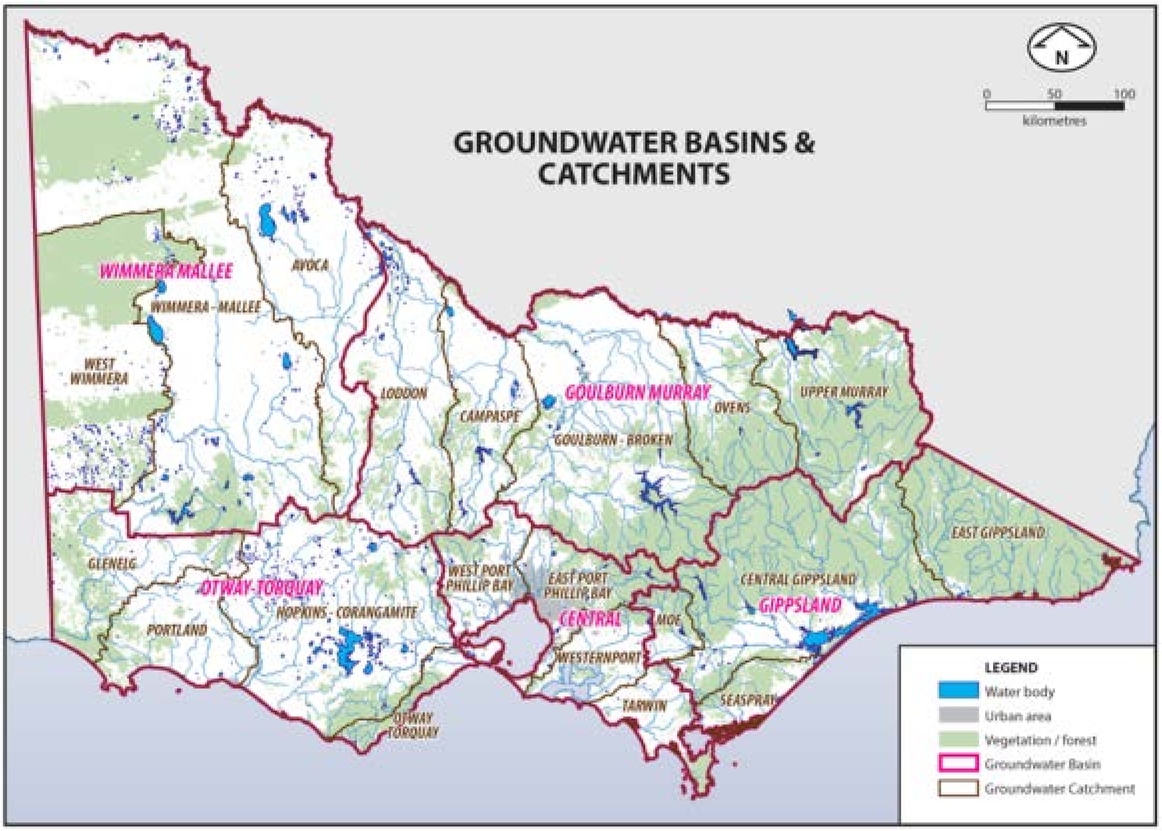
Victoria's groundwater resources are contained in five major groundwater management basins and each groundwater basin contains several groundwater catchments (Figure 7.1-1):

- **Goulburn Murray basin**: covers the Loddon, Campaspe, Goulburn–Broken, Ovens and Upper Murray groundwater catchments
- **Wimmera–Mallee basin**: covers the Wimmera–Mallee, West Wimmera and Avoca groundwater catchments
- **Otway-Torquay basin**: covers the Glenelg, Portland and Hopkins-Corangamite and Otway Torquay groundwater catchments
- **Central basin**: covers the West Port Phillip Bay, East Port Phillip Bay, Westernport and Tarwin groundwater catchments
- **Gippsland basin**: covers the East Gippsland, Central Gippsland, Moe and Seaspray Groundwater catchments.

Within each catchment, groundwater is managed through GMUs. There are two types of GMU: Water Supply Protection Areas (WSPAs) and Groundwater Management Areas (GMAs). Areas that fall outside of these units are referred to as unincorporated areas.

Licensing is the fundamental basis for allocating groundwater, and the total volume of groundwater that may be taken from a GMU is referred to as the Permissible Consumptive Volume (PCV). PCVs are declared by the Minister for Water through an order published in the government gazette. Adaptive management is achieved through a series of groundwater management instruments, which include statutory groundwater management plans, local management plans, groundwater strategies, single source urban water bulk entitlements and groundwater licences. All management instruments are developed in consultation with local stakeholders including customer groups, environmental representatives and relevant government departments.

Figure 7.1-1 Map of Victorian groundwater basins and catchments



A comprehensive summary of the groundwater management framework in Victoria can be found online at www.depi.vic.gov.au/water/groundwater/managing-groundwater.

7.1.3 Licensed groundwater volumes and use table

This table reports the total volume of take and use licences held by individual customers in the catchment, which represents the total volume of water that could be extracted for the water year, plus all licensed use including urban use. It also includes domestic and stock use where such use is included in a groundwater license.

Groundwater use in unincorporated areas for 2011–12 is listed as 'n/a', as this information was not available for the boundaries used in the previous reporting method. Therefore the reported total volume of licensed groundwater use for 2011–12 does not include use within unincorporated areas. With the adoption of the changes to Victoria's groundwater management framework, unincorporated areas can now be reported upon at the catchment scale for 2012–13.

7.1.4 Number of domestic and stock bores and estimated use table

This table presents the number of bores used for domestic and stock purposes in each GMU, together with the estimated groundwater use for this purpose. Where domestic and stock use forms part of a groundwater licence, the estimated use is not presented in this table; it has been accounted for in the total licensed groundwater use (see section 7.1.3).

Estimated use has been calculated based on the assumption of 2 ML per bore per year in groundwater areas managed by Goulburn–Murray Water and GWMWater, and 1.5 ML per bore per year in groundwater areas managed by Southern Rural Water (except for the Nepean GMA, which was estimated at 1 ML per bore per year).

The number of domestic and stock bores recorded for each GMU includes all bores registered in the groundwater management system that are less than 30 years old, as this is the expected average life of a bore. Bore depths (where recorded) have been taken into account to ensure that domestic and stock bores are assigned appropriately where GMUs overlap. To better account for domestic and stock bores in unincorporated areas, bores that are located spatially within a GMU, but do not have a constructed depth within the GMU's depth range, are allocated to an unincorporated area.

7.1.5 Urban groundwater use table

This table reports on take and use licences held by urban water corporations to supply townships within their service area. The volumes reported in this table reflect the portion of total groundwater use (see section 7.1.3) that is attributable to urban supply; they are not an additional resource in the catchment.

7.2 Goulburn–Murray groundwater basin

The Goulburn–Murray basin is located in north-east Victoria. It borders the Gippsland basin to the south and and the Wimmera Mallee basin to the west. The basin also forms part of the Murray river basin in Victoria.

The hydrogeology of the region can be broadly subdivided into two distinct geological regions: 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 eroded material that form the Quarternary Aquifer. This thin shallow aquifer is comprised of sand, colluvium, fluvial sands, gravels, clay and silts. It is found in upland valleys such as Alexandra, Yea and Flowerdale. Water is also held in the Mesozoic and Palaeozoic basement rock, which is comprised of sedimentary fractured rock. Basement rock is close to the surface near Jamieson, Mansfield, Marysville, Kilmore and Seymour and is increasingly buried deeper to the east.

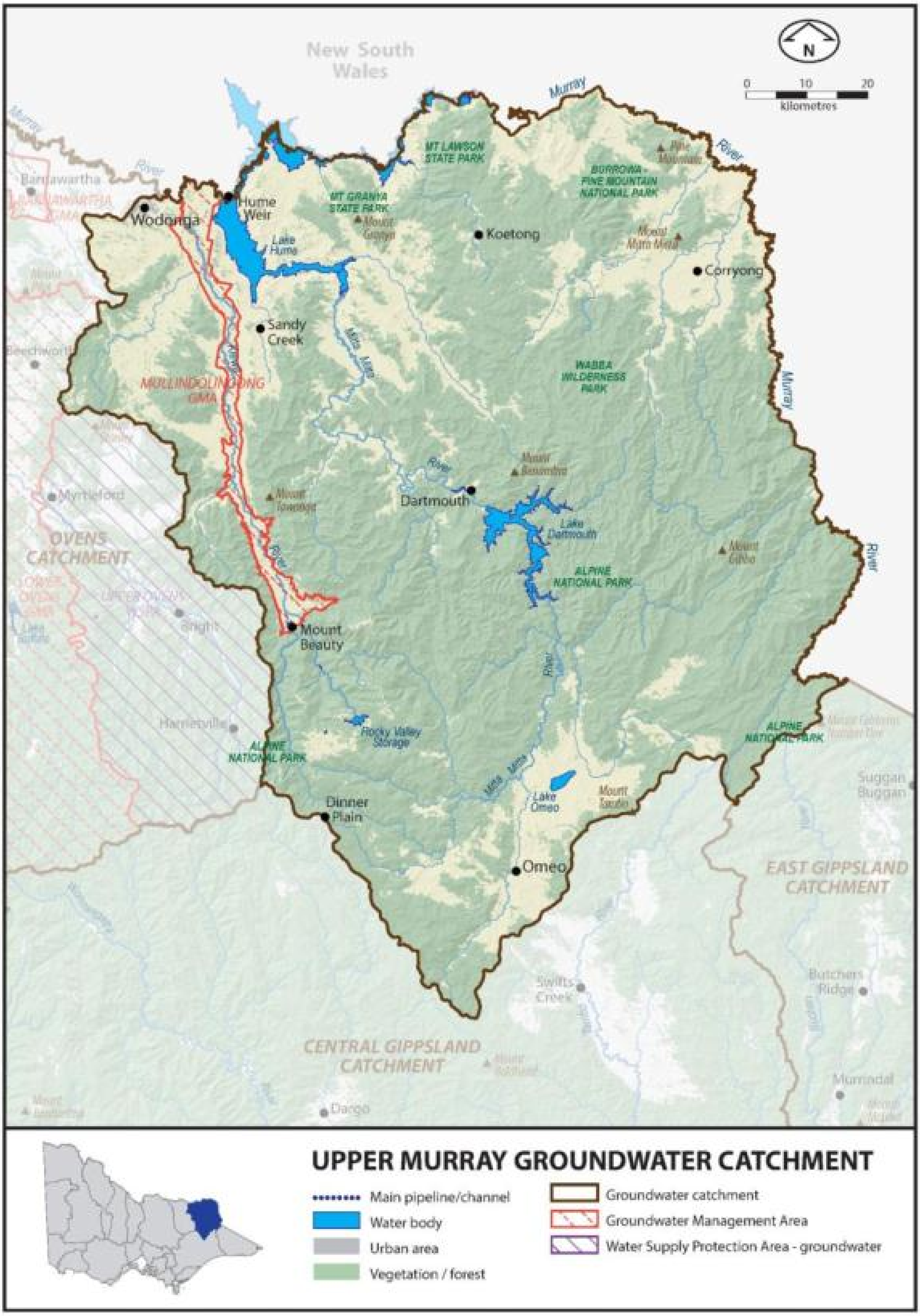
In the north, the plain of the Goulburn–Murray basin gradually thickens into several geological layers:

- The Upper Tertiary Quarternary Aquifer (UTQA) of the Shepparton formation is made of layered clay, sands and silt. It appears north of Seymour, and runs to Nathalia, Barmah and Nurmurkah. Along the Murray the UTQA is accompanied by the Calvil formation Upper Tertiary Aquifer fluvial, containing fluvial sand, gravel and clay.
- The Lower Tertiary Aquifers of the Renmark formation appear in pockets of the north, near Nathalia and Barmah. They comprise sand, gravel, clay and silt, minor coal.
- Cretaceous Permian sediments made of fractured rock, sand and minor coal. They appear from Shepparton to parts of the north near Nathalia and Nurmurkah.
- Mesozoic and Palaeozoic basement rock, which comprises sedimentary fractured rock.

7.3 Upper Murray groundwater catchment

The Upper Murray groundwater catchment is located in north-east Victoria (Figure 7.3-1 Upper Murray groundwater catchment) and contains part of the Murray river basin. The Upper Murray catchment extends from the Victorian Alps to the Murray River. Major rural centres within the boundary include Omeo, Tallangatta and Corryong.

Figure 7.3-1 Upper Murray groundwater catchment



7.3.1 Groundwater resources overview

Groundwater resources in the Upper Murray catchment are managed by Goulburn–Murray Water (G-MW) which carries out the development and implementation of groundwater management plans. G-MW also issues licences for groundwater use and bore construction. The Upper Murray 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 catchment contains the Mullindolingong GMA, a small part of Upper Ovens WSPA (which also extends into the Ovens catchment) and unincorporated areas. Groundwater resources supply licences, domestic and stock use and also the town of Dinner Plain. G-MW is developing a new management plan to establish the Upper Murray GMA, which will cover the majority of the catchment.

The groundwater level trends in this catchment are generally categorised as increasing or stable.

7.3.2 Groundwater entitlements and use

Licensed groundwater entitlements and use from GMUs are presented in Table 7.3-1.

Table 7.3-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
Mullindolingong GMA	All depths	1,604	35	15
Upper Ovens WSPA	All depths	12	0	0
Unincorporated area(1)	-	5,164	339	n/a
Total(2)		**6,780**	**374**	**15**

Notes:

(1) Information for the total licenced groundwater use within unincorporated areas in 2011–12 is not available at the catchment scale.

(2) The reported total volume of licensed groundwater use for 2011–12 does not include that used in unincorporated areas (see Note 1).

An estimate of domestic and stock groundwater use is provided in Table 7.3-2. A number of groundwater licences also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed volume in Table 7.3-1.

Table 7.3-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 2 ML per bore) (ML)
Mullindolingong GMA	59	118
Unincorporated area	616	1,232
Total	675	1,350

Groundwater is used to provide urban water supply to the township of Dinner Plains. The licensed entitlements and metered use for these supplies are presented in Table 7.3-3 Urban groundwater use.

Table 7.3-3 Urban groundwater use

Town supplied	Licensed volume (ML)	Metered use 2012–13 (ML)	Metered use 2011–12 (ML)
Dinner Plains	120	42	0
Total	**120**	**42**	**0**

7.4 Ovens groundwater catchment

The Ovens groundwater catchment is located in northern Victoria (Figure 7.4-1), extending from the Murray River in the north to the Great Dividing Range in the south, and contains the Kiewa and Ovens river basins.

Figure 7.4-1 Map of the Ovens groundwater catchment

7.4.1 Groundwater resources overview

Groundwater resources in the Ovens catchment are managed by Goulburn–Murray Water (G-MW) which is responsible for the development and implementation of groundwater management plans. G-MW also issues licences for groundwater use and bore construction. The Ovens 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 catchment contains the Barnawartha GMA, Lower Ovens GMA, Upper Ovens WSPA and unincorporated areas. The Upper Ovens WSPA Management Plan manages groundwater in the unconsolidated sedimentary aquifer as a connected system with surface water. Groundwater resources supply licences and domestic and stock usage through private bores. Groundwater is also used to supply Wangaratta, and is available as back-up supply for six further towns in the area.

G-MW manages groundwater licensed diversions for the Ovens catchment. Groundwater supply to the towns of Wangaratta, Bright, Myrtleford and Chiltern is managed by North East Water.

The groundwater level trend in the Lower Ovens GMA is categorised as increasing, and the trend for the Upper Ovens WSPA is categorised as stable. Insufficient observation bores were available to determine a trend for Barnawartha GMA.

7.4.2 Groundwater entitlements and use

Licensed groundwater entitlements and use from GMUs are presented in Table 7.4-1. Groundwater use was higher in 2012–13 compared to 2011–12, largely due to increased extraction in the Lower Ovens GMA.

Table 7.4-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
Barnawartha GMA	All depths	375	22	0
Lower Ovens GMA	All depths	19,913	5,343	2,681
Upper Ovens WSPA	All depths	3,691	667	277
Unincorporated areas(1)	-	2,962	706	n/a
Total(2)		**26,941**	**6,737**	**2,958**

Notes:

(1) Information for the total licenced groundwater use within unincorporated areas in 2011–12 is not available at the catchment scale

(2) The reported total volume of licensed groundwater use for 2011–12 does not include that used in unincorporated areas (see Note 1).

An estimate of domestic and stock groundwater use is provided in Table 7.4-2. A number of groundwater licences also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed volume in Table 7.4-1.

Table 7.4-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 2 ML per bore) (ML)
Barnawartha GMA	27	54
Lower Ovens GMA	1,872	3,744
Shepparton Irrigation WSPA	3	6
Upper Ovens WSPA	303	606
Unincorporated area	168	336
Total	2,373	4,746

Groundwater in the Ovens catchment is available for urban water supply for Barnawartha and as a back-up urban water supply for the townships of Bright, Chiltern, Moyhu, Myrtleford and Springhurst and the city of Wangaratta. North East Water has a licence with a permanent volume of zero, which enables emergency supplies to be traded into Bright when required. During 2012–13 a temporary trade of 75 ML was made from the Myrtleford entitlement for use in Bright. The volume of licensed entitlements and metered use for these groundwater supplies are provided in Table 7.4-3.

In 2012–13, no groundwater was supplied to the towns of Barnawartha, Chiltern, Moyhu, Myrtleford and Springhurst. Urban groundwater supply to Wangaratta increased slightly in 2012–13 compared to 2011–12.

Ovens groundwater catchment

Table 7.4-3 Urban groundwater use

Town supplied	Licensed volume (ML)	Metered use 2012–13 (ML)	Metered use 2011–12 (ML)
Barnawartha	293	0	0
Bright(1)	0	46	0
Chiltern	25	0	0
Moyhu	15	0	0
Myrtleford(1)	75	0	0
Springhurst	20	0	0
Wangaratta	665	136	108
Total	**1,093**	**182**	**108**

Notes:

(1) A temporary trade of 75 ML was made from the Myrtleford take and use licence to the Bright take and use licence in 2012–13 to account for the use in Bright.

7.5 Goulburn–Broken groundwater catchment

The Goulburn–Broken groundwater catchment is located in northern Victoria (Figure 7.5-1) and contains the Goulburn and Broken river basins. The hydrogeology of this groundwater catchment 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 7.5-1 Map of the Goulburn–Broken groundwater catchment

7.5.1 Groundwater resources overview

Groundwater resources in the Goulburn–Broken catchment are managed by Goulburn–Murray Water (GMW). GMW has delegated responsibility for licensing groundwater use and bore construction, and leads the development and implementation of groundwater management plans. The Goulburn–Broken 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 Alexandra GMA, Katunga WSPA, Kinglake GMA, Mid-Goulburn GMA, most of Shepparton Irrigation Region WSPA (which also extends into the Campaspe catchment) and unincorporated areas.

Groundwater resources supply licences, and domestic and stock use, and are also available to supply the three townships in the area: Goorambat, Katunga and Strathmerton.

The groundwater level trends in this catchment are generally categorised as increasing or stable, in comparison to 2011–12 when levels were categorised as declining in several GMUs.

7.5.2 Groundwater entitlements and use

Licensed groundwater entitlements and use from GMUs are presented in Table 7.5-1. Extractions from the Katunga WSPA are limited to 70% of licensed entitlement volume in 2012–13.

Groundwater use was significantly higher in 2012–13 compared to 2011–12, largely due to increased extraction in the Mid-Goulburn GMA, Katunga WSPA and Shepparton WSPA.

Table 7.5-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
Alexandra GMA	All depths	1,707	253	127
Kinglake GMA	All depths	1,851	231	150
Mid-Goulburn GMA	Zone 1070: >25 Zone 1071: All depths	12,465	3,477	2,180
Katunga WSPA	>25	60,678	23,708	18,809
Shepparton Irrigation WSPA	≤25	184,036	37,250	23,798
Unincorporated areas(1)	-	10,507	1,440	n/a
Total(2)		**271,244**	**66,359**	**45,064**

Notes:

(1) Information for the total licenced groundwater use within unincorporated areas in 2011–12 is not available at the catchment scale.

(2) The reported total volume of licensed groundwater use for 2011–12 does not include that used in unincorporated areas (see Note 1).

An estimate of domestic and stock groundwater use is provided in Table 7.5-2. A number of groundwater licences also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed volume in Table 7.5-1.

Table 7.5-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 2 ML per bore) (ML)
Alexandra GMA	17	34
Kinglake GMA	188	376
Mid-Goulburn GMA	208	416
Katunga WSPA	834	1,668
Shepparton Irrigation WSPA	1,395	2,790
Unincorporated area – Goulburn–Murray Water	2,092	4,184
Total	4,734	9,468

The licensed entitlements and metered use for these supplies are presented in Table 7.5-3. Groundwater use for Goorambat and Katunga reduced slightly in 2012–13 compared to 2011–12.

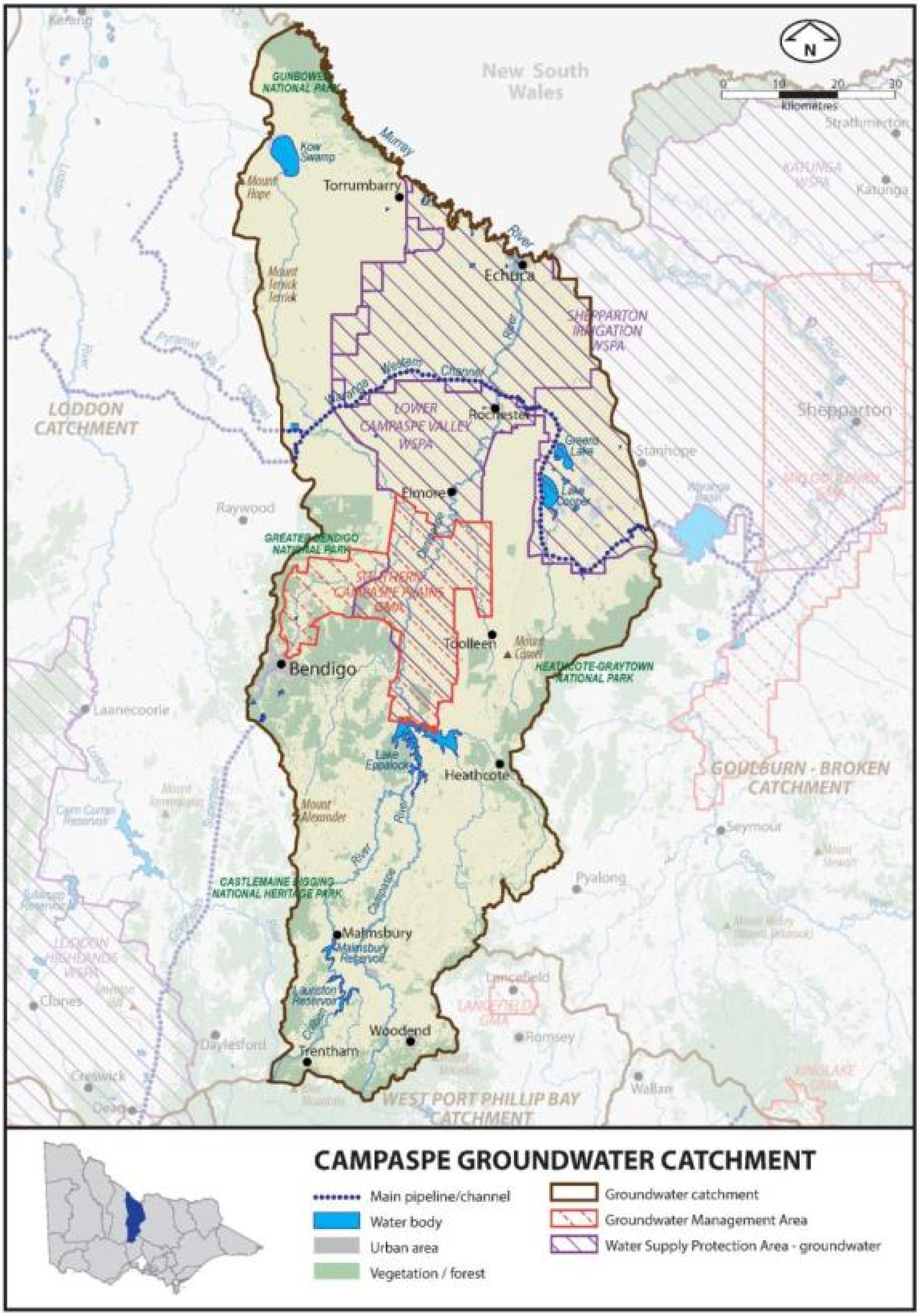
Table 7.5-3 Urban groundwater use

Town supplied	Licensed volume (ML)	Metered use 2012–13 (ML)	Metered use 2011–12 (ML)
Goorambat	24	12	13
Katunga	110	52	58
Strathmerton	730	0	0
Total	**864**	**64**	**71**

7.6 Campaspe groundwater catchment

The Campaspe groundwater catchment is located in Northern Victoria (Figure 7.6-1) and corresponds with the Campaspe river basin. The catchment extends from the Murray River near Echuca in the north to the Great Dividing Range at Woodend and Trentham in the south.

Figure 7.6-1 Map of the Campaspe groundwater catchment



7.6.1 Groundwater resources overview

Groundwater resources in the Campaspe catchment are managed by Goulburn–Murray Water (G-MW) which is responsible for the development and implementation of groundwater management plans. G-MW also issues licences for groundwater use and bore construction, as well as for surface water diversions. The Campaspe 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 WSPA, Shepparton Irrigation WSPA and unincorporated areas. Groundwater resources supply licences and domestic and stock use in the area, and are also available for urban supply to the towns of Elmore and Trentham. G-MW is developing a management plan to establish the newly formed Central Victoria Mineral Springs GMA, which will be approved in late 2013, and will also establish the Shepparton Irrigation GMA, which will extend into the Goulburn–Broken catchment and replace the Shepparton Irrigation WSPA.

In 2012–13, the groundwater level trend in the Lower Campaspe Valley WSPA was categorised as rising, while the trend in the Shepparton Irrigation WSPA was categorised as stable.

7.6.2 Groundwater entitlements and use

A summary of the licensed entitlements and use from GMUs within the Campaspe catchment, excluding domestic and stock use, is presented in Table 7.6-1. Groundwater use was significantly higher in 2012–13 compared to 2011–12, largely due to increased extraction in the Lower Campaspe Valley WSPA.

Table 7.6-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
Lower Campaspe Valley WSPA	All depths	55,874	27,260	17,404
Shepparton Irrigation WSPA	≤25	17,389	2,329	1,321
Unincorporated areas(1)	-	7,065	689	n/a
Total(2)		**80,328**	**30,278**	**18,725**

Notes:

(1) Information for the total licenced groundwater use within unincorporated areas in 2011–12 is not available at the catchment scale.

(2) The reported total volume of licensed groundwater use for 2011–12 does not include that used in unincorporated areas (see Note 1).

An estimate of domestic and stock groundwater use is provided in Table 7.6-2. A number of groundwater licences also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed volume in Table 7.6-1.

Table 7.6-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 2 ML per bore) (ML)
Lower Campaspe Valley WSPA	462	924
Shepparton Irrigation WSPA	260	520
Unincorporated area – Goulburn–Murray Water	1,553	3,106
Total	2,275	4,550

In the Campaspe catchment, groundwater is an option for urban water supply to the townships of Elmore and Trentham. In 2012–13, only Elmore drew on groundwater for urban use and used approximately half the volume of groundwater used in 2011–12 (Table 7.6-3).

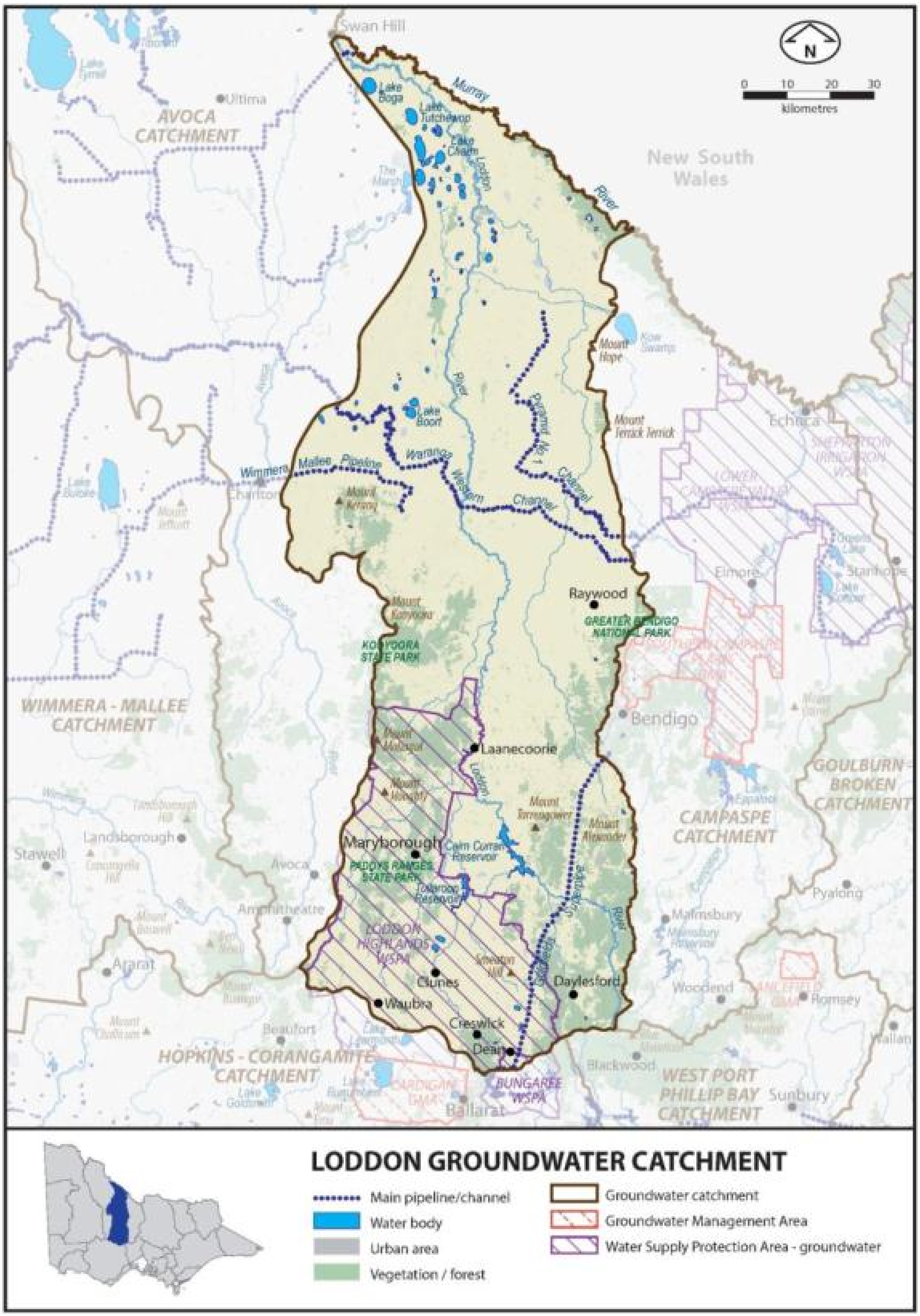
Table 7.6-3 Urban groundwater use

Town supplied	Licensed volume (ML)	Metered use 2012–13 (ML)	Metered use 2011–12 (ML)
Elmore	284	62	123
Trentham	48	0	0
Total	**332**	**62**	**123**

7.7 Loddon groundwater catchment

The Loddon groundwater catchment is located in northern Victoria (Figure 7.7-1) and broadly corresponds with the Loddon river basin. The catchment covers an area between Creswick and Swan Hill. Neighbouring groundwater catchments are Avoca to the west, Otway-Torquay to the south and Campaspe to the east.

Figure 7.7-1 Map of the Loddon groundwater catchment



7.7.1 Groundwater resources overview

Groundwater resources in the Loddon catchment are managed by Goulburn–Murray Water (G-MW) which is responsible for the development and implementation of groundwater management plans. G-MW also issues licences for groundwater use and bore construction, as well as for surface water licensed diversions. 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 catchment contains all of the Mid-Loddon GMA, Loddon Highlands WSPA and parts of the unincorporated areas. Groundwater resources supply licences, domestic and stock use and also the six townships in the area. G-MW is developing a new management plan to establish the Central Victoria Mineral Springs GMA, to be approved in late 2013. This will cover the Loddon River upstream of Cairn Curran Reservoir, including the Coliban River and highlands section of the Campaspe River.

The groundwater level trend is generally categorised as rising for GMUs in this area.

7.7.2 Groundwater entitlements and use

Licensed groundwater entitlements and use from GMUs are presented in Table 7.7-1. Groundwater use in Mid-Loddon GMA and Loddon Highlands WSPA was significantly higher in 2012–13 compared to 2011–12.

Table 7.7-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
Mid-Loddon GMA	All depths	34,037	17,207	11,128
Loddon Highlands WSPA	All depths	20,694	7,052	4,098
Unincorporated area(1)	-	7,930	329	n/a
Total(2)		**62,661**	**24,588**	**15,226**

Notes:

(1) Information for the total licenced groundwater use in the unincorporated area in 2011–12 is not available at the catchment scale.

(2) The reported total volume of licensed groundwater use for 2011–12 does not include that used in the unincorporated area (see Note 1 above).

An estimate of domestic and stock groundwater use is provided in Table 7.7-2. A number of groundwater licences also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed volume in Table 7.7-1.

Table 7.7-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 2.0 ML per bore) (ML)
Mid-Loddon GMA	378	756
Bungaree WSPA(1)	11	17
Loddon Highlands WSPA	676	1,352
Unincorporated area	790	1,580
Total	1,855	3,705

Note:

(1) Estimated domestic and stock use for Bungaree WSPA is calculated using a factor of 1.5 ML per bore.

Groundwater is an option for urban water supply to six towns within the catchment, though less than 25% of the licensed volume was used in 2012–13. The licensed entitlements and metered use for urban groundwater supplies in the Loddon catchment are provided in Table 7.7-3.

Table 7.7-3 Urban groundwater use

Town supplied	Licensed volume (ML)	Metered use 2012–13 (ML)	Metered use 2011–12 (ML)
Clunes	350	217	175
Daylesford	273	0	0
Forest Hill	350	162	139
Learmonth	100	53	50
Maryborough	851	0	22
Waubra	100	25	28
Total	**2,024**	**457**	**414**

7.8 Gippsland groundwater basin

The Gippsland groundwater basin is located 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 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.

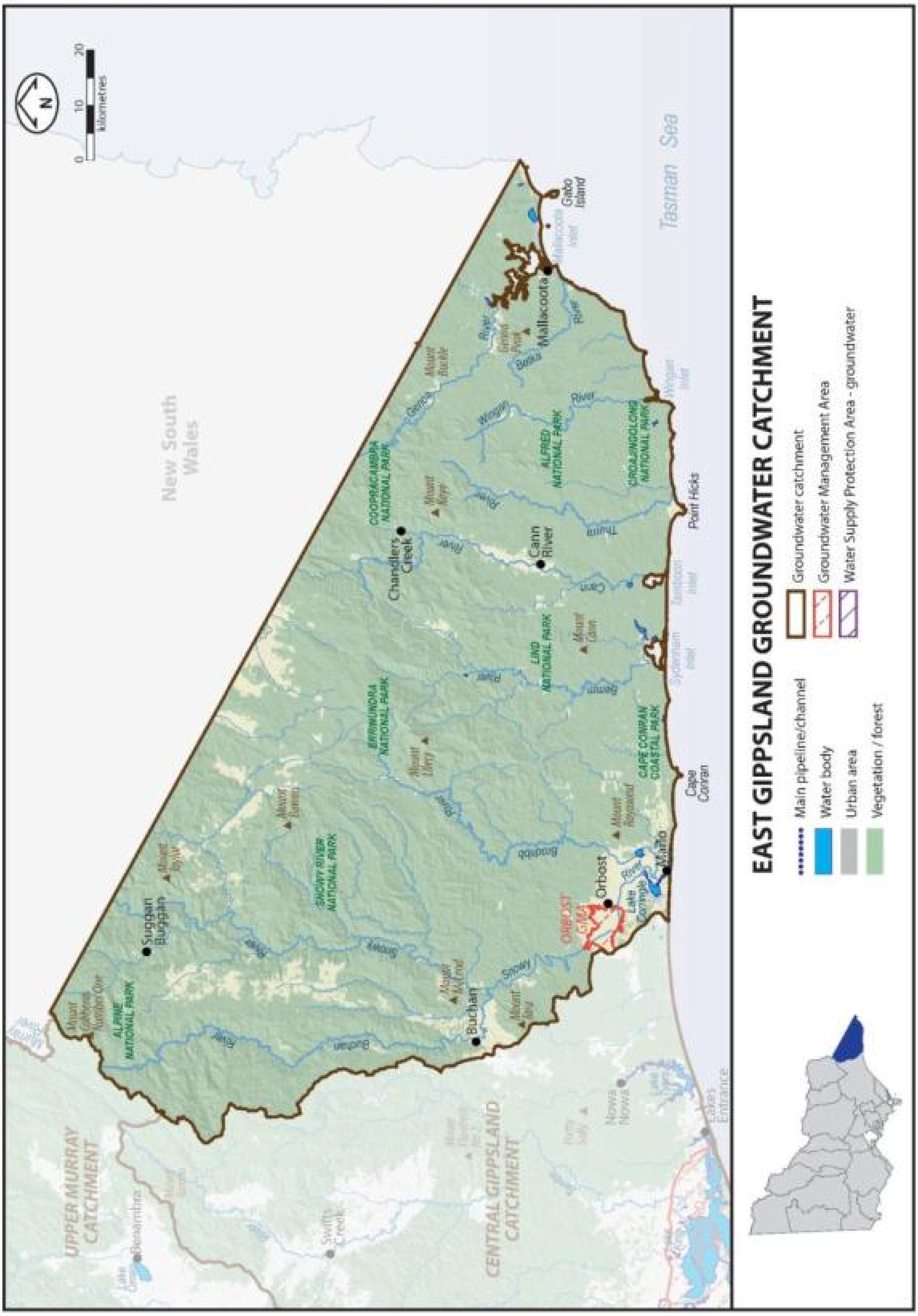
Middle aquifers cover a large part of the Gippsland groundwater basin from Moe to Bairnsdale. They comprise thick seams of sand aquifers separated by aquitards. The aquitards are generally clay or coal seams in the north-west of the Gippsland groundwater basin, and limestone in the east and centre of the basin. Recharge occurs from leakage through the overlying and surrounding sediments, and discharge is to the limestone aquitards to the east of the basin and along the coast.

Lower aquifers extend across the Gippsland 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 the upper and middle aquifers together with thick silt, clay, coal and limestone aquitards, while underlain by basement rock. Where the lower aquifers occur at or near the surface they receive direct recharge from rainfall and river leakage, while in the deeper basin recharge occurs by downward leakage. Discharge occurs offshore in Bass Strait.

7.9 East Gippsland groundwater catchment

The East Gippsland groundwater catchment (Figure 7.9-1) is located in the Gippsland basin in eastern Victoria and encompasses the rivers of the East Gippsland and the Snowy river basins. Neighbouring groundwater catchments are the Central Gippsland catchment to the west and the Upper Murray catchment to the north-west.

Figure 7.9-1 Map of the East Gippsland groundwater catchment



7.9.1 Groundwater resources overview

Groundwater resources in the East Gippsland groundwater catchment are managed by Southern Rural Water (SRW). SRW is responsible for issuing bore construction and licensing groundwater extractions under take and use licences.

The East Gippsland groundwater catchment contains the Orbost GMA and unincorporated areas. Groundwater supplies licences and domestic and stock use in the area. Groundwater use in the East Gippsland groundwater catchment is predominantly for irrigation and it is also available for urban use in the town of Mallacoota.

The groundwater level trend in the Orbost GMA, based on seasonal observations for the preceding five years, was categorised as rising in July 2012 and by the end of June 2013 it was categorised as stable.

7.9.2 Groundwater entitlements and use

Licensed groundwater entitlements and use for the Orbost GMA and unincorporated areas are shown in Table 7.9-1.

Groundwater use was higher in 2012–13 compared to 2011–12 due to increased extraction in the Orbost GMA.

Table 7.9-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
Orbost GMA	20-45	1,217	300	0
Unincorporated areas(1)	-	537	62	n/a
Total(2)		**1,754**	**362**	**0**

Notes:

(1) Information for the total licenced groundwater use within unincorporated areas in 2011–12 is not available at the catchment scale.

(2) The reported total volume of licensed groundwater use for 2011–12 does not include that used in unincorporated areas (see Note 1).

An estimate of domestic and stock groundwater use is provided in Table 7.9-2. A number of groundwater licences also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed volume in Table 7.9-1.

Table 7.9-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 1.5 ML per bore) (ML)
Orbost GMA	3	5
Unincorporated areas – Southern Rural Water	71	107
Total	74	112

Within the East Gippsland catchment, groundwater is available for urban water supply to the township of Mallacoota. Urban groundwater use in the East Gippsland catchment increased in 2012–13 compared to the previous year. The licensed entitlements and metered use for this supply are provided in Table 7.9-3.

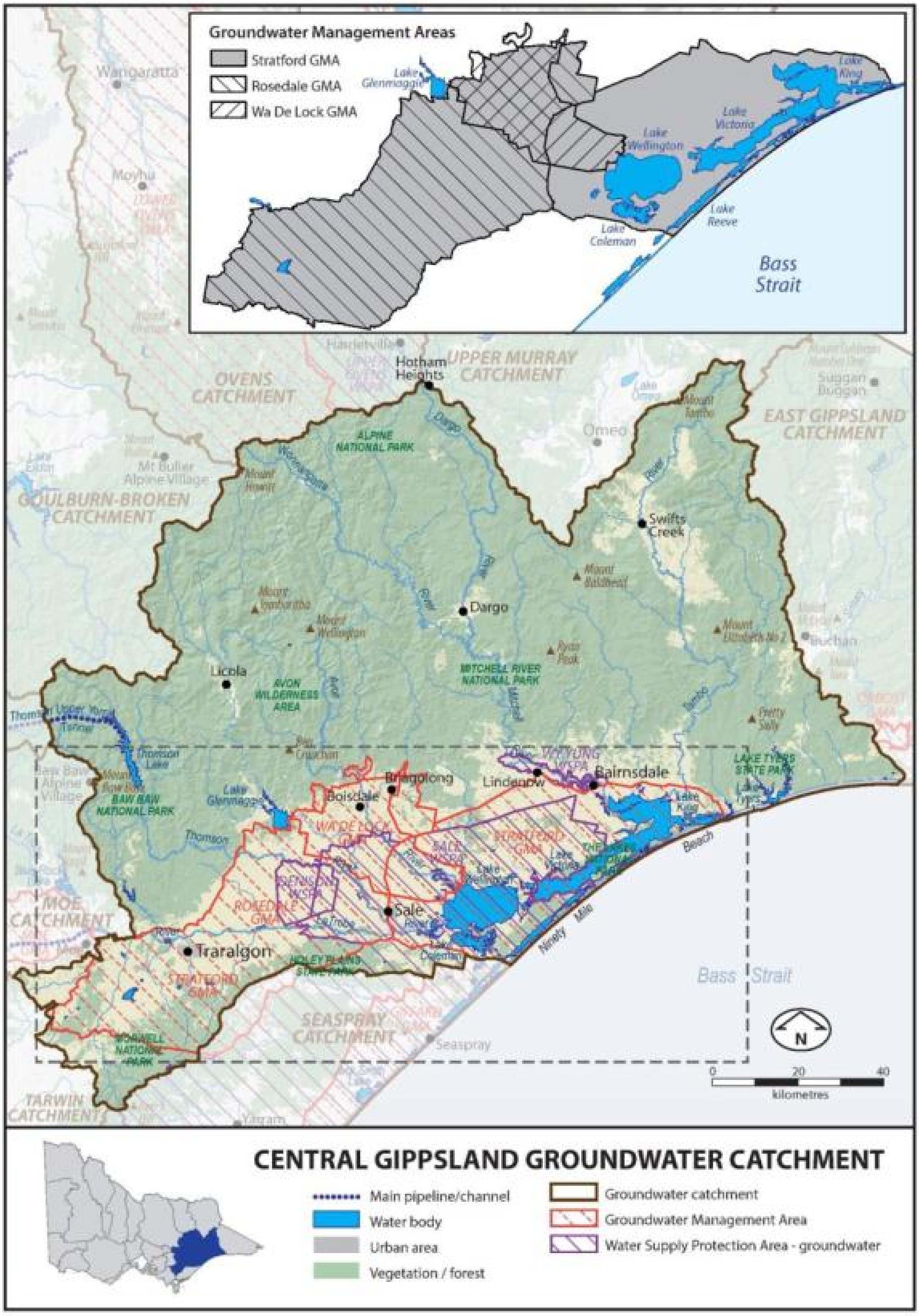
Table 7.9-3 Urban groundwater use

Town supplied	Licensed volume (ML)	Metered use 2012–13 (ML)	Metered use 2011–12 (ML)
Mallacoota	220	62	25
Total	**220**	**62**	**25**

7.10 Central Gippsland groundwater catchment

The Central Gippsland groundwater catchment (Figure 7.10-1) is located in the Gippsland groundwater basin in eastern Victoria. It encompasses the major systems of the Gippsland Lakes and contains the, Tambo, Mitchell and Thomson river basins, and parts of the Latrobe and Snowy river basins. Neighbouring groundwater catchments are the Goulburn–Broken and Moe catchments to the west, the Ovens and Upper Murray catchments to the north and East Gippsland to the east.

Figure 7.10-1 Map of the Central Gippsland groundwater catchment



7.10.1 Groundwater resources overview

Groundwater resources in the Central Gippsland groundwater catchment are managed by Southern Rural Water (SRW). SRW is responsible for issuing bore construction licences and for the licensing of groundwater extractions under take and use licences.

The Central Gippsland groundwater catchment contains the Rosedale GMA, Wa De Lock GMA, Denison WSPA, Sale WSPA, Wy Yung WSPA and unincorporated areas. It also contains most of the Stratford GMA (which also extends into the Seaspray groundwater catchment), and a small part of both the Moe GMA (the majority of which is in the Moe groundwater catchment) and Yarram WSPA (the majority of which is in the Seaspray groundwater catchment).

Groundwater resources supply licences, domestic and stock use and also some urban use. While the majority of groundwater use in the Central Gippsland groundwater catchment is for irrigation purposes, groundwater resources also supply four towns in the area together with some power generators in the Latrobe Valley.

At the end of 2012–13, the groundwater level trends in the Central Gippsland groundwater catchment's GMUs were generally categorised as stable or declining. Of the eight GMUs in the catchment, only the Wy Yung WSPA was classified as having a rising groundwater level trend based on the seasonal observations of the preceding five years.

7.10.2 Groundwater entitlements and use

A summary of the licensed entitlements and use from GMAs in the Central Gippsland catchment are shown in Table 7.10-1.

Groundwater use in the Central Gippsland groundwater catchment was significantly higher in 2012–13 compared to 2011–12, largely due to increased extraction across most GMUs.

Table 7.10-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
Moe GMA	>25	28	6	7
Rosedale GMA[1]	Zone 1: 50-150 Zone 2: 25-350 Zone 3: 200-300	22,372	18,923	7,739
Stratford GMA[1]	Zone 1: >150 Zone 2: >350	27,283	17,667	26,041
Wa De Lock GMA[2]	≤25	29,287	8,181	3,240
Denison WSPA[2]	≤25	18,501	10,209	2,992
Sale WSPA	25-200	21,238	12,739	6,324
Wy Yung WSPA	≤25	7,462	932	347
Yarram WSPA	Zone 1: >200 Zone 2: All depths	5,261	3,757	3,186
Unincorporated areas[3]	-	20,502	2,441	n/a
Total[4]		**151,934**	**74,855**	**49,876**

Notes:

(1) The use volume reported in Rosedale GMA and Stratford GMA includes metered extractions from Latrobe Valley mines (Rosedale GMA 10,846 ML and Stratford GMA 17,664 ML).

(2) The volume of use in Wa De Lock GMA and Denison WSPA includes metered extractions for salinity control (Wa De Lock GMA 735 ML and Denison WSPA 1,285 ML).

(3) Information for the total licensed groundwater use within unincorporated areas in 2011–12 is not available at the catchment scale.

(4) The reported total volume of licensed groundwater use for 2011–12 does not include that used in unincorporated areas (see Note 3).

An estimate of domestic and stock groundwater use is provided in Table 7.10-2. A number of groundwater licences also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed volume in Table 7.10-1.

Table 7.10-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 1.5 ML per bore) (ML)
Rosedale GMA	185	278
Stratford GMA	1	2
Wa De Lock GMA	410	615
Denison WSPA	207	311
Sale WSPA	353	530
Wy Yung WSPA	31	47
Yarram WSPA	95	143
Unincorporated areas – Southern Rural Water	316	474
Total	1,598	2,397

Groundwater is used to provide urban water supply for the townships of Boisdale, Briagolong, Lindenow and Sale. The licensed entitlements and metered use for these supplies is presented in Table 7.10-3.

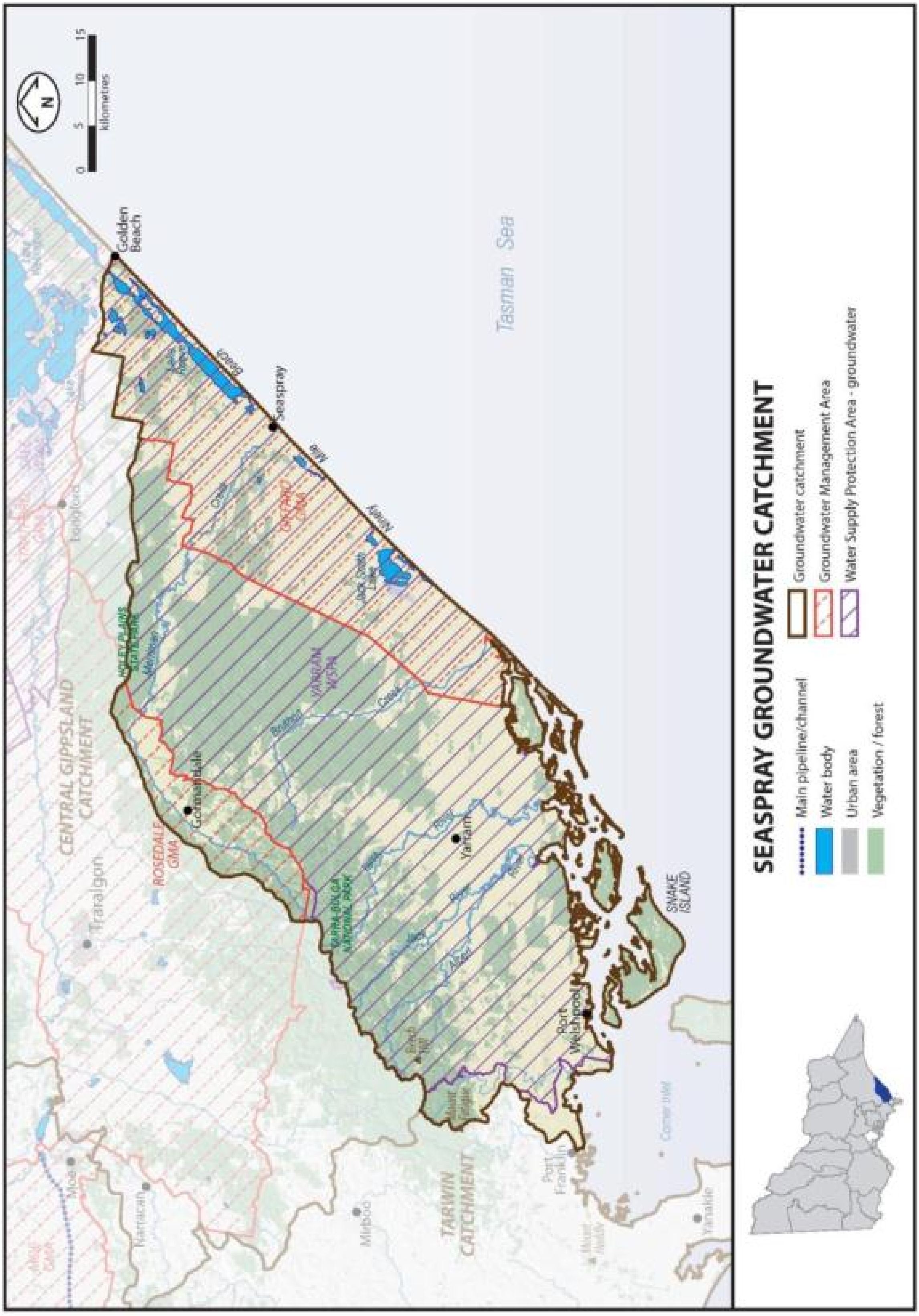
Table 7.10-3 Urban groundwater use

Town supplied	Licensed volume (ML)	Metered use 2012–13 (ML)	Metered use 2011–12 (ML)
Boisdale	37	0	0
Briagolong	160	110	61
Lindenow	120	60	0
Sale	3,500	1,924	1,771
Total	**3,817**	**2,094**	**1,832**

7.11 Seaspray groundwater catchment

The Seaspray groundwater catchment (Figure 7.11-1) is located in the Gippsland groundwater basin in Victoria's south-east, and falls within the South Gippsland river basin. Neighbouring groundwater catchments are Central Gippsland to the north and Tarwin to the west.

Figure 7.11-1 Map of the Seaspray groundwater catchment



7.11.1 Groundwater resources overview

Groundwater resources in the Seaspray groundwater catchment are managed by Southern Rural Water (SRW). SRW is responsible for the issuing of bore construction licenses and the licensing of groundwater extractions under take and use licences.

The catchment contains the Giffard GMA and unincorporated areas, together with most of the Yarram WSPA which also extends into the Central Gippsland catchment. Groundwater resources supply licences, domestic and stock use and also the township of Yarram. Groundwater use in the Seaspray catchment is predominantly for irrigation.

At the end of 2012–13, the five-year groundwater level trends in this catchment were generally categorised as stable to declining. Historical observations indicate that the groundwater levels in both the Stratford GMA and Yarram WSPA are experiencing a long-term decline.

7.11.2 Groundwater entitlements and use

A summary of the licensed groundwater entitlements and use from GMUs in the Seaspray catchment is shown in Table 7.11-1. Groundwater use was significantly higher in 2012–13 compared to 2011–12, largely due to increased extraction in the Giffard GMA and Yarram WSPA.

Table 7.11-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
Giffard GMA	50-200	5,689	1,504	845
Stratford GMA	Zone 1: >150 Zone 2: >350	362	45	1
Yarram WSPA	Zone 1: >200 Zone 2: All depths	20,428	7,911	3,554
Unincorporated areas(1)	-	518	174	n/a
Total(2)		**26,997**	**9,634**	**4,400**

Notes:

(1) Information for the total licensed groundwater use within unincorporated areas in 2011–12 is not available at the catchment scale.

(2) The reported total volume of licensed groundwater use for 2011–12 does not include that used in unincorporated areas (see Note 1).

An estimate of domestic and stock groundwater use is provided in Table 7.11-2. A number of groundwater licences also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed volume in Table 7.11-1.

Table 7.11-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 1.5 ML per bore) (ML)
Giffard GMA	70	105
Rosedale GMA	1	2
Yarram WSPA	196	294
Total	267	401

Groundwater supplies are available for the town of Yarram, however there was no metered use of groundwater for urban supply in 2012–13 (Table 7.11-3).

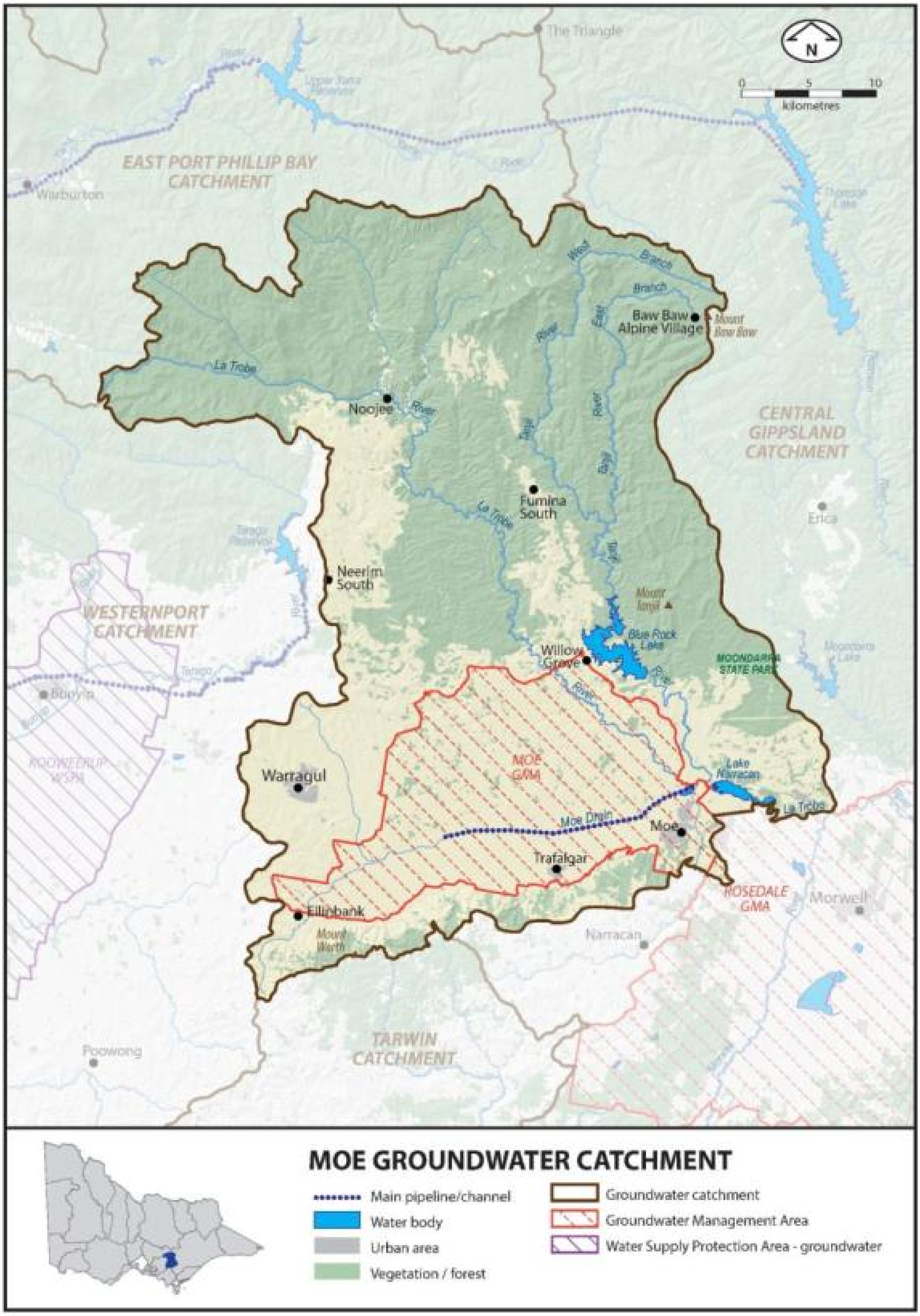
Table 7.11-3 Urban groundwater use

Town supplied	Licensed volume (ML)	Metered use 2012–13 (ML)	Metered use 2011–12 (ML)
Yarram	154	0	0
Total	**154**	**0**	**0**

7.12 Moe groundwater catchment

The Moe groundwater catchment (Figure 7.12-1) is located in the Gippsland basin in eastern Victoria and falls within the Latrobe river basin. Neighbouring groundwater catchments are Central Gippsland to the east and south-east, East Port Phillip Bay and Westernport to the west and Tarwin to the south.

Figure 7.12-1 Map of the Moe groundwater catchment



7.12.1 Groundwater resources overview

Groundwater resources in the Moe groundwater catchment are managed by Southern Rural Water (SRW). SRW is responsible for issuing bore construction licences and for licensing groundwater extractions under take and use licences.

The Moe catchment contains the Moe GMA and parts of unincorporated areas. Groundwater resources supply licences and domestic and stock use and are also available for the town of Trafalgar. While the majority of groundwater licensed in the Moe GMA is used for irrigation purposes, it is also used for dairy wash-down.

The groundwater level trend in the Moe GMA was categorised as declining throughout 2012–13.

7.12.2 Groundwater entitlements and use

A summary of the licensed groundwater entitlements and use from GMUs is presented in Table 7.12-1.

Groundwater use was higher in 2012–13 compared to 2011–12, largely due to increased extraction in the Moe GMA.

Table 7.12-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
Moe GMA	>25	3,965	902	323
Unincorporated areas(1)	-	1,005	241	n/a
Total(2)		**4,970**	**1,143**	**323**

Notes:

(1) Information for the total licensed groundwater use within unincorporated areas in 2011–12 is not available at the catchment scale.

(2) The reported total volume of licensed groundwater use for 2011–12 does not include that used in unincorporated areas (see Note 1).

An estimate of domestic and stock groundwater use is provided in Table 7.12-2. A number of groundwater licences also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed volume in Table 7.12-1.

Table 7.12-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 1.5 ML per bore) (ML)
Moe GMA	130	195
Unincorporated areas – Southern Rural Water	147	221
Total	277	416

Groundwater is available for urban water supply to the township of Trafalgar, however this entitlement is not currently metered or used (Table 7.12-3).

Table 7.12-3 Urban groundwater use

Town supplied	Licensed volume (ML)	Metered use 2012–13 (ML)	Metered use 2011–12 (ML)
Trafalgar	100	0	0
Total	**100**	**0**	**0**

7.13 Central groundwater basins

The Central groundwater basins comprise the Port Phillip, Westernport and Tarwin groundwater basins, which are grouped for management purposes. These basins are located in the south-central region of Victoria, encompassing the area around Port Phillip Bay and extending into the South Gippsland region. Groundwater catchments contained within the Central basins are Tarwin, Westernport, East Port Phillip Bay and West Port Phillip Bay. See Figure 7.1-1.

The upper aquifers of the Central groundwater basins 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 flood plains 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.

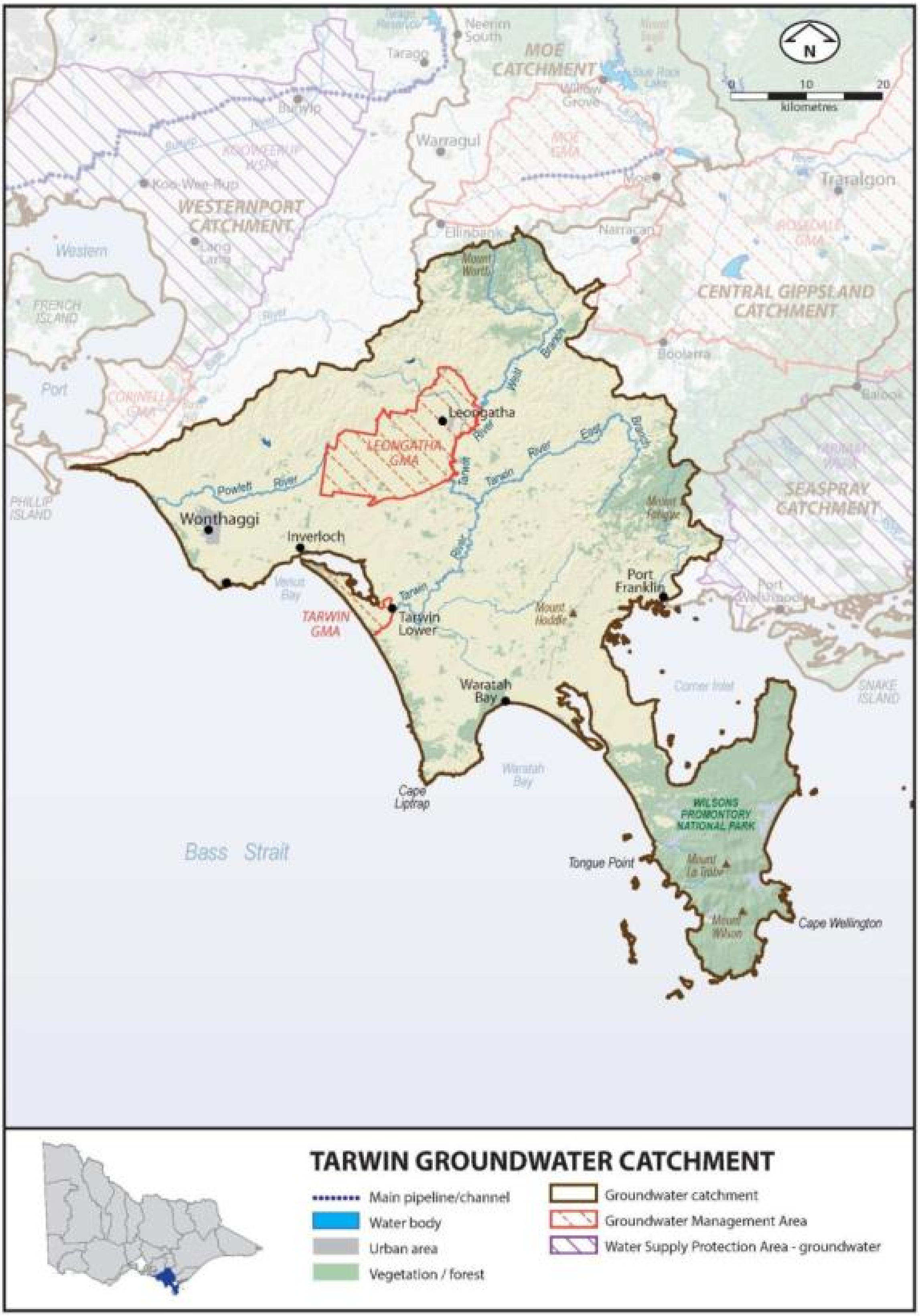
The middle aquifers of the Central groundwater basins cover a large part of the region. They are made up of several formations, which are connected and act as one aquifer in each basin. These aquifers vary in composition, and include fine sands, coarse sand and gravel, clay and limestone. These aquifers 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, however they are at the surface and unconfined on the eastern side of Port Phillip Bay. Recharge occurs from leakage through the overlying sediments or, where the aquifers are near the surface, from direct rainfall recharge.

Lower aquifers extend across the region, lying very deep along the coast or, in some areas, at or close to the surface. The aquifers largely comprise sand, sandstone and basalt, and some also contain clay and coal layers that act as aquitards. The basement rock 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 basement rock 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 basement rock are at the surface; elsewhere recharge occurs as leakage.

7.14 Tarwin groundwater catchment

The Tarwin groundwater catchment is located in south-eastern Victoria (Figure 7.14-1) and overlaps part of the South Gippsland surface water basin. Neighbouring groundwater catchments are Westernport to the west, Central Gippsland and Seaspray to the east and Moe to the north. Bass Strait forms the southern boundary of the onshore catchment.

Figure 7.14-1 Map of the Tarwin groundwater catchment



7.14.1 Groundwater resources overview

Groundwater resources in the Tarwin groundwater catchment are managed by Southern Rural Water (SRW). SRW is responsible for licensing bore construction and groundwater extractions under take and use licences.

The Tarwin groundwater catchment contains the Leongatha GMA, Tarwin GMA and parts of unincorporated areas. Groundwater resources supply licences, domestic and stock use and also the township of Leongatha.

The groundwater level trend in this catchment is generally categorised as stable.

7.14.2 Groundwater entitlements and use

Licensed groundwater entitlements and use from GMUs are presented in Table 7.14-1.

Table 7.14-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
Leongatha GMA	All depths	1,841	180	72
Tarwin GMA	≤	38	13	15
Unincorporated areas(1)	-	351	70	n/a
Total(2)		**2,230**	**263**	**87**

Notes:

(1) Information for the total licensed groundwater use within unincorporated areas in 2011–12 is not available at the catchment scale.

(2) The reported total volume of licensed groundwater use for 2011–12 does not include that used in unincorporated areas (see Note 1).

An estimate of domestic and stock groundwater use is provided in Table 7.14-2. A number of groundwater licences also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed volume in Table 7.14-1.

Table 7.14-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 1.5 ML per bore) (ML)
Leongatha GMA	81	122
Tarwin GMA	663	995
Unincorporated areas – Southern Rural Water	334	501
Total	1,078	1,618

Groundwater supply is available for the township of Leongatha. The licensed entitlements and metered use for the supply is presented in Table 7.14-3. Very little water was extracted under the licence in 2012–13.

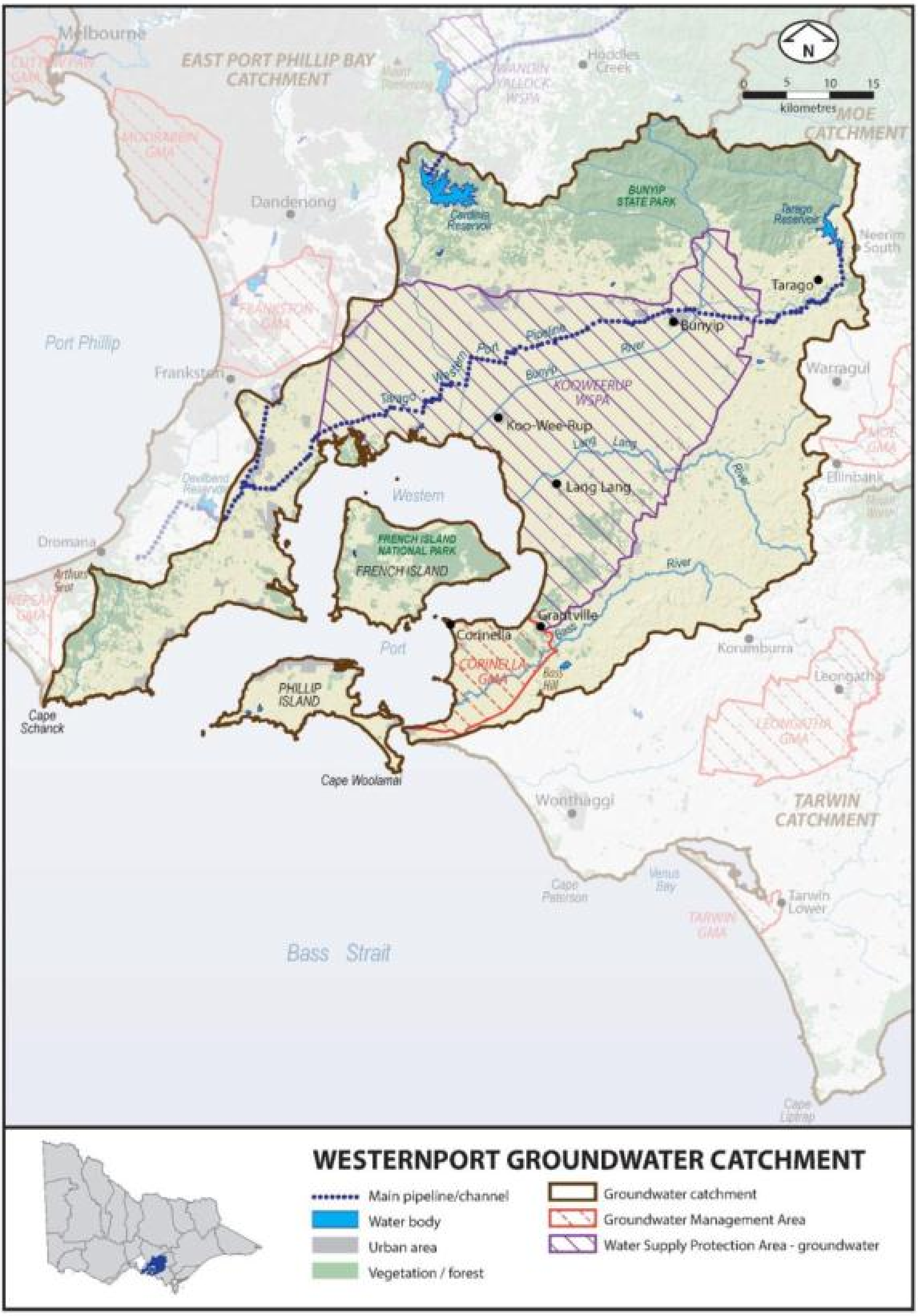
Table 7.14-3 Urban groundwater use

Town supplied	Licensed volume (ML)	Metered use 2012–13 (ML)	Metered use 2011–12 (ML)
Leongatha	715	4	0
Total	**715**	**4**	**0**

7.15 Westernport groundwater catchment

The Westernport groundwater catchment is located in southern Victoria (Figure 7.15-1) and contains the Bunyip river basin. Neighbouring groundwater catchments are the East Port Phillip Bay to the west, Moe to the north-east and Tarwin to the south-east.

Figure 7.15-1 Map of the Westernport groundwater catchment



7.15.1 Groundwater resources overview

Groundwater resources in the Westernport groundwater catchment are managed by Southern Rural Water (SRW), which is responsible for licensing bore construction and groundwater extractions under take and use licences.

The Westernport groundwater catchment contains the Corinella GMA, Koo Wee Rup WSPA and unincorporated areas. Groundwater resources supply licences, domestic and stock use and also the townships of Corinella/Grantville and Lang Lang.

In 2012–13, the groundwater level trend for both Corinella GMA and Koo Wee Rup WSPA was categorised as rising.

7.15.2 Groundwater entitlements and use

A summary of the licensed entitlements and use from GMUs within the Westernport catchment is presented in Table 7.15-1.

Groundwater use increased significantly in 2012–13 compared to 2011–12, largely due to increased extraction in the Koo Wee Rup WSPA.

Table 7.15-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
Corinella GMA	All depths	662	74	20
Koo Wee Rup WSPA	All depths	12,514	3,474	1,924
Unincorporated areas(1)	-	4,213	404	n/a
Total(2)		**17,389**	**3,952**	**1,944**

Notes:

(1) Information for the total licensed groundwater use within unincorporated areas in 2011–12 is not available at the catchment scale.

(2) The reported total volume of licensed groundwater use for 2011–12 does not include that used in unincorporated areas (see Note 1).

An estimate of domestic and stock groundwater use is provided in Table 7.15-2. A number of groundwater licences also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed volume in Table 7.15-1.

Table 7.15-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 1.5 ML per bore) (ML)
Corinella GMA	84	126
Koo Wee Rup WSPA	1,163	1,745
Unincorporated areas – Southern Rural Water	539	809
Total	1,786	2,680

Groundwater is available as an urban water supply to the townships of Corinella/Grantville and Lang Lang. In 2012–13, groundwater was not used for urban supply at Lang Lang and metered groundwater use for the township of Corinella/Grantville was less than 10% of the licensed volume (Table 7.15-3).

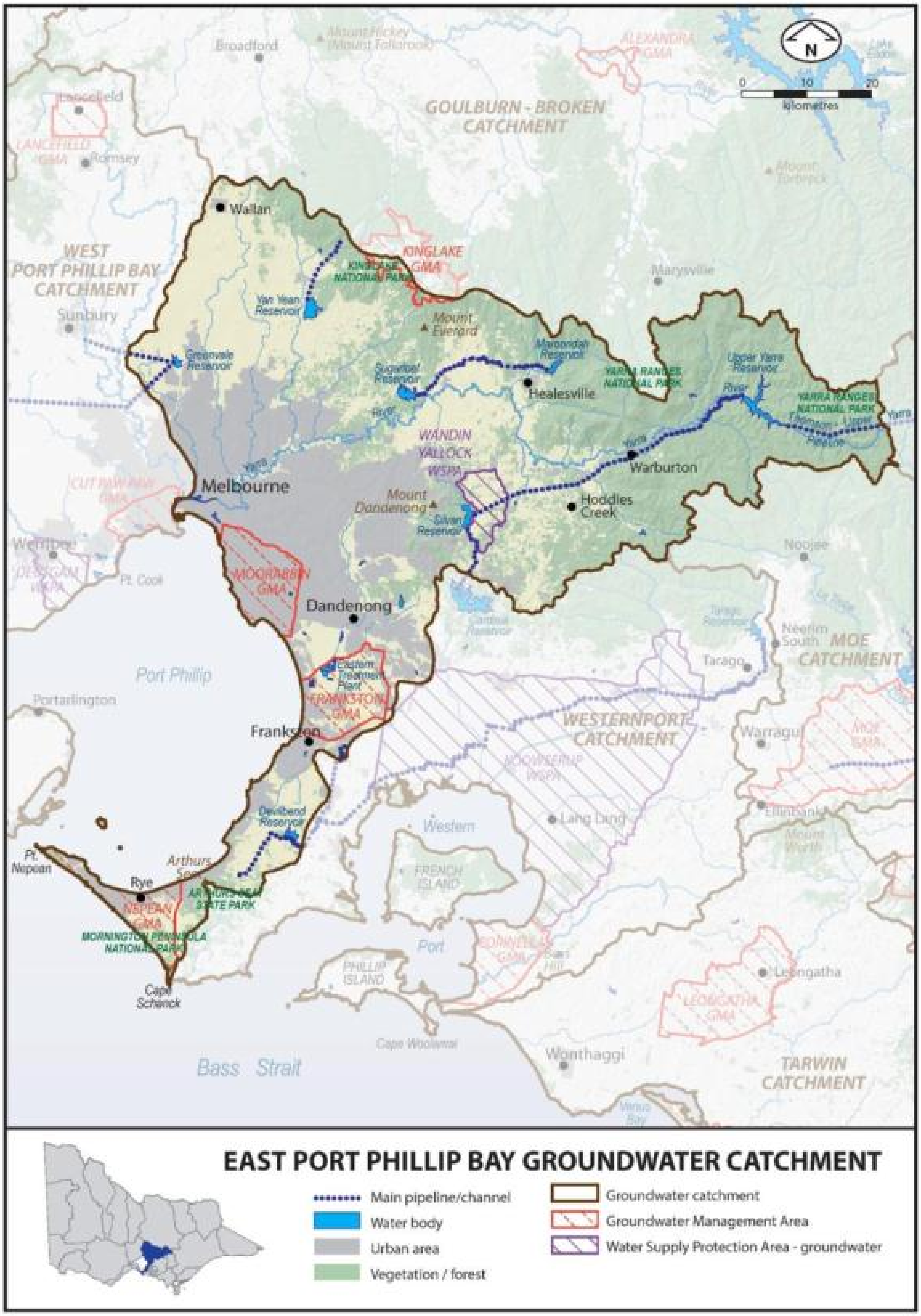
Table 7.15-3 Urban groundwater use

Town supplied	Licensed volume (ML)	Metered use 2012–13 (ML)	Metered use 2011–12 (ML)
Corinella/Grantville	490	41	1
Lang Lang	119	0	3
Total	**609**	**41**	**4**

7.16 East Port Phillip Bay groundwater catchment

The East Port Phillip Bay groundwater catchment is located in southern Victoria (Figure 7.16-1) and overlaps parts of the Yarra and Bunyip surface river basins. Neighbouring groundwater catchments are the West Port Phillip Bay to the west, Goulburn–Broken to the north and Westernport and Moe to the east.

Figure 7.16-1 Map of the East Port Phillip Bay groundwater catchment



7.16.1 Groundwater resources overview

Groundwater resources in the East Port Phillip Bay groundwater catchment are managed by Southern Rural Water (SRW), which licenses bore construction and groundwater extractions under take and use licences.

The East Port Phillip Bay catchment contains the Frankston GMA, Kinglake GMA, Moorabbin GMA, Nepean GMA, Wandin Yallock WSPA, a small part of Koo Wee Rup WSPA and unincorporated areas. Groundwater resources supply licences and domestic and stock use. Groundwater in the East Port Phillip Bay catchment is mainly used for irrigation purposes, with some bores licensed for industrial and commercial purposes. Groundwater resources are not used for urban supply in the East Port Phillip Bay catchment.

The trends for groundwater levels of GMUs in this catchment are generally categorised as increasing or stable, the same as in 2011–12.

7.16.2 Groundwater entitlements and use

Licensed groundwater entitlements and use from GMUs are presented in Table 7.16-1.

Groundwater use across the East Port Phillip Bay catchment increased slightly in 2012–13 compared to 2011–12.

Table 7.16-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
Frankston GMA	50-200	1,671	218	119
Moorabbin GMA	All depths	2,614	1,053	547
Nepean GMA	All depths	6,110	3,159	3,152
Koo Wee Rup WSPA	All depths	111	0	0
Wandin Yallock WSPA	All depths	3,008	450	285
Unincorporated areas(1)	-	11,442	2,295	n/a
Total(2)		**24,956**	**7,175**	**4,103**

Notes:

(1) Information for the total licensed groundwater use within unincorporated areas in 2011–12 is not available at the catchment scale

(2) The reported total volume of licensed groundwater use for 2011–12 does not include that used in unincorporated areas (see Note 1).

An estimate of domestic and stock groundwater use is provided in Table 7.16-2. A number of groundwater licences also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed volume in Table 7.16-1.

Table 7.16-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 1.5 ML per bore) (ML)
Frankston GMA	116	174
Kinglake GMA(1)	42	84
Moorabbin GMA	299	449
Nepean GMA(2)	2,125	2,125
Koo Wee Rup WSPA	1	2
Wandin Yallock WSPA	78	117
Unincorporated areas – Southern Rural Water	1,314	1,971
Total	3,975	4,922

Notes:

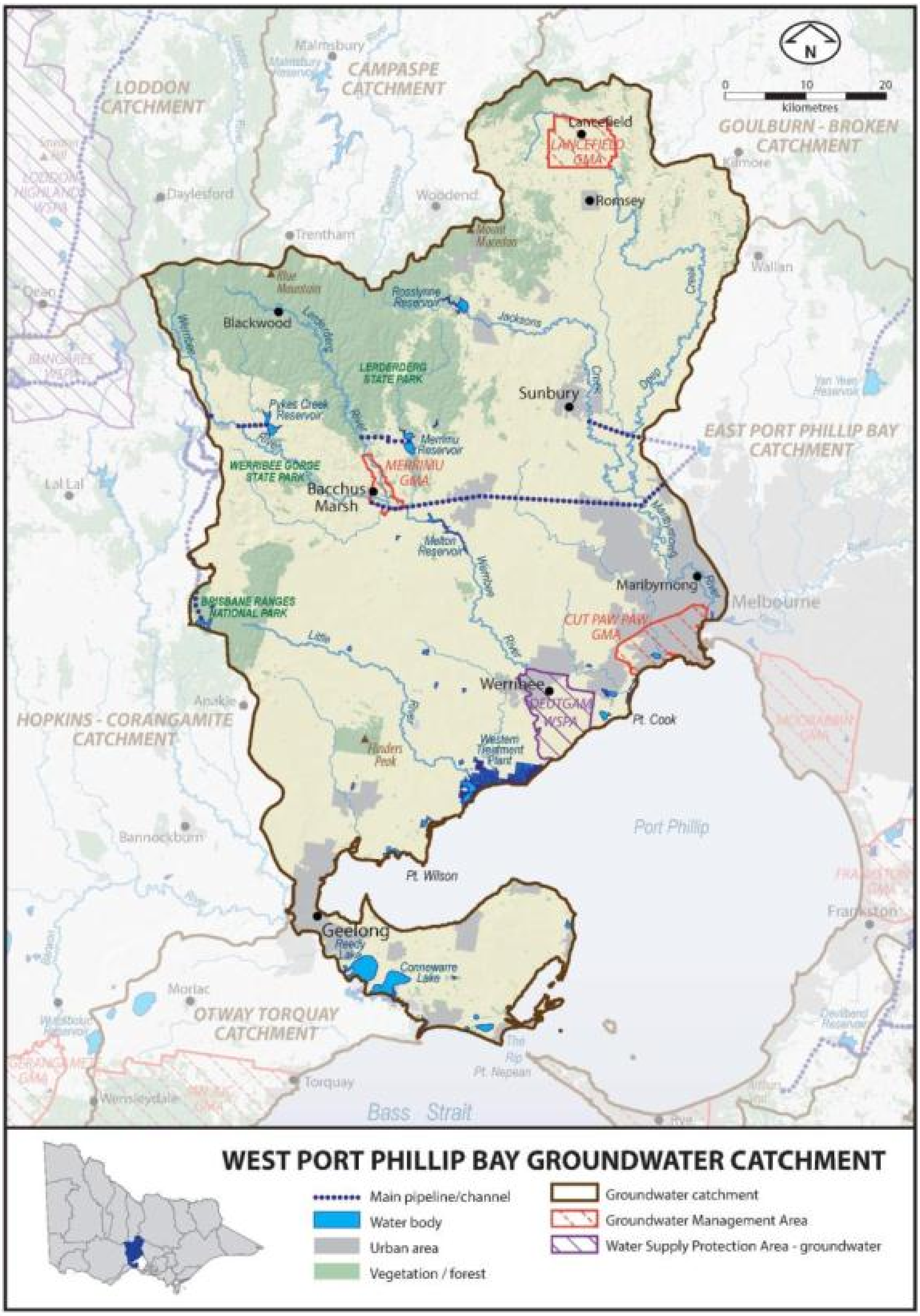
(1) Estimated domestic and stock use for Kinglake GMA calculated using a factor of 2 ML per bore.

(2) Estimated domestic and stock use for Nepean GMA calculated using a factor of 1 ML per bore.

7.17 West Port Phillip Bay groundwater catchment

The West Port Phillip Bay groundwater catchment is located in the Port Phillip groundwater basin in southern Victoria (Figure 7.17-1). Neighbouring groundwater catchments are the Hopkins-Corangamite to the west, Loddon, Campaspe and Goulburn–Broken to the north and East Port Phillip Bay to the east.

Figure 7.17-1 Map of the West Port Phillip Bay groundwater catchment



7.17.1 Groundwater resources overview

Groundwater resources in the West Port Phillip Bay groundwater catchment are managed by Southern Rural Water. The catchment contains the Cut Paw Paw GMA, Lancefield GMA, Merrimu GMA, Deutgam WSPA and parts of unincorporated areas. Groundwater resources supply licences and domestic and stock use in the area and are also available to supply the towns of Blackwood, Lancefield and Romsey.

Groundwater level trends were categorised as increasing in the Deutgam WSPA and stable in Lancefield GMA, while the trend for Merrimu GMA was categorised as declining. Insufficient observation bores were available to determine a trend for Cut Paw Paw GMA.

7.17.2 Groundwater entitlements and use

A summary of the licensed entitlements and use for GMUs are shown in Table 7.17-1.

Table 7.17-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
Cut Paw Paw GMA	>50	515	208	84
Lancefield GMA	All depths	1,378	224	106
Merrimu GMA	<=30	440	28	145
Deutgam WSPA	<=30	5,082	1,389	979
Unincorporated areas(1)	-	7,828	959	n/a
Total(2)		**15,243**	**2,808**	**1,314**

Notes:

(1) Information for the total licensed groundwater use within unincorporated areas in 2011–12 is not available at the catchment scale

(2) The reported total volume of licensed groundwater use for 2011–12 does not include that used in unincorporated areas (see Note 1).

An estimate of domestic and stock groundwater use is provided in Table 7.17-2. A number of groundwater licences also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed volume in Table 7.17-1.

Table 7.17-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 1.5 ML per bore) (ML)
Lancefield GMA	61	92
Merrimu GMA	8	12
Deutgam WSPA	125	188
Unincorporated areas – Southern Rural Water	1,389	2,084
Total	1,583	2,376

Within the West Port Phillip Bay catchment, groundwater is an option for urban water supply to the townships of Blackwood, Lancefield and Romsey. As shown in Table 7.17-3, only Lancefield drew on groundwater for urban use in 2012–13.

Table 7.17-3 Urban groundwater use

Town supplied	Licensed volume (ML)	Metered use 2012–13 (ML)	Metered use 2011–12 (ML)
Blackwood	50	0	0
Lancefield	294	130	0
Romsey	600	0	0
Total	**944**	**130**	**0**

7.18 Otway–Torquay groundwater basin

The Otway–Torquay groundwater basin is located in south-west Victoria and extends offshore beneath the Southern Ocean. It borders the Goulburn–Murray basin and the Wimmera–Mallee basin to the north and the Central basins to the east.

The upper aquifers of the Otway–Torquay groundwater basin are widely located across the south-west of the basin, and include volcanic aquifers, a significant sand and limestone aquifer, and a number of 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 predominantly through leakage from the upper aquifer to the middle aquifer, and also occurs through baseflow to streams. The upper aquifers interact closely with surface water such as rivers, creeks, drainage lines, wetlands, swamps and lakes.

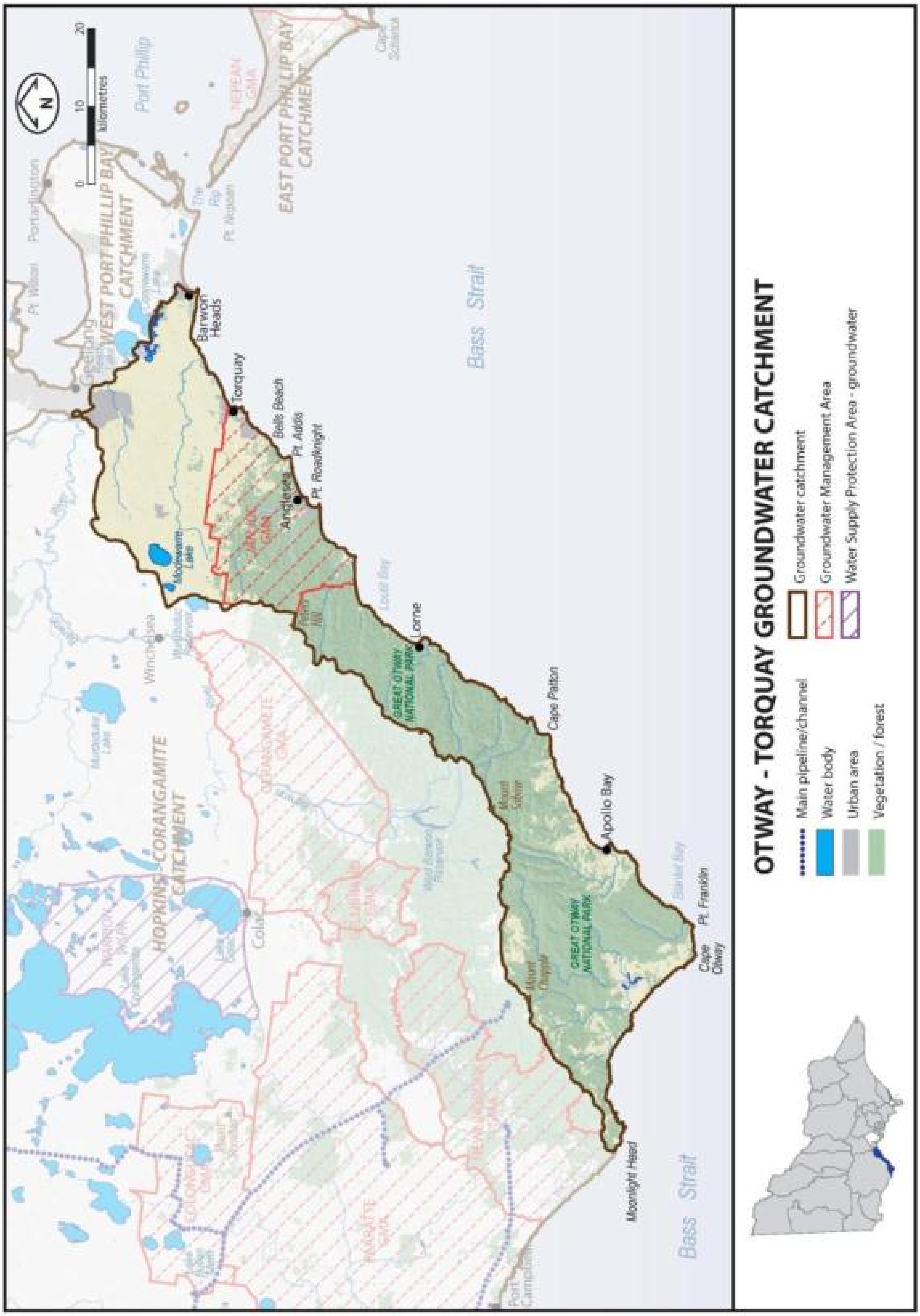
Middle aquifers occur across the southern part of the region, stretching from the South Australian border near the Grampians across to Port Campbell. There are two main levels of middle aquifers known as the upper middle aquifers and lower middle aquifers, which are separated by a thick aquitard of impermeable 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; the exception is 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 both the upper middle and lower middle aquifers is most likely to occur along the coastline or into other formations; additionally there is some surface discharge to swamps and leakage in low lying areas.

The lower aquifers occur across the south of the basin, stretching from the South Australian border south of the Grampians across to Port Phillip Bay. In many parts of the basin they are overlain by hundreds of metres of sediment, however in the basin's north and around the Otway Ranges they occur at or near the surface as unconfined aquifers. The lower aquifers mainly comprise alternating layers of sand and clay, however some are sand aquifers with minor amounts of silt and brown coal. Near the coast, the aquifers are under very high pressure from the weight of the large amount of overlying sediments and water. As a result of the pressure, the groundwater from these aquifers can reach temperatures of 50 – 60°C. The lower aquifers are underlain by basement rock comprised mainly of siltstone, which reaches the surface around the basin margin to form the Grampians, the Otway Ranges and the Central Highlands. The lower aquifers of the Otway–Torquay basin are one of the most substantial and reliable groundwater sources in Victoria due to their massive storage. However, their relatively small annual recharge restricts their potential. Groundwater around the Otway Ranges discharges offshore, while further inland the lower aquifer groundwater primarily discharges to other aquifers.

7.19 Otway–Torquay groundwater catchment

The Otway–Torquay groundwater catchment (Figure 7.19-1) is located in the Otway–Torquay groundwater basin in south-western Victoria and falls within the Otway Coast surface water basin. Much of the catchment boundary is along the coastline; neighbouring groundwater catchments are Hopkins–Corangamite to the north-west and West Port Phillip to the north-east.

Figure 7.19-1 Map of the Otway–Torquay groundwater catchment



7.19.1 Groundwater resources overview

Groundwater resources in the Otway–Torquay groundwater catchment are managed by Southern Rural Water (SRW). SRW is responsible for issuing bore construction licences and for the licensing of groundwater extractions under take and use licences.

The Otway–Torquay catchment contains the Jan Juc GMA and unincorporated areas. Groundwater resources supply licences and domestic and stock use in the area and are also available to supply the city of Geelong.

The groundwater level trend in the Jan Juc GMA was categorised as declining throughout 2012–13.

7.19.2 Groundwater entitlements and use

A summary of licensed groundwater entitlements and use from GMUs within the Otway–Torquay catchment are presented in Table 7.19-1. Total groundwater use for 2012–13 decreased compared to 2011–12, largely due to Barwon Water not using groundwater resources during the year. The majority of use is attributable to the Alcoa mine at Anglesea.

Table 7.19-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
Jan Juc GMA	Zone 1: All depths Zone 2: Eastern View formation	11,250	3,505	7,806
Unincorporated areas[1]	-	90	0	n/a
Total[2]		**11,340**	**3,505**	**7,806**

Notes:

(1) Information for the total licenced groundwater use within unincorporated areas in 2011–12 is not available at the catchment scale.

(2) The reported total volume of licensed groundwater use for 2011–12 does not include that used in unincorporated areas (see Note 1).

An estimate of domestic and stock groundwater use is provided in Table 7.19-2. A number of groundwater licences also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed volume in Table 7.19-1.

Table 7.19-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 1.5 ML per bore) (ML)
Jan Juc GMA	4	6
Unincorporated areas – Southern Rural Water	50	75
Total	54	81

In the Otway–Torquay catchment, groundwater is used for urban water supply to the city of Greater Geelong. The licensed entitlements and metered use for these groundwater supplies are provided in Table 7.19-3. 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, however it cannot exceed an average of 7,000 ML per year over any five-year period. The bulk entitlement supplements supply to homes and businesses in the Greater Geelong region. No groundwater was extracted under this bulk entitlement in 2012–13.

Table 7.19-3 Urban groundwater use

Town supplied	Licensed volume (ML)	Metered use 2012–13 (ML)	Metered use 2011–12 (ML)
Greater Geelong (Anglesea borefield)[1]	7,000	0	4,019
Total	**7,000**	**0**	**4,019**

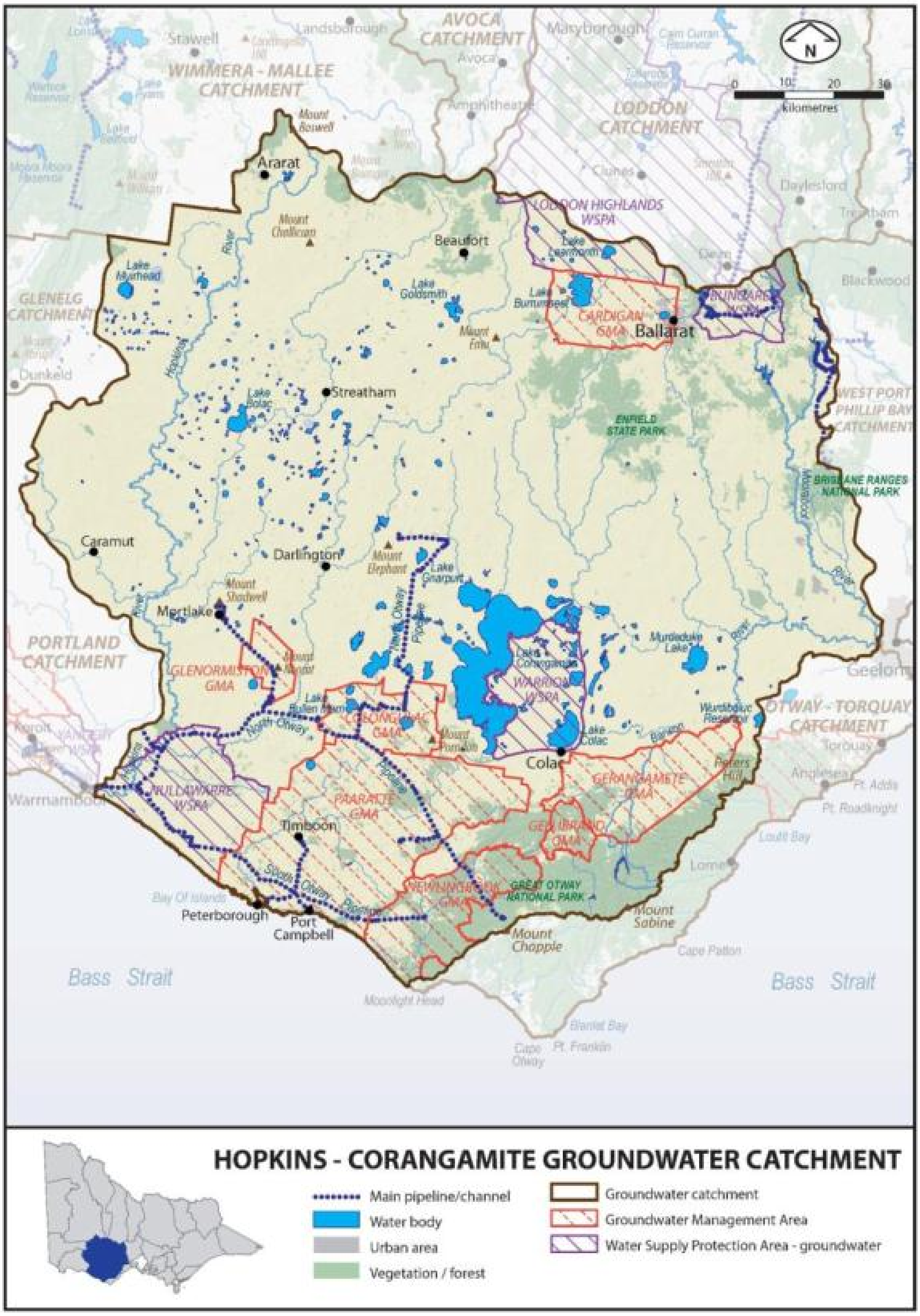
Note:

(1) The bulk entitlement for Greater Geelong (Anglesea, Torquay, Lorne) is split into Greater Geelong (Anglesea Bore Field) located in the Otway-Torquay catchment, and Greater Geelong (Barwon Downs Bore Field) located in the Hopkins-Corangamite catchment. The *Bulk Entitlement (Anglesea Groundwater) Order 2009* allows Barwon Water to extract a maximum of 10,000 ML of groundwater from the Anglesea borefield in any given year, however it cannot exceed an average of 7,000 ML per year over any five-year period.

7.20 Hopkins–Corangamite groundwater catchment

The Hopkins–Corangamite groundwater catchment (Figure 7.20-1) is located in the Otway-Torquay groundwater basin in south-western Victoria. Neighbouring groundwater catchments are Portland and Glenelg to the west, Wimmera–Mallee, Avoca and Loddon to the north, West Port Phillip Bay to the east and Otway–Torquay to the south-east.

Figure 7.20-1 Map of the Hopkins–Corangamite Groundwater Catchment



7.20.1 Groundwater resources overview

Groundwater resources in the Hopkins–Corangamite groundwater catchment are managed by Southern Rural Water (SRW). SRW is responsible for issuing licenses for groundwater use and bore construction.

The Hopkins–Corangamite catchment contains a number of Groundwater Management Units: Bungaree WSPA, Cardigan GMA, Colongulac GMA, Gellibrand GMA, Gerangamete GMA, Glenormiston GMA, Newlingrook GMA, Nullawarre WSPA, Paaratte GMA and Warrion WSPA. It also contains a small part of the Loddon-Highlands WSPA, the majority of which is within the Loddon groundwater catchment.

Groundwater resources in the Hopkins–Corangamite catchment are predominantly used for urban supply and irrigation.

In 2012–13, the five-year groundwater level trend for most GMUs in the Hopkins–Corangamite catchment was categorised as increasing to stable, with the exception of the Gerangamete GMA which was categorised as declining.

7.20.2 Groundwater entitlements and use

A summary of the licensed entitlements and use for GMUs are shown in Table 7.20-1.

Table 7.20-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
Cardigan GMA	All depths	3,887	563	294
Colongulac GMA	All depths	4,068	1,215	1,060
Gerangamete GMA(1)	>60	20,000	0	0
Glenormiston GMA	<=60	2,691	1,167	1,261
Newlingrook GMA	All depths	1,958	326	24
Paaratte GMA	>120	3,212	345	322
Bungaree WSPA(2)	All depths	5,293	2,729	1,973
Nullawarre WSPA	<=250	22,635	11,583	10,616
Warrion WSPA	All depths	14,081	4,530	3,497
Unincorporated areas(3)	-	15,515	5,162	n/a
Total(4)		**93,340**	**27,620**	**19,047**

Notes:

(1) The PCV for the Gerangamete GMA has the following limits: 20,000 ML in one year; 80,000 ML over 10 years; and 400,000 ML over 100 years. The entitlement limit in Table 7.20-1 represents the single year limit, however compliance would also need to be assessed at the 10-year and 100-year level.

(2) The licensed entitlement volume for Bungaree WSPA includes a 55 ML mineral water licence.

(3) Information for the total licensed groundwater use within unincorporated areas in 2011–12 is not available at the catchment scale.

(4) The reported total volume of licensed groundwater use for 2011–12 does not include that used in unincorporated areas (see Note 3).

An estimate of domestic and stock groundwater use is provided in Table 7.20-2. A number of groundwater licences also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed use in Table 7.20-1.

Hopkins–Corangamite groundwater catchment

Table 7.20-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 1.5 ML per bore) (ML)
Cardigan GMA	96	144
Colongulac GMA	124	186
Gellibrand GMA	2	3
Gerangamete GMA	2	3
Glenormiston GMA	96	144
Newlingrook GMA	7	11
Paaratte GMA	2	3
Bungaree WSPA	201	302
Loddon Highlands WSPA(1)	108	216
Nullawarre WSPA	942	1,413
Warrion WSPA	304	456
Unincorporated areas – Southern Rural Water	1,630	2,445
Total	3,514	5,326

Note:

(1) Estimated domestic and stock use calculated using a factor of 2 ML per bore.

In the Hopkins–Corangamite catchment, groundwater is available for urban water supply to the townships of Beaufort, Caramut, Darlington, Dean, Mortlake, Port Campbell, Timboon and Peterborough, Streatham, areas around Carlisle, as well as the cities of Ballarat and Geelong. Licensed entitlements and metered use for urban supply are presented in Table 7.20-3.

Table 7.20-3 Urban groundwater use

Town supplied	Licensed volume (ML)	Metered use 2012–13 (ML)	Metered use 2011–12 (ML)
Ballarat – Bungaree Bore	120	0	54
Ballarat West (1)	1,700	374	129
Beaufort	200	0	0
Caramut	50	31	26
Darlington	10	3	2
Dean	30	22	15
Greater Geelong (Barwon Downs borefield)(2)	8,000	0	0
Mortlake (part)	335	31	29
Otway System (Carlisle)	1,800	263	4
Port Campbell, Timboon and Peterborough	3,159	345	322
Streatham	60	38	44
Total	**15,464**	**1,107**	**625**

Notes:

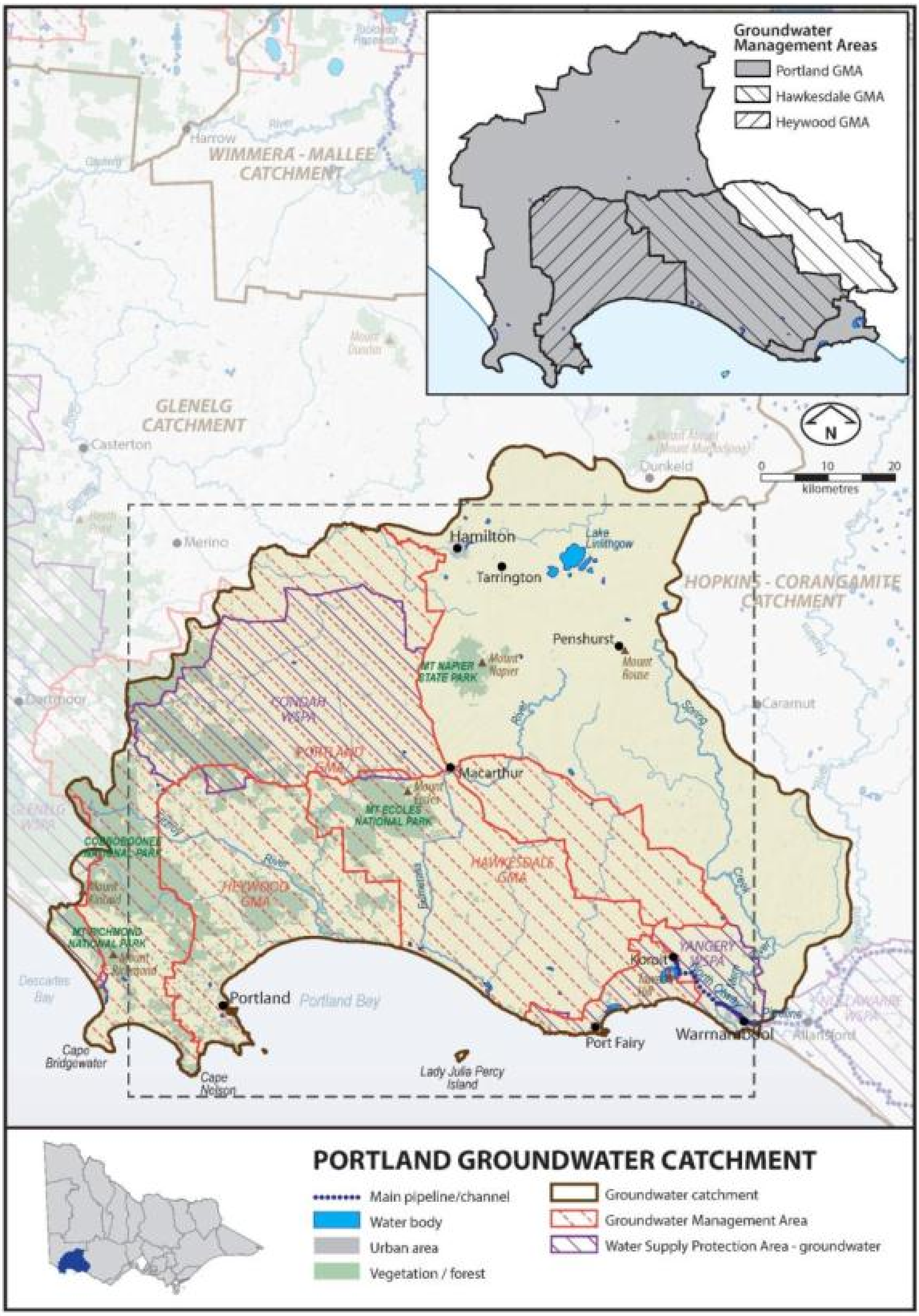
(1) Volume of the licence for Ballarat is 1,700 ML, but up to 3,000 ML may be taken in any one year during a water shortage.

(2) The bulk entitlement for Greater Geelong (Anglesea, Torquay, Lorne) is split into Greater Geelong (Barwon Downs borefield) located in the Hopkins-Corangamite catchment, and Greater Geelong (Anglesea borefield) located in the Otway–Torquay catchment. The *Bulk Entitlement (Anglesea Groundwater) Order 2009* allows Barwon Water to extract 8,000 ML per year, however in a drought year up to 20,000 ML may be extracted.

7.21 Portland groundwater catchment

The Portland groundwater catchment (Figure 7.21-1) is located in the Otway–Torquay groundwater basin in south-west Victoria. It overlaps both the Goulburn and Broken river basins. Neighbouring groundwater catchments are Glenelg to the west and Hopkins–Corangamite to the east.

Figure 7.21-1 Map of the Portland groundwater catchment



Portland groundwater catchment

7.21.1 Groundwater resources overview

Groundwater resources in the Portland groundwater catchment are managed by Southern Rural Water, which is responsible for issuing licences for groundwater use and bore construction.

The Portland groundwater catchment contains the Condah WSPA, Hawkesdale GMA, Heywood GMA, Portland GMA and Yangery WSPA and unincorporated areas. It also contains part of the Nullawarre WSPA, which extends into the Hopkins–Corangamite catchment.

Groundwater resources supply licences, domestic and stock use and a number of towns in the area. The majority of groundwater use in the Portland groundwater catchment is for irrigation and urban use and, to a lesser extent, for dairy wash and industrial supply.

In 2012–13, the groundwater level trends in the GMUs of the Portland groundwater catchment were generally categorised as stable or rising.

7.21.2 Groundwater entitlements and use

Licensed groundwater entitlements and use from GMUs are presented in Table 7.21-1.

Groundwater use within the catchment increased slightly in 2012–13 compared to 2011–12.

Table 7.21-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
Hawkesdale GMA	As per plan	12,454	5,939	5,630
Heywood GMA	≤70	7,006	1,726	1,749
Portland GMA	>200	7,794	2,692	2,639
Condah WSPA	70-200	7,475	3,380	2,358
Nullawarre WSPA	≤250	106	31	14
Yangery WSPA	≤100	14,343	3,059	3,006
Unincorporated areas(1)	-	7,152	886	n/a
Total(2)		**56,330**	**17,713**	**15,396**

Notes:

(1) Information for the total licensed groundwater use within unincorporated areas in 2011–12 is not available at the catchment scale.

(2) The reported total volume of licensed groundwater use for 2011–12 does not include that used in unincorporated areas (see Note 1).

An estimate of domestic and stock groundwater use is provided in Table 7.21-2. A number of groundwater licences also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed volume in Table 7.21-1.

Table 7.21-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 1.5 ML per bore) (ML)
Hawkesdale GMA	1,117	1,676
Heywood GMA	1,185	1,778
Portland GMA	3	5
Condah WSPA	49	74
Glenelg WSPA	13	20
Yangery WSPA	826	1,239
Unincorporated areas – Southern Rural Water	1,505	2,258
Total	4,698	7,050

Groundwater is used as an urban water supply for some townships in the Portland groundwater catchment. The licensed entitlements and metered use for these supplies are presented in Table 7.21-3.

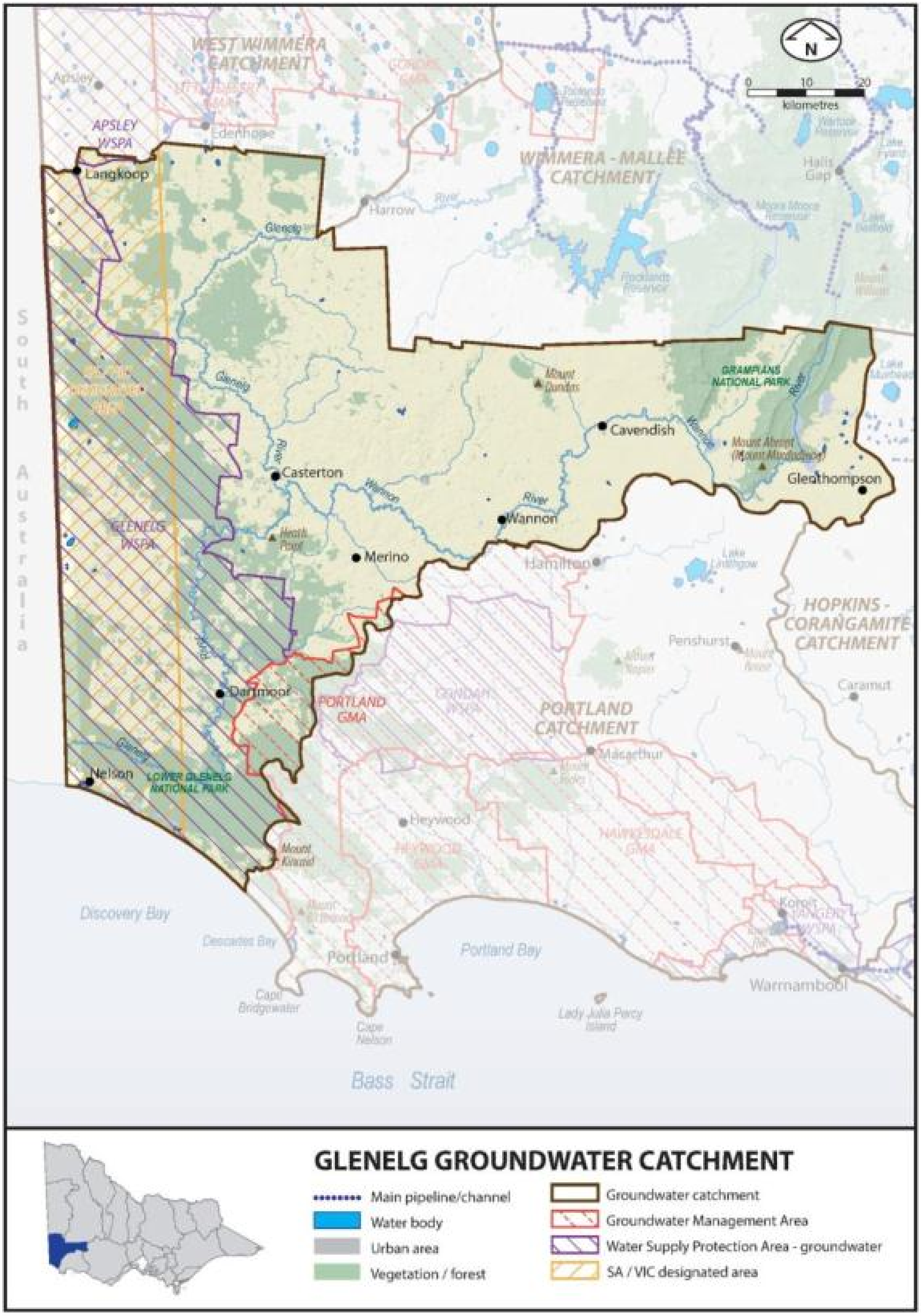
Table 7.21-3 Urban groundwater use

Town supplied	Licensed volume (ML)	Metered use 2012–13 (ML)	Metered use 2011–12 (ML)
Hamilton, Tarrington, Dunkeld	1,102	1	3
Heywood	333	179	172
Koroit	524	4	2
Macarthur	130	38	34
Penshurst	250	100	111
Port Fairy	1,026	646	634
Portland	6,222	1,867	1,832
Warrnambool, Allansford and Koroit (part)	750	383	446
Total	**10,337**	**3,218**	**3,234**

7.22 Glenelg groundwater catchment

The Glenelg groundwater catchment (Figure 7.22-1) is located in the Otway–Torquay basin in western Victoria, and contains the Glenelg river basin and part of the Millicent Coast basin. The Victorian/South Australian border forms the western boundary of the Glenelg groundwater catchment, and the area that extends 20 kilometres east from the border forms part of the South Australia/Victoria Designated Area. Neighbouring catchments are the Portland groundwater catchment to the south-east, the Hopkins–Corangamite catchment in the east and the West Wimmera and Wimmera–Mallee catchments to the north.

Figure 7.22-1 Map of the Glenelg groundwater catchment



7.22.1 Groundwater resources overview

Groundwater resources in the Glenelg groundwater catchment are managed by Southern Rural Water (SRW), which is responsible for issuing licenses for groundwater use and bore construction. The part of the Glenelg groundwater catchment that falls within the Victorian/South Australian Border Designated Area is managed under the *Border Groundwaters Agreement*, with management responsibilities shared between SRW and South Australia's Department of Water, Land and Biodiversity Conservation.

The Glenelg groundwater catchment contains the Glenelg WSPA and unincorporated areas, along with very small parts of the Portland GMA and West Wimmera GMA. Groundwater resources supply licences, domestic and stock use and the townships of Casterton, Dartmoor and Merino.

The groundwater level trend in the Glenelg WSPA was categorised as stable throughout 2012–13.

7.22.2 Groundwater entitlements and use

A summary of the licensed entitlements and use for GMUs are presented in Table 7.22-1.

Table 7.22-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
Glenelg WSPA	All depths	32,659	8,938	7,004
Unincorporated areas(1)	-	2,111	279	n/a
Total(2)		**34,770**	**9,217**	**7,004**

Notes:

(1) Information for the total licensed groundwater use within unincorporated areas in 2011–12 is not available at the catchment scale.

(2) The reported total volume of licensed groundwater use for 2011–12 does not include that used in unincorporated areas (see Note 1).

An estimate of domestic and stock groundwater use is provided in Table 7.22-2. A number of groundwater licences also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed volume in Table 7.22-1.

Table 7.22-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 1.5 ML per bore) (ML)
Glenelg WSPA	1,119	1,679
West Wimmera GMA(1)	3	6
Unincorporated areas	298	447
Total	1,420	2,132

Note:

(1) Estimated domestic and stock use for this GMA is calculated using a factor of 2 ML per bore.

Groundwater is available for urban water supply to the townships of Casterton, Dartmoor and Merino. The licensed entitlements and metered use for these supplies is presented in Table 7.22-3.

Table 7.22-3 Urban groundwater use

Town supplied	Licensed volume (ML)	Metered use 2012–13 (ML)	Metered use 2011–12 (ML)
Casterton	1,000	506	469
Dartmoor	150	25	17
Merino	100	0	0
Total	**1,250**	**531**	**486**

7.23 Wimmera Mallee groundwater basin

The Wimmera Mallee groundwater basin is located in north-west Victoria. It borders the Otway–Torquay groundwater basin to the south and the Goulburn Murray groundwater basin to the east. The Wimmera Mallee groundwater basin also forms part of the Murray river basin in Victoria. The Wimmera Mallee region is dominated in its northern plains by sedimentary aquifers and in the south by fractured rock highlands extending along the Great Dividing Range.

As depth increases, the major aquifers in the region are:

- Upper Tertiary Aquifer – including the Parilla Sands Aquifer, also known as the Pliocene Sands Aquifer
- Mid Tertiary Aquifer – including the Murray Group Limestone Aquifer
- Lower Tertiary Aquifer – primarily consisting of the Tertiary Confined Sands Aquifer, also known as the Renmark Group Aquifer.

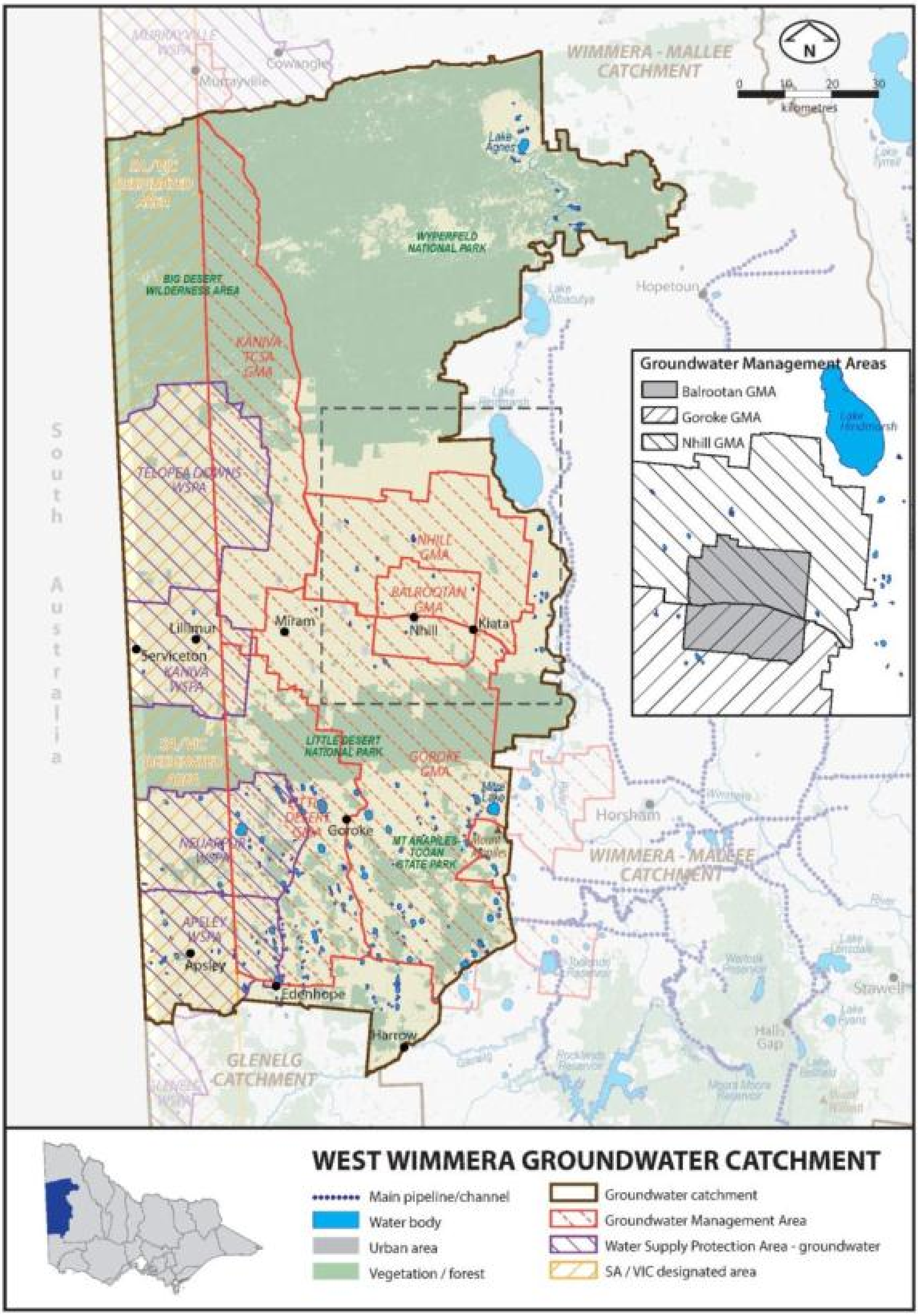
In most areas the aquifers are all considered to be connected, with thin aquitards between the aquifers in part or all of the catchment. The exception to this is the Renmark Group Aquifer in the West Wimmera GMA, which is considered to be disconnected from the water above it.

The majority of groundwater is extracted from the Murray Group and deeper Renmark Group aquifers along the border with South Australia, and from the fractured basement rock aquifers of the Grampians. The water in the Murray Group and Renmark Group aquifers 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.

7.24 West Wimmera groundwater catchment

The West Wimmera groundwater catchment (Figure 7.24-1) is located in western Victoria and contains portions of the Mallee, Wimmera and Millicent Coast river basins. The Victorian/South Australian border forms the western boundary of the West Wimmera groundwater catchment, and the area that extends 20 kilometres east from the border forms part of the South Australia/Victoria Designated Area. Neighbouring groundwater catchments are the Wimmera–Mallee catchment to the east and Glenelg catchment to the south.

Figure 7.24-1 Map of the West Wimmera groundwater catchment



7.24.1 Groundwater resources overview

Groundwater resources in the West Wimmera catchment are managed by GWMWater, which is responsible for the development and implementation of groundwater management plans. GWMWater issues licenses for groundwater use and bore construction, as well as for surface water licensed diversions. The West Wimmera catchment forms part of the Murray–Darling basin, and groundwater management arrangements are subject to the requirements of the Murray–Darling Basin Plan. The part of the catchment that falls within the Victorian/South Australian Border Designated Area is managed under the *Border Groundwaters Agreement*, with management responsibilities shared between GWMWater and South Australia's Department of Water, Land and Biodiversity Conservation.

The West Wimmera groundwater catchment is covered entirely by the West Wimmera GMA, which replaced the Balrootan, Nhill, Goroke, Kaniva TCSA and Little Desert GMAs, and the Apsley, Kaniva, Neuarpur and Telopea Downs WSPAs.

Groundwater resources supply licenced use, domestic and stock use and the townships of Apsley, Harrow, Miram, Serviceton, Edenhope, Kiata, Goroke, Lillimur and Nhill.

Groundwater level trends are generally categorised as stable in the area, however levels in the western part of the catchment have historically been declining. In response to this, a strategy was proposed to restrict some licensed entitlements to groundwater by 4% per year until levels stabilise. In line with this strategy, licence holders in Neuarpur sub-zone 1 were restricted to 92% of their licence volume during 2012–13.

7.24.2 Groundwater entitlements and use

A summary of the licensed entitlements and use from GMUs within the West Wimmera groundwater catchment is shown in Table 7.24-1.

Table 7.24-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
West Wimmera GMA	All depths	53,327	17,866	15,601
Total		**53,327**	**17,866**	**15,601**

An estimate of domestic and stock groundwater use is provided in Table 7.24-2. A number of groundwater licenses also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed volume in Table 7.24-1.

Table 7.24-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 2.0 ML per bore) (ML)
West Wimmera GMA	623	1,246
Unincorporated areas	1	2
Total	624	1,248

Groundwater is available for urban water supply to the townships of Apsley, Edenhope, Goroke, Harrow, Kaniva, Kiata, Lillimur, Miram, Nhill and Serviceton. The licensed entitlements and metered use for these supplies are presented in Table 7.24-3.

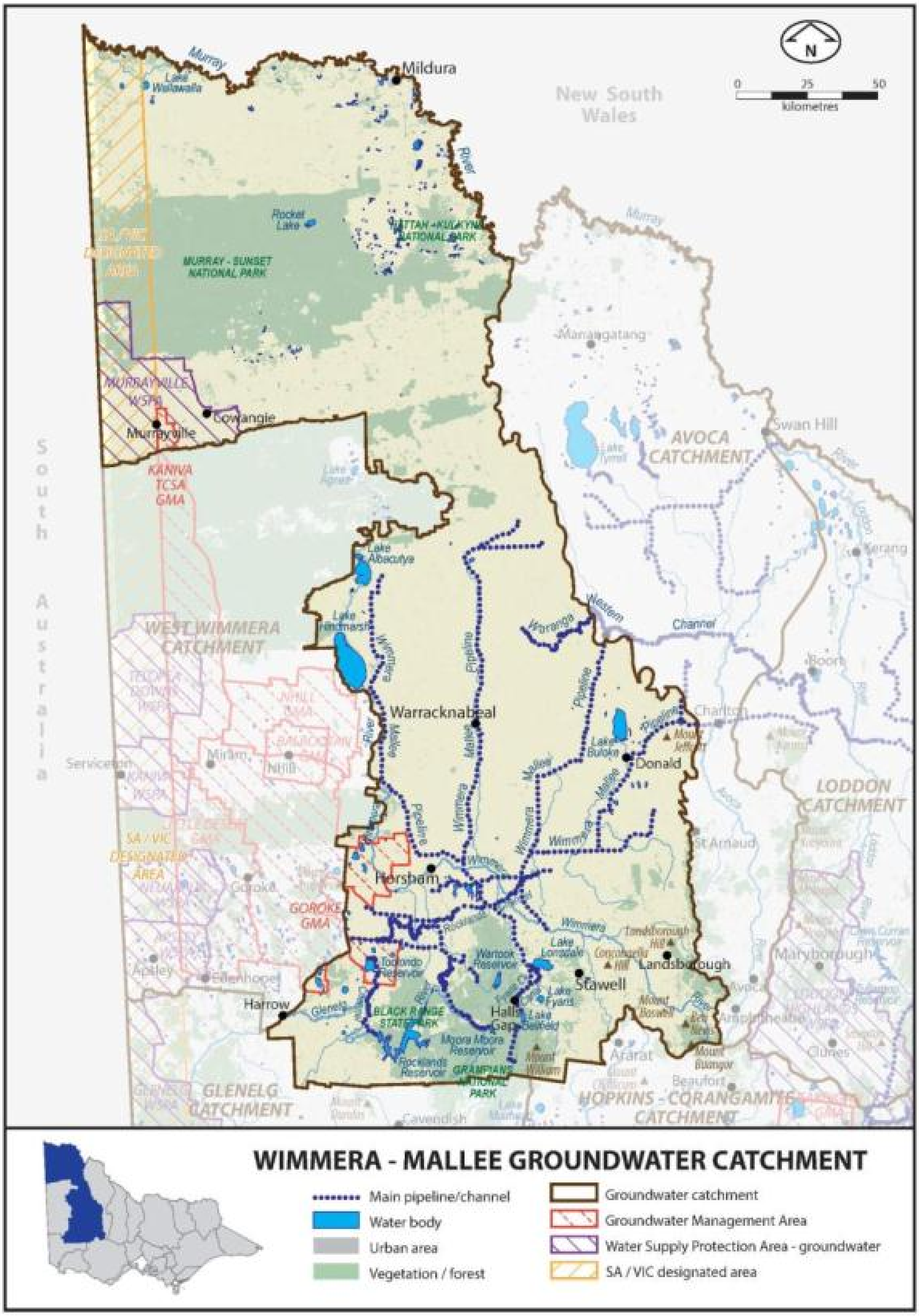
Table 7.24-3 Urban groundwater use

Town supplied	Licensed volume (ML)	Metered use 2012–13 (ML)	Metered use 2011–12 (ML)
Apsley	40	33	26
Edenhope	250	145	148
Goroke	86	62	54
Harrow	54	54	49
Kaniva	600	232	191
Kiata	40	0	5
Lillimur	32	8	8
Miram	7	2	2
Nhill	1,000	450	386
Serviceton	25	9	9
Total	**2,134**	**995**	**878**

7.25 Wimmera–Mallee groundwater catchment

The Wimmera–Mallee catchment (Figure 7.25-1) is located in north-west Victoria and overlaps the Mallee river basin in its north and Wimmera river basin in its south. The Victorian/South Australian border forms the north-western boundary of the Wimmera–Mallee groundwater catchment, and the area that extends 20 kilometres east from the border forms part of the South Australia/Victoria Designated Area. Neighbouring groundwater catchments are the West Wimmera catchment to the west, the Avoca catchment to the east and the Glenelg and Hopkins–Corangamite catchments to the south.

Figure 7.25-1 Map of the Wimmera–Mallee groundwater catchment



7.25.1 Groundwater resources overview

Groundwater resources in the Wimmera–Mallee catchment are managed by GWMWater, which is responsible for the development and implementation of groundwater management plans. GWMWater issues licences for groundwater use and bore construction, as well as for surface water diversions. 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. The part of the Wimmera–Mallee groundwater catchment that falls within the Victorian/South Australian Border Designated Area is managed under the *Border Groundwaters Agreement*, with management responsibilities shared between GWMWater and South Australia's Department of Water, Land and Biodiversity Conservation.

The Wimmera–Mallee catchment contains the Murrayville WSPA and unincorporated areas. Groundwater resources supply licences, domestic and stock use and also the townships of Cowangie, Horsham, Mt Zero, Landsborough and Murrayville. Groundwater resources from the Wimmera–Mallee catchment also supply the township of Willaura, though the town itself is located outside the catchment.

The groundwater level trend in the Murrayville WSPA is generally categorised as stable and in line with management objectives.

7.25.2 Groundwater entitlements and use

Licensed groundwater entitlements and use from GMUs are presented in Table 7.25-1.

Table 7.25-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
Murrayville WSPA	70-200	9,634	5,568	4,891
Unincorporated areas(1)	-	9,825	2,894	n/a
Total(2)		**19,458**	**8,462**	**4,891**

Notes:

(1) Information for the total licensed groundwater use within unincorporated areas in 2011–12 is not available at the catchment scale.

(2) The reported total volume of licensed groundwater use for 2011–12 does not include that used in unincorporated areas (see Note 1).

An estimate of domestic and stock groundwater use is provided in Table 7.25-2. A number of groundwater licences also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed volume in Table 7.25-1.

Table 7.25-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 2.0 ML per bore) (ML)
Murrayville WSPA	98	196
Unincorporated area – GWMWater	389	778
Total	487	974

Groundwater is used as an urban water supply to the townships of Cowangie, Horsham, Mt Zero, Landsborough, Murrayville and Willaura. The licensed entitlements and metered use for these supplies is presented in Table 7.25-3.

Table 7.25-3 Urban groundwater use

Town supplied	Licensed volume (ML)	Metered use 2012–13 (ML)	Metered use 2011–12 (ML)
Cowangie	40	12	14
Horsham/Mt Zero	800	0	133
Landsborough	150	35	45
Murrayville	475	144	113
Willaura system(1)	220	118	191
Total	**1,685**	**309**	**496**

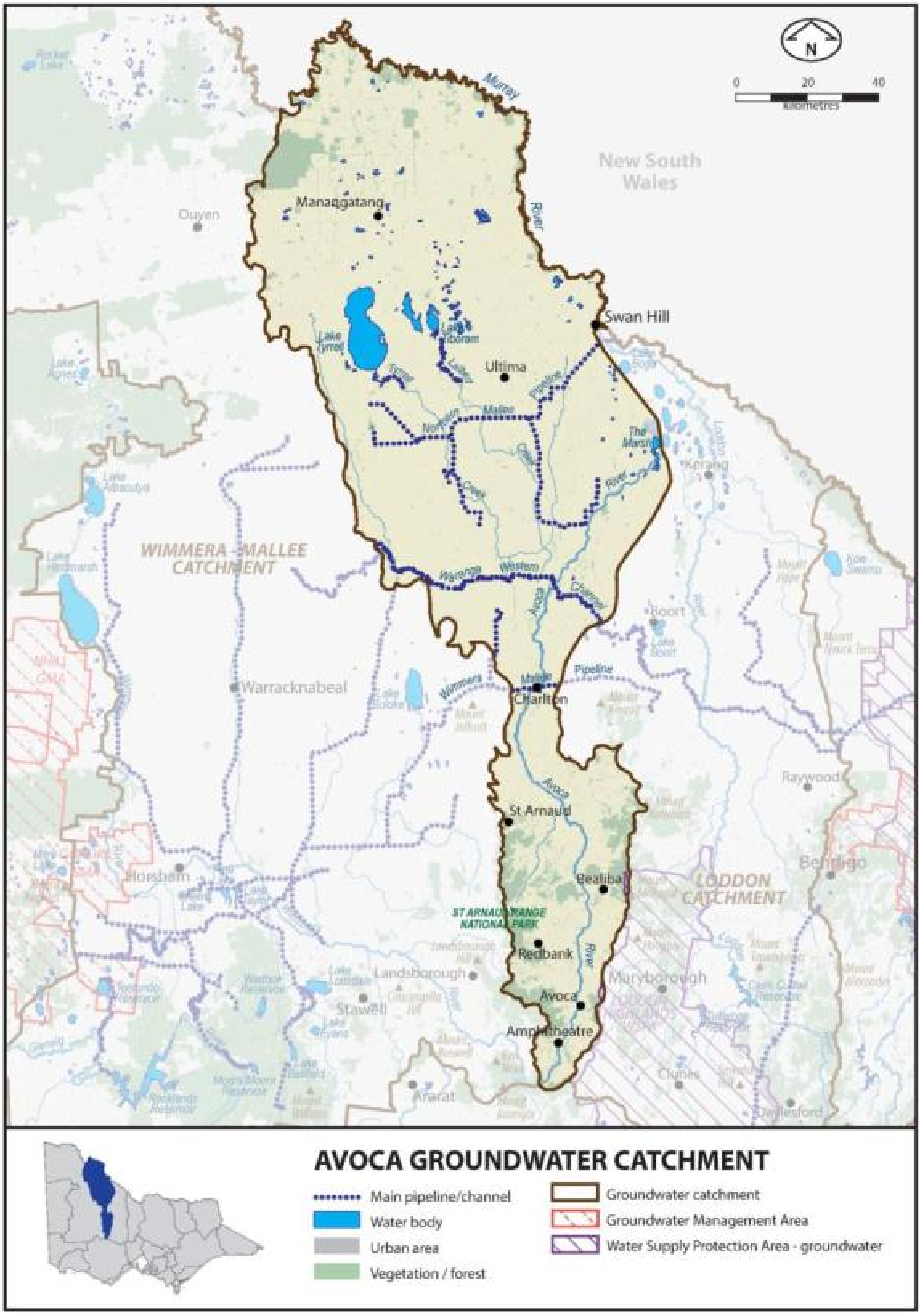
Note:

(1) While the township of Willaura is located in Hopkins-Corangamite groundwater catchment, the bores that supply the town are situated within the Wimmera–Mallee catchment in Mafeking.

7.26 Avoca groundwater catchment

The Avoca groundwater catchment is located in north-west Victoria (Figure 7.26-1) and contains the Avoca river basin and a portion of the Wimmera basin. Neighbouring groundwater catchments are the Wimmera–Mallee to the west and Loddon to the east.

Figure 7.26-1 Map of the Avoca groundwater catchment



7.26.1 Groundwater resources overview

Groundwater resources in the Avoca catchment are mainly managed by GWMWater, which is responsible for the development and implementation of groundwater management plans. GWMWater also issues licenses for groundwater use and bore construction. Central Highlands Water supplies groundwater for the townships of Amphitheatre, Avoca and Redbank.

The Avoca catchment forms part of the Murray–Darling basin, and groundwater management arrangements are subject to the requirements of the Murray–Darling Basin Plan.

There are no GMAs or WSPAs located within the Avoca catchment.

7.26.2 Groundwater entitlements and use

Licensed groundwater entitlements and use from parts of unincorporated areas are presented in Table 7.26-1.

Table 7.26-1 Licensed groundwater volumes and use

WSPA/GMA	GMA/WSPA aquifer depth limits (m)	Licensed entitlement (ML/year)	Total licensed groundwater use (ML) 2012–13	Total licensed groundwater use (ML) 2011–12
Unincorporated areas	-	5,690	976	n/a
Total		**5,690**	**976**	**n/a**

An estimate of domestic and stock groundwater use is provided in Table 7.25-2. A number of groundwater licences also incorporate domestic and stock use, and in these cases the use from these bores is reported in the licensed volume in Table 7.26-1.

Table 7.26-2 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (assuming 1.5 ML per bore) (ML)
Unincorporated areas	73	146
Total	73	146

Groundwater is used to provide urban water supply to some towns in the Avoca groundwater catchment. The licensed entitlements and metered use for these supplies are presented in Table 7.25-3. Groundwater use for Avoca and Redbank increased slightly in 2012–13 compared to 2011–12, and no groundwater was used for urban supply to Amphitheatre during the year.

Table 7.26-3 Urban groundwater use

Town supplied	Licensed volume (ML)	Metered use 2012–13 (ML)	Metered use 2011–12 (ML)
Amphitheatre	20	0	0
Avoca	250	103	49
Redbank	50	10	0
Total	**320**	**113**	**49**

8 Distribution system water accounts 2012–13

8.1 Overview of methodology

Because distribution systems start where water is taken from a waterway or aquifer, these distribution system accounts include off-stream storages, bulk supply channels, treatment plants and the like, as well as reticulation networks to supply customers.

Sometimes the accounts partition a distribution system into its bulk (or feeder) and reticulation components.

On-stream storages such as Lake Eildon are covered in the first half of each of the Victorian Water Accounts, which track water in waterways.

An off-stream storage often has a certain amount of catchment inflow (that is, it has some on-stream characteristics). The bulk water entitlements that authorise water being taken from waterways serve as a guide to whether a storage is off-stream.

8.1.1 Groupings of distribution systems

Water may pass through more than one distribution system before it reaches the eventual customer. For example, water for Melbourne is diverted by Melbourne Water to supply several retail water corporations. In turn their distribution systems supply residential, commercial and municipal customers.

Distribution system boundaries do not necessarily align with basins. For example, Goulburn–Murray Water's Goulburn system straddles the Goulburn, Campaspe and Loddon basins, and also supplies water further west into the Avoca basin. Distribution systems (with the exception of the Goldfields Superpipe) are all operated by a single water corporation and are generally located in one of the four regions (Northern, Gippsland, Central and Western). Southern Rural Water operates three irrigation systems: one in the Gippsland Region, and two in the Central Region. Southern Rural Water systems therefore appear in two regions: Central and Gippsland.

Most water corporation websites have diagrams or maps of their distribution systems.

8.1.2 Types of distribution systems

For convenience of description, the following titles are used.

Common distribution system: This is a bulk or feeder system that mainly supplies two or more other distribution systems. It may have few, or no, retail customers. Examples are Melbourne Water's system, the Goldfields Superpipe (operated jointly by Coliban Water and Central Highlands Water), and the Waranga Western Channel (which supplies several irrigation and other systems including the Goldfields Superpipe).

Rural distribution system: This may be:

- an irrigation system which primarily supplies irrigation water, although it may also supply other commercial customers, urban systems and domestic and stock water
- a domestic and stock system which primarily supplies non-irrigation rural customers and may also supply urban systems. It may previously have been (wholly or partly) a natural stream (for example, the upper and lower Broken Creek and several waterways in the Torrumbarry area), the flows of which are now controlled to the extent that it is more correctly described as all or part of a distribution system than as a river or stream.

Urban distribution system: This is a system that primarily supplies urban customers. It may supply a single town or a group of towns, and may also transfer water to other distribution systems. As explained above, an urban distribution system may have feeder and reticulation components, with the water balance for the two components shown separately.

Two water corporations (Wannon Water and GWMWater) each operate rural distribution systems that supply several towns as well as rural customers. While deliveries to different customer groups can usually be separated (for example, deliveries to towns can be identified and shown separately from deliveries to rural customers), inflows and distribution losses often cannot be separated. For simplicity, reports on these systems consolidate urban and rural components as 'combined distribution systems'.

8.1.3 Data sources and limitations

Almost all the data used for the accounts was provided by the water corporations that operate the systems. They obtained the data using various types of meters, various methods of infilling data when meters fail, hydrographic measurement, hydrologic techniques to estimate inflows they did not measure, and back-calculation. Details of these methods are available from the relevant corporation and are not necessarily included in notes to the accounts, which are as concise as possible.

The presentation of the accounts is consistent with the draft National Water Accounting Standards developed under COAG. For example, whereas water accounts traditionally might have reported net evaporation from a storage as a loss, the draft standards prefer that data on rainfall and evaporation is reported separately as inflows and outflows.

This may affect efficiency as well as loss measures, although usually the differences when compared to traditional figures are small.

8.1.4 Balancing items

In many cases, water balances are exact. This is because one of the items is back-calculated, thus forcing inflows to equal outflows. In the reports, the balancing item (usually distribution system losses, but sometimes inflows) is always identified as such.

In cases where all items in the accounts can be measured or estimated without resorting to back-calculations, the account will not balance exactly because of inevitable measurement inaccuracies. In such cases, a separate balancing item is shown as an unaccounted-for outflow or loss. If that figure is negative, it is an unaccounted-for inflow.

8.1.5 Efficiency calculations

System efficiency calculations are based on the formula Efficiency = 100 x (delivered to customers + passed to other systems) / total outflows.

'Total outflows' includes all the end uses of water received by the distribution system (the inflows). It includes deliveries to customers and water passed to other systems (these two together constitute useful deliveries), plus losses.

The reports classify outfalls at the end of channels as water passed to other systems if they are regulated to a river, wetland or downstream distribution system. Outfalls due to rain rejections or inaccuracies in system regulation are classified as a distribution system loss, even though they may turn up in the downstream system as an unregulated inflow.

Some cases do not fit the above classifications and call for a common sense approach. For example, at Loddon Weir in periods of regulated flows, inflows are received from the Loddon into the Waranga Western Channel (WWC) and regulated westward along the channel, leaving a minimum flow to be passed downstream. In wet periods, almost all the Loddon inflow simply passes downstream because there is no capacity to re-regulate it. In both cases, it is common sense to record all Loddon inflows as inflow to the WWC and all water passed to the Loddon as passed to other systems, to achieve a reasonable indication of distribution system efficiency.

In systems where there is a large balancing item (which implies poor measurement somewhere), the efficiency calculation may be rather meaningless. In such cases, no calculated figure is shown in the tables and efficiency is simply recorded as 'N/A' (not applicable). In other cases, small measurement errors or unmeasured inflows result in a calculated efficiency higher than 100%, which is reported as such.

The Department of Environment and Primary Industries recognises that the system efficiency formula above is only one of many used in the water industry.

The efficiency figures that water corporations include in their annual reports and provide to the Essential Services Commission are often for the reticulation component of a distribution system, rather than for off-stream storages and treatment plants, as is essential in the present accounts. As explained above, in some cases it makes sense to show feeder and reticulation components separately. More corporations may choose to do this in future.

8.1.6 Interpreting and using distribution system accounts

The accounts in this chapter are summarised: the full account for a system has usually been condensed to a single line in a table. Nonetheless, the accounts are useful in drawing attention to possible management issues. For example, an unusually low distribution efficiency could occur for various reasons, such as:

- poor or difficult measurement
- the system configuration giving rise to intrinsically low efficiency (an example is the Millewa Rural system, which includes Lake Cullulleraine with its high evaporation – management options to improve the situation are limited, although they exist)
- inadequately maintained infrastructure, or infrastructure that cannot be improved economically
- relatively high treatment system losses in small urban systems
- unmeasured deliveries for purposes such as fire-fighting and transport by tanker as a drought-relief measure.

Conversely, an unusually high efficiency can be the result of poor measurement, unmeasured inflows or other unknown factors.

The accounts can only indicate a possible issue: managers would need to investigate and analyse an issue before determining a response. Any management response would, of course, need to be cost-effective.

Any low efficiencies in systems with treated or desalinated water are particularly noteworthy because of the energy cost of, and the value added by, the treatment.

As far as possible, the accounts have been prepared on a consistent basis, while recognising the substantial differences between systems. They should become more useful after a number of years as trends become apparent.

8.2 Northern region

8.2.1 North East Water

North East Water provides water and sewerage services to 37 towns, villages and cities in north-east Victoria. It is one of 12 similar corporations throughout regional Victoria. It operates largely as a retailer that on-sells water from the wholesaler, Goulburn–Murray Water, which manages water storage, delivery and drainage systems.

North East Water serves approximately 115,000 people in an area of about 20,000 square kilometres. The region extends from Corryong in the east, along the Murray River to Yarrawonga, then south to Benalla and the alpine towns of Bright, Mount Beauty and Dartmouth. Table 8.2-1 summarises North East Water's urban distribution systems.

Table 8.2-1 North East Water urban distribution systems

Area	System/towns supplied	Source of supply	Treatment plant location
Alpine	Bright system – Bright, Wandiligong and Porepunkah	Unregulated Ovens River	Bright
	Harrietville	Simmons Creek and unregulated Ovens River	Harrietville
	Mount Beauty system – Tawonga, Tawonga South and Mount Beauty	West Kiewa River	Tawonga South
	Myrtleford	Buffalo Creek	Myrtleford
Broken River	Benalla	Ryan and Whiskey creeks	Benalla
Central	Goorambat	Groundwater	Goorambat
King and Ovens rivers	Glenrowan	Fifteen Mile Creek	Glenrowan
	Moyhu	Regulated King River	Moyhu
	Oxley	Regulated King River	Oxley
	Wangaratta and Glenrowan	Regulated Ovens River, groundwater	Wangaratta
	Whitfield	Musk Gully Creek	Whitfield
Mitta Mitta River	Dartmouth	Mt Tabor Creek	Dartmouth
	Eskdale	Regulated Mitta Mitta River	Eskdale
Murray River	Bellbridge	Lake Hume	Bellbridge
	Tallangatta	Lake Hume	Tallangatta
	Wahgunyah system – Wahgunyah and Rutherglen	Regulated Murray River	Wahgunyah
	Wodonga system – Wodonga, Baranduda, Kiewa, Springhurst, Tangambalanga, Bonegilla, Ebden, Barnawartha and Chiltern	Regulated Murray River	Wodonga
	Yarrawonga system – Yarrawonga, Tungamah, St James and Devenish	Regulated Murray River	Yarrawonga
Sub-alpine	Beechworth	Nine Mile Creek Frenchmans Creek Lake Kerferd catchment	Beechworth
	Yackandandah	Nine Mile Creek	Yackandandah
Upper Murray	Corryong system – Corryong and Cudgewa	Nariel Creek	Corryong
	Walwa	Unregulated Murray River	Walwa

Table 8.2-2 summarises shows North East Water's urban distribution systems' water balances.

Table 8.2-2 North East Water urban distribution systems' water balances

Area/system	Start volume in store (ML)	Total inflows (ML)	Outflows (ML)					End volume in store (ML)	Distribution system efficiency (%)
			Deliveries		Losses[1]		Total outflows		
			To urban residential	To urban other	From treatment plants	From distribution systems			
Alpine area									
Bright system	3	559	289	162	36	71	558	3	81%
Harrietville town	-	46	27	16	-	2	46	-	94%
Mount Beauty system (Tawonga group)	6	390	178	71	12	131	392	4	64%
Myrtleford town	404	624	299	218	18	128	662	366	78%
Broken River									
Benalla town	21	1,478	946	319	90	125	1,480	19	85%
Central area									
Goorambat town	-	11	10	1	0	1	11	-	94%
Kings and Ovens rivers									
Moyhu town	-	35	23	4	3	4	35	-	79%
Oxley town	-	67	33	1	8	24	67	-	52%
Wangaratta group	35	3,721	1,829	1,098	285	522	3,735	21	78%
Whitfield town[2]	11	22	10	5	0	18	33	1	46%
Mitta Mitta River									
Dartmouth town	-	28	9	9	3	8	28	-	64%
Eskdale town	-	13	8	4	-	1	13	-	91%
Murray River									
Bellbridge town	-	56	42	2	2	10	56	1	79%
Rutherglen/Wahgunyah system	7	695	394	155	54	93	696	6	79%
Tallangatta town	2	187	91	52	16	29	187	2	76%
Wodonga system	52	6,221	3,569	1,848	246	535	6,198	75	87%
Yarrawonga system	8	1,357	928	192	58	175	1,353	12	83%
Sub-alpine area									
Beechworth town[3]	816	669	299	141	22	207	669	817	66%
Yackandandah town	23	147	78	43	7	16	144	25	84%
Upper Murray River									
Corryong system	76	256	125	53	2	73	253	79	70%
Walwa town	1	19	9	4	2	3	19	1	72%

Notes:
(1) Where an account does not balance exactly, any unaccounted-for flows have been added to distribution system losses.
(2) The distribution system efficiency in the Whitfield town is much lower than 2011–12 because the raw water basin is no longer in use.
(3) For the Beechworth system, the distribution system efficiency includes allowance for evaporation losses from Lake Kerferd (off-stream storage).

8.2.2 Goulburn Valley Water

Goulburn Valley Water provides urban water and wastewater services to over 129,000 people. It services around 57,500 properties in 54 towns, from the outskirts of Melbourne in the south to the Murray River in the north. Bulk water supply is principally from the Goulburn/Broken, Murray, Steavenson, Rubicon and Delatite River systems, and from some smaller local streams such as Sunday Creek and Seven Creeks. Table 8.2-3 summarises Goulburn Valley Water's urban distribution systems.

Table 8.2-3 Goulburn Valley Water urban distribution systems

Area	System/towns supplied	Source of supply	Treatment plant location/ Comment
Broken Creek	Nathalia	Broken Creek	Nathalia
	Numurkah system – Numurkah and Wunghnu	Broken Creek and the Murray 6/6 Channel	Numurkah
Goulburn channels	Towns supplied from Shepparton Irrigation Area – Dookie and Katandra West	Shepparton Irrigation Area	At each town
	Towns supplied from Central Goulburn Irrigation Area – Tatura, Kyabram, Tongala, Girgarre, Stanhope, Merrigum and Rushworth	Central Goulburn Irrigation Area	At each town except Merrigum which is supplied from Kyabram
	Colbinabbin	Rochester Irrigation Area	Colbinabbin
	Corop	Rochester Irrigation Area	Disinfection only
Goulburn River	Alexandra	Regulated Goulburn River	Alexandra
	Murchison	Regulated Goulburn River	Murchison
	Nagambie	Regulated Goulburn River	Nagambie
	Seymour system – Seymour, Avenel, Mangalore and Tallarook	Regulated Goulburn River	Seymour
	Shepparton system – Shepparton, Mooroopna, Congupna, Toolamba and Tallygaroopna	Regulated Goulburn River	Shepparton
	Kirwans Bridge	Regulated Goulburn River	Disinfection only
	Molesworth	Regulated Goulburn River	Disinfection only
	Baxters Road	Regulated Goulburn River	Disinfection only
	Woods Point	Unregulated Goulburn River	Disinfection only
Goulburn River tributaries	Euroa system – Euroa and Violet Town	Mountain Hut Creek and Seven Creeks	Euro
	Strathbogie	Seven Creeks	Disinfection only
	Longwood	Nine Mile Creek	Longwood
	Mansfield	Delatite River	Mansfield
	Upper Delatite system – Sawmill Settlement and Merrijig	Delatite River	Sawmill Settlement
	Marysville system – Marysville and Buxton	Steavenson River	Marysville
	Yea	Yea River	Yea
	Pyalong	Mollisons Creek	Pyalong
	Broadford system – Broadford and Waterford Park (Clonbinane)	Sunday Creek Reservoir on Sunday Creek and Regulated Goulburn River at Tallarook	Broadford
	Kilmore system – Kilmore, Wandong and Heathcote Junction	Sunday Creek Reservoir on Sunday Creek, Hazels Creek	Kilmore
Lake Eildon	Bonnie Doon	Brankeet Creek/Lake Eildon	Bonnie Doon
Murray channels	Katamatite and Picola	Murray Valley Irrigation Area	At each town
Murray River	Cobram system – Cobram, Strathmerton and Yarroweyah	Murray River	Cobram
	Barmah	Murray River	Barmah
Supplied from groundwater	Katunga		Disinfection only

Table 8.2-4 shows Goulburn Valley Water's urban distribution systems' water balances.

Distribution systems: Northern region

Table 8.2-4 Goulburn Valley Water urban distribution systems' water balances

Area/system	Start volume in store (ML)	Total inflows (ML)	Outflows (ML): Deliveries: To urban residential	Outflows (ML): Deliveries: To urban non-residential	Outflows (ML): Losses[1]: From treatment plants	Outflows (ML): Losses[1]: From distribution systems	Outflows (ML): Passed to other systems[3]	Outflows (ML): Total outflows	End volume in store (ML)	Distribution system efficiency (%)
Broken Creek										
Nathalia	0	450	215	83	26	45	81	450	0	84%
Numurkah system	0	1,292	577	354	248	14	99	1,292	0	80%
Goulburn channels										
Towns supplied from Central Goulburn IA	638	5,064	1,866	2,399	7	621	171	5,064	638	88%
Towns supplied from Rochester IA	0	38	16	10	6	3	3	38	0	76%
Towns supplied from Shepparton IA	0	159	88	38	16	9	8	159	0	84%
Goulburn River										
Alexandra	0	607	238	99	4	58	208	607	0	90%
Murchison	0	186	105	36	4	23	18	186	0	85%
Nagambie system	0	657	196	395	2	43	21	657	0	93%
Seymour system	0	2,105	916	493	328	197	171	2,105	0	75%
Shepparton system	0	11,649	6,176	4,143	5	657	668	11,649	0	94%
Woods Point	0	9	7	1	0	1	0	9	0	89%
Goulburn River tributaries										
Broadford system	45	666	368	107	34	109	0	618	93	77%
Euroa system	0	750	493	167	(62)	152	0	750	0	88%
Kilmore system	69	901	629	105	30	116	35	916	54	84%
Longwood	22	81	40	11	5	20	7	83	20	70%
Mansfield	541	631	354	158	80	240	42	874	298	63%
Marysville and Buxton	81	171	65	27	(25)	94	6	167	85	59%
Pyalong	34	39	41	3	(15)	11	1	41	32	110%
Thornton	0	46	25	14	0	7	0	46	0	85%
Upper Delatite system	0	91	50	17	4	15	5	91	0	79%
Yea system	0	244	150	57	(7)	38	6	244	0	87%
Lake Eildon										
Eildon and Bonnie Doon	46	189	104	52	1	31	5	193	42	83%
Murray channels										
Katamatite and Picola	16	78	46	12	(1)	6	15	78	16	94%
Murray River										
Cobram system	0	3,014	715	1,814	40	141	304	3,014	0	94%
Barmah	0	59	38	8	4	7	2	59	0	81%
Supplied from groundwater										
Katunga	0	52	40	7	0	3	2	52	0	94%

Notes:

(1) Treatment plant losses are used as the balancing item, where the treatment plant loss reported is negative, metering issues have been identified that explain the apparent unaccounted-for inflow.

(3) Passed to other systems includes (based on Goulburn Valley Water's 2012 water plan demand strategy forecast) estimated water treatment supernatant/backwash water returned to wastewater management facilities, rivers and channel systems.

8.2.3 Goulburn–Murray Water

Goulburn–Murray Water manages water-related services in a region of 68,000 square kilometres bordered by the Great Dividing Range in the south and the Murray River in the north and stretching from Corryong in the east downriver to Nyah. It supplies irrigators and other rural water users and provides bulk water supply to many towns within irrigation areas and along regulated rivers.

It operates two common distribution systems:

- the Waranga Western Channel
- the Victorian Mid-Murray Storages and associated bulk carriers.

It also operates nine irrigation and six other rural distribution systems, as shown in Table 8.2-8.

8.2.3.1 Waranga Western Channel

The Waranga Western Channel (WWC) sources most of its water from the Goulburn River at Goulburn Weir, and is supplemented by extractions from the Campaspe and Loddon rivers. The major supply channels of Stuart Murray Canal and Cattenach Canal are included in the WWC. It supplies water to three irrigation areas, three domestic and stock (D&S) areas and through the Goldfields Superpipe to Bendigo and Ballarat. The Waranga Basin, a substantial off-stream storage, is also included in the WWC. It has been divided into three segments because it crosses three river basins: the division facilitates cap reporting to the Murray–Darling Basin Authority.

The water balance, divided into its three segments, is shown in Table 8.2-5.

Table 8.2-5 Waranga Western Channel water balance

Waranga Western Channel	Campaspe segment (ML)	Goulburn segment (ML)	Loddon segment (ML)	Eliminations (ML)	Total (ML)
Volumes in store					
Start volume (1 July 2012)					
Waranga basin (total)	-	367,613	-	-	367,613
Greens Lake (total)	17,329	-	-	-	17,329
End volume (30 June 2013)					
Waranga basin (total)	-	165,139	-	-	165,139
Greens Lake (total)	10,436	-	-	-	10,436
Increase or (decrease) in storages	**(6,893)**	**(202,474)**	**-**	**-**	**(209,367)**
Inflows					
From Goulburn River	-	867,834	-	-	867,834
Natural to Waranga	-	1,190	-	-	1,190
Rain on Waranga	-	14,389	-	-	14,389
From WWC Goulburn segment	504,920	-	-	(504,920)	0
From Campaspe East	0	-	-	-	0
From Campaspe West	0	-	-	-	0
From Campaspe pumps	2,796	-	-	-	2,796
From Wanalta Creek to WWC	191	-	-	-	191
From Cornella Creek to WWC	0	-	-	-	0
From Lake Cooper to Greens Lake	0	-	-	-	0
Rain on Greens Lake	1,112	-	-	-	1,112
From WWC Campaspe segment	-	-	254,393	(254,393)	0
From Loddon River	-	-	85,321		85,321
Total inflows	**509,019**	**883,413**	**339,714**	**(759,313)**	**972,833**
Outflows					
Passed to other systems					
To Central Goulburn Irrigation Area	-	518,612	-	-	518,612
To Goldfields Superpipe	-	318	-	-	318
To Campaspe segment	-	504,920	-	(504,920)	0
To Rochester Irrigation Area[(1)]	253,514	-	-	-	253,514
To Campaspe River (ex-Goulburn River)	0	-	-	-	0

Distribution systems: Northern region

Waranga Western Channel	Campaspe segment (ML)	Goulburn segment (ML)	Loddon segment (ML)	Eliminations (ML)	Total (ML)
To Campaspe River	0	-	-	-	0
To Campaspe River (via Campaspe Channel)	0	-	-	-	0
To Lake Cooper	0	-	-	-	0
To Loddon segment	254,393	-	-	(254,393)	0
To Pyramid–Boort Irrigation Area(2)	-	-	281,734	-	281,734
To Loddon River	-	-	56,840	-	56,840
To Wimmera–Mallee	-	-	0	-	0
WWC to East Loddon waterworks district	-	-	579	-	579
WWC to West Loddon waterworks District	-	-	193	-	193
WWC to Normanville	-	-	368	-	368
WWC to Boort Lakes	-	-	0	-	0
Losses					
Evaporation/seepage Waranga	-	52,998	-	-	52,998
Evaporation Greens Lake	5,381	-	-	-	5,381
Total outflows	**513,288**	**1,076,848**	**339,714**	**(759,313)**	**1,170,537**
Balancing item (unaccounted-for outflow)	**2,624**	**9,039**	**0**	**0**	**11,663**
System efficiency (%)	**99%**	**95%**	**100%**	-	N/A

Notes:
(1) The balancing item for the Campaspe segment is outflows to Rochester Irrigation Area.
(2) The balancing item for the Loddon segment is outflows to Pyramid–Boort Irrigation Area.

8.2.3.2 Victorian Mid-Murray Storages

The Victorian Mid-Murray Storages (VMMS) concept was introduced as a means of capturing a portion of the increased unregulated Victorian tributary flows into the Murray River resulting from the decommissioning of Lake Mokoan in the Broken River basin. These unregulated flows occur mainly from May to November.

The VMMS consists of Kow Swamp, Lake Boga, Lake Charm and Kangaroo Lake: these have a combined capacity of nearly 58,000 ML. They are connected by a number of bulk carriers, for which losses are apportioned.

On average, 22,100 ML a year will be harvested into Lake Boga, Lake Charm and Kangaroo Lake, and released. The capture of water will offset the reduction of the Snowy Required Annual Release to the upper Murray by retaining some unregulated flows within Victoria, which will be available to supplement Victoria's Murray resource.

Table 8.2-6 shows the water balance for the VMMS.

Table 8.2-6 Victorian Mid-Murray Storages water balance

Victorian Mid-Murray Storage (VMMS)	Volume (ML)
Volumes in store	
Start volume (1 July 2012)	
Total Kow Swamp, Lake Charm, Kangaroo Lake, Lake Boga	111,943
End volume (30 June 2013)	
Total Kow Swamp, Lake Charm, Kangaroo Lake, Lake Boga	104,156
Change in storages	**(7,787)**
Inflows	
Rain on all storages	14,255
Murray to Lake Boga	0
Torrumbarry Irrigation Area to Lake Boga	1,350
Torrumbarry Irrigation Area to Lake Charm	11,331
Torrumbarry Irrigation Area to VMMS	0
Total inflows	**26,936**
Outflows	

Victorian Mid-Murray Storage (VMMS)	Volume (ML)
Passed to other systems	
Lake Charm to Murray River	6,410
Lake Boga to Murray River	0
6/7 channel to Murray River	3,013
Kerang Weir to Murray River	73,045
VMMS to Torrumbarry Irrigation Area	5,851
Total passed to other systems	***88,319***
Losses	
Evaporation on storages	57,083
Distribution losses(1)	11,442
Total losses	***68,525***
Total outflows	**156,844**
Balancing item (unaccounted-for inflow)	**122,121**
System efficiency (%)	**n/a**

Notes:
(1) Fixed allowance for distribution system losses.
n/a = not applicable.

8.2.3.3 Other distribution systems

Goulburn–Murray Water's other distribution systems are rural, and are summarised in Table 8.2-7.

Table 8.2-7 Goulburn–Murray Water rural distribution systems

System	Customers supplied	Source of supply
Irrigation distribution systems		
Central Goulburn Irrigation Area	Primarily irrigation and D&S to irrigators. Also provides bulk supply to seven towns in its area	WWC system – from Stuart Murray Canal, Waranga Basin and WWC
Loddon Valley Irrigation Area	Primarily irrigation and D&S to irrigators. Also provides bulk supply to four towns in its area and small volumes to the Torrumbarry Irrigation Area	WWC, Loddon River supplement and Torrumbarry Irrigation Area
Murray Valley Irrigation Area	Primarily irrigation and D&S to irrigators. Also provides bulk supply to two towns in its area	Murray River via Yarrawonga Main Channel and pumps. Shepparton Irrigation Area via Lower Broken Creek
Nyah Irrigation District	Irrigation and D&S to irrigators	Pumped from Murray River
Rochester Irrigation Area	Primarily irrigation and D&S to irrigators. Also provides bulk supply to four towns in its area	WWC
Shepparton Irrigation Area	Primarily irrigation and D&S. Also provides bulk supply to two towns in its area and to the Murray Valley system via the lower Broken Creek	Goulburn River at Goulburn Weir
Torrumbarry Irrigation Area and Gunbower Creek (excluding Woorinen, Tresco and VMMS)	Primarily irrigation and D&S to irrigators. Also provides bulk supply to VMMS, Tresco Irrigation Area, two towns in its area and significant supplies to environmental sites	National Channel and other minor sources from the Murray River. Unregulated Loddon flows. Small volumes from Pyramid–Boort Irrigation Area
Tresco Irrigation Area	Irrigation and D&S to irrigators	Torrumbarry Irrigation Area
Woorinen Irrigation Area	Irrigation and D&S to irrigators	Pumped from Murray
Other rural distribution systems		
East Loddon D&S	Rural D&S	Waranga Western Channel
Lower Broken Creek	Primarily irrigation and D&S to irrigators. Also provides bulk supply to two towns in its area	Shepparton Irrigation Area. Minor unregulated inflows from upper Broken Creek
Normanville D&S	Rural D&S. Also provides bulk supply to Quambatook urban	Waranga Western Channel
Tungamah D&S	Rural D&S	Shepparton Irrigation Area
Upper Broken Creek	Irrigation diversions	Broken River at Caseys Weir
West Loddon D&S	Rural D&S	Waranga Western Channel

Table 8.2-8 shows Goulburn–Murray Water's rural distribution systems' water balances.

Table 8.2-8 Goulburn–Murray Water rural distribution systems' water balances

Distribution system	Start volume in store (ML)	Total inflows (ML)	Outflows (ML)					End volume in store (ML)	Distribution system efficiency (%)
			Deliveries						
			To rural customers	To other	Losses[1]	Passed to other systems	Total outflows		
Irrigation distribution systems									
Central Goulburn Irrigation Area	-	518,612	416,086	0	97,793	4,733	518,612	-	81%
Murray Valley Irrigation Area	-	417,555	280,937	0	76,904	59,715	417,555	-	82%
Nyah Irrigation Area	-	6,216	5,964	0	252	0	6,216	-	96%
Pyramid–Boort Irrigation Area	-	254,393	234,452	0	18,309	1632	254,393	-	93%
Rochester Irrigation Area	-	260,672	215,812	0	42,977	1,883	260,672	-	84%
Shepparton Irrigation Area	-	242,217	164,037	0	32,602	45,578	242,217	-	87%
Torrumbarry Irrigation Area[2]	11,889	1,019,197	459,122	15,900	306,124	237,394	1,018,540	12,547	70%
Tresco Irrigation Area	-	7,565	6,878	0	687	0	7,565	-	91%
Woorinen Irrigation Area	-	11,063	10,377	0	686	0	11,063	-	94%
Other rural distribution systems									
East Loddon D&S	-	579	460	0	119	0	579	-	79%
Normanville D&S	67	370	168	0	78	122	368	69	79%
West Loddon D&S	-	193	193	0	0	0	193	-	100%
Tungamah D&S	-	269	297	0	(28)	0	269	-	110%
Lower Broken Creek[3]	-	80,615	22,277	0	(32,033)	90,372	80,615	-	N/A
Upper Broken Creek	-	3,612	577	0	1,875	1,160	3,612	-	N/A

Notes:

(1) Losses are back-calculated and include outfalls not deliberately passed to other systems.

(2) Torrumbarry Irrigation Area includes Gunbower Creek and excludes Woorinen Irrigation Area, Tresco Irrigation Area and Victorian Mid-Murray Storages.

(3) An unaccounted-for inflow (reported as a negative loss) in Lower Broken Creek is explained by unmeasured inflows.

The Shepparton Irrigation Area had early take-up of modernisation, i.e. lined channels, some closure of spur channels, remotely operated weirs and gates, and accurate metering. This is reflected in the system's 87% efficiency.

On the other hand, the Torrumbarry system efficiency is 70%.This lower efficiency can be explained by it being only in the early stages of modernisation, as well as by the use of natural carriers like Gunbower Creek as part of the system.

8.2.4 Coliban Water

Coliban Water has its head office in Bendigo. It provides water and wastewater services to around 140,000 people in 49 towns across central and northern Victoria. The largest towns it services are Bendigo, Castlemaine, Echuca and Kyneton. Coliban Water also supplies around 1,500 rural licence holders from 500 kilometres of open channels in the Coliban rural water supply system extending from Malmsbury to Bendigo, and to Raywood and surrounding areas.

Coliban Water's service area is within parts of the Campaspe, Loddon, Murray, Goulburn and Avoca basins. It operates two common distribution systems:

- the Goldfields Superpipe, incorporating the Eppalock Pipeline which it jointly operates with Central Highlands Water, and
- the Coliban Main Channel.

Coliban Water operates nine urban water supply systems, including the two separate groundwater systems of Elmore and Trentham, and 11 rural subsystems.

8.2.4.1 Goldfields Superpipe

This pipeline transfers water from the Waranga Western Channel (Goulburn system) and from Lake Eppalock (Campaspe system) for use in the Coliban water supply system and to supply water to Central Highlands Water's Ballarat system. Table 8.2-9 shows the superpipe's water balance.

Table 8.2-9 Goldfields Superpipe water balance

Goldfields Superpipe	Volume (ML)
Volumes in store	
Start volume (1 July 2012)	-
End volume (30 June 2013)	-
Change in storage	**-**
Inflows	
From WWC at Colbinabbin – Coliban Water	318
From WWC at Colbinabbin – Central Highlands Water	0
From Lake Eppalock – Coliban Water	2,434
From Lake Eppalock – Central Highlands Water	43
From Sandhurst	0
Total inflows	**2,795**
Outflows	
To Eppalock – Coliban Water	0
To Eppalock – Central Highlands Water	0
Direct to Coliban Water rural customers	377
To Sandhurst – Coliban Water(1)	(2,209)
To Sandhurst – Central Highlands Water	0
Transfer to Central Highlands Water at White Swan Reservoir	43
To Heathcote (Caledonia Reservoir)	411
To Emu Valley rural channel subsystem	174
To Axe Creek rural channel subsystem	453
To Spring Gully Reservoir	3,374
To Specimen Hill rural channel subsystem	172
Total outflows	**2,795**
Balancing item (unaccounted-for outflow)	**0**
System efficiency (%)	**100%**

Note:
(1) Outflow to Sandhurst Reservoir – Coliban Water is the balancing item in this water balance and, in this case, represents an unaccounted-for inflow.

8.2.4.2 Coliban Main Channel

This channel conveys water from the Coliban storages (Upper Coliban, Lauriston and Malmsbury reservoirs) to supply rural subsystems and the Coliban North and Coliban South urban water supply systems. Table 8.2-10 shows the water balance for the Coliban Main Channel.

Table 8.2-10 Coliban Main Channel water balance

Coliban Main Channel	Volume (ML)
Volumes in store	
Start volume (1 July 2012)	-
End volume (30 June 2013)	-
Change in storage	-
Inflows	
From Malmsbury Reservoir	23,545
Total inflows	**23,545**
Outflows	
Deliveries to customers	
Direct deliveries to rural customers off channel	449
Total deliveries to customers	***449***
Passed to other systems	
To Coliban North system at Sandhurst Reservoir	13,540
To Poverty Gully rural subsystem	2,936
To Harcourt rural subsystem	3,225

Distribution systems: Northern region

Coliban Main Channel	Volume (ML)
To Emu Valley rural subsystem	1,115
To Specimen Hill rural subsystem	1,985
To Spring Gully rural subsystem	362
Total passed to other systems	**23,163**
Losses	
System losses (back-calculated)[1]	(67)
Total losses	***(67)***
Total outflows	**23,545**
System efficiency (%)	**100%**

Note:
(1) System losses (back-calculated) represent unmeasured inflow runoff direct to main channel.

8.2.4.3 Rural distribution systems

Coliban Water's rural distribution system supplies rural licence customers (including stock, domestic and irrigation customers) with entitlements of around 15,800 ML in rural areas extending from Castlemaine to Bendigo, and further north to Raywood. Table 8.2-11 shows Coliban Water's rural distribution systems' water balances.

Table 8.2-11 Coliban Water rural distribution systems' water balances

Distribution system	Start volume in store (ML)	Total inflows (ML)	Outflows (ML): Deliveries: To rural customers	Outflows (ML): Deliveries: To other	Outflows (ML): Losses[1]	Outflows (ML): Passed to other systems	Outflows (ML): Total outflows	End volume in store (ML)	Distribution system efficiency (%)
Ascot	-	1,190	889	-	301	-	1,190	-	75%
Axe Creek	-	453	179	-	274	-	453	-	40%
Cockatoo Hill	-	565	285	-	280	-	565	-	50%
Emu Valley	-	1,289	664	-	625	-	1,289	-	52%
Harcourt	1,690	3,225	1,389	-	2,116	-	3,505	1,410	40%
Jackass Flat	-	22	6	-	16	-	22	-	27%
Lockwood	-	1,119	446	-	673	-	1,119	-	40%
Poverty Gully[2]	-	2,936	12	-	364	2,560	2,936	-	88%
Specimen Hill[3]	-	2,157	435	-	581	1,141	2,157	-	73%
Spring Gully Reservoir[4]	224	2,620	0	-	550	1,755	2,305	539	76%
Spring Gully rural subsystem[5]	-	362	105	-	123	134	362	-	66%

Notes:
(1) Losses are the balancing item in all cases.
(2) Passed to other systems represents a transfer to the urban Castlemaine system.
(3) Specimen Hill supplied water to Jackass Flat and Lockwood.
(4) Spring Gully Reservoir supplied water to Ascot and Cockatoo Hill.
(5) Spring Gully rural subsystem supplied water to Spring Gully Reservoir.

In some rural distribution systems, customers are relinquishing their licences due to urban encroachment. This is particularly true for Jackass Flat and Axe Creek, and has led to low efficiencies in these channels in 2012–13.

8.2.4.4 Urban distribution systems

Table 8.2-12 summarises Coliban Water's nine urban distribution systems.

Table 8.2-12 Coliban Water urban distribution systems

Area	System/towns supplied	Source of supply	Treatment plant location/ Comment
Campaspe	Goornong	Campaspe River	Goornong
Coliban Northern	Bendigo, Axedale, Raywood and Sebastian	Coliban storages (via Main Channel), Lake Eppalock and the Goulburn system (Lake Eildon and Waranga Basin via Goldfields Superpipe)	Bendigo and Raywood
	Heathcote and Tooborac	Lake Eppalock and the Goulburn system (via Goldfields Superpipe)	Heathcote
Coliban Southern	Castlemaine system – Castlemaine, Maldon, Campbells Creek, Chewton, Newstead, Elphinstone, Taradale and Harcourt	Coliban storages (via Coliban Main Channel)	Castlemaine
	Kyneton system – Kyneton, Malmsbury and Tylden	Lauriston Reservoir	Kyneton
Elmore Groundwater	Elmore	Lower Campaspe Valley Water Supply Protection Area	Elmore
Goulburn	Towns supplied from Pyramid–Boort Irrigation Area – Boort, Dingee, Macorna, Mitiamo, Mysia and Pyramid Hill	Goulburn system (Lake Eildon and Waranga Basin)	Boort and Pyramid Hill No treatment at Dingee, Macorna, Mitiamo and Mysia
	Towns supplied from Rochester Irrigation Area – Lockington and Rochester	Goulburn system (Lake Eildon and Waranga Basin)	Lockington and Rochester
Loddon	Bridgewater system – Bridgewater and Inglewood	Loddon River	Bridgewater
	Jarklin	Loddon River – Serpentine Creek and tankered	No treatment (not a drinking water supply)
	Laanecoorie system – Laanecoorie, Tarnagulla, Bealiba and Dunolly	Loddon River	Laanecoorie
	Serpentine	Loddon River – Serpentine Creek and tankered	Serpentine
Murray	Cohuna and Cohuna-Mead-Gunbower rural system	Murray River – Gunbower Creek	Cohuna
	Echuca	Murray River	Echuca
	Gunbower	Murray River – Taylors Creek	Gunbower
	Leitchville	Murray River – Gunbower Creek and Cohuna irrigation channel	Leitchville
Trentham Groundwater	Trentham	Spring water and groundwater from Campaspe basin	Trentham
Wimmera	Borung	Wimmera–Mallee Pipeline	No treatment (not a drinking water supply)
	Korong Vale system – Korong Vale and Wedderburn	Wimmera–Mallee Pipeline	Korong Vale
	Wychitella	Wimmera–Mallee Pipeline	No treatment (not a drinking water supply)

Distribution systems: Northern region

Table 8.2-13 shows Coliban Water's urban distribution systems' water balances.

Table 8.2-13 Coliban Water urban distribution systems' water balances

Area/system	Start volume in store (ML)	Total inflows (ML)	Outflows (ML)						End volume in store (ML)	Distribution system efficiency (%)
			Deliveries		Losses(1)					
			To urban residential	To urban non-residential	From treatment plants	From distribution systems	Passed to other systems	Total outflows		
Campaspe										
Goornong	0	61	31	9	0	21	0	61	0	66%
Coliban Northern										
Bendigo system	1,312	11,361	7,495	2,729	0	377	0	10,601	2,072	96%
Heathcote system	129	431	155	79	0	207	0	441	119	53%
Coliban Southern										
Castlemaine system – McKay Reservoir	906	2,625	1,063	820	0	432	0	2,315	1,216	81%
Kyneton system	0	877	439	337	0	101	0	877	0	88%
Elmore groundwater system										
Elmore	0	132	75	43	0	14	0	132	0	89%
Goulburn system										
Supplied from Pyramid–Boort Irrigation Area(2)	0	394	156	65	0	172	0	394	0	56%
Supplied from Rochester Irrigation Area(3)	0	1,510	398	790	0	322	0	1,510	0	79%
Loddon system										
Bridgewater system	0	281	81	40	0	161	0	282	0	43%
Jarklin	0	3	2	1	0	0	0	3	0	100%
Laanecoorie system	0	124	73	19	0	32	0	124	0	74%
Serpentine	0	30	14	5	0	12	0	30	0	61%
Murray system										
Cohuna	0	768	312	209	0	247	0	768	0	68%
Echuca	0	3,329	1,634	1,232	0	463	0	3,329	0	86%
Gunbower	0	57	36	11	0	10	0	57	0	82%
Leitchville	0	241	47	125	0	69	0	241	0	71%
Trentham groundwater system										
Trentham(4)	83	389	64	14	0	74	260	412	60	82%
Wimmera system										
Borung	0	2	2	0	0	0	0	2	0	95%
Koorong Vale – Wedderburn	0	166	73	25	0	68	0	166	0	59%
Wychitella	0	2	2	0	0	0	0	2	0	85%

Note:

(1) Distribution system losses are the balancing item in all cases.

(2) Pyramid–Boort Irrigation Area consists of Macorna town, Pyramid Hill town, Boort town, Mysia town, Mitiamo town and Dingee town.

(3) Rochester Irrigation Area consists of Lockington town and Rochester town (part).

(4) Trentham passed to other systems is spilled down Trent Creek.

8.2.5 Lower Murray Water

Lower Murray Water is based in Mildura. Its area of operation extends along the Murray River from Kerang to the South Australian border, taking in the municipalities of Mildura, Swan Hill and Gannawarra. It provides the region with urban water and wastewater services, and supplies river-quality water to stock and irrigation customers. It also operates subsurface irrigation drainage water collection systems.

Lower Murray Water operates four irrigation distribution systems, three other rural distribution systems and 10 urban distribution systems.

Table 8.2-14 summarises Lower Murray Water's rural distribution systems.

Table 8.2-14 Lower Murray Water rural distribution systems

System	Customers supplied	Source of supply
Irrigation distribution systems		
First Mildura Irrigation District	Primarily irrigators, both inside and adjacent to its district, who are supplied with irrigation and D&S water	Murray River at Mildura pumps
Merbein Irrigation District	Primarily irrigators, both inside and adjacent to its district, who are supplied with irrigation and D&S water. Also passes water to the Wargan-Yelta part of the Cardross-Yelta waterworks district	Murray River at Merbein pumps
Red Cliffs Irrigation District	Primarily irrigators, both inside and adjacent to its district, who are supplied with irrigation and D&S water. Also supplies environmental water to Cardross Basin and passes water to the Cardross part of the Cardross-Yelta waterworks district	Murray River at Red Cliffs pumps
Robinvale Irrigation District	Primarily irrigators, both inside and adjacent to its district, who are supplied with irrigation and D&S water	Murray River at Robinvale pumps
Other rural distribution systems		
Cardross part of the Cardross-Yelta waterworks district	D&S customers	Red Cliffs Irrigation District
Millewa waterworks district	Primarily piped supply to D&S customers. Also supplies three small towns and irrigation water diverted from Lake Cullulleraine	Murray River at Lake Cullulleraine pumps
Wargan-Yelta part of the Cardross-Yelta waterworks district	D&S customers	Merbein Irrigation District

Table 8.2-15 shows Lower Murray Water's rural distribution systems' water balances.

Table 8.2-15 Lower Murray Water rural distribution systems' water balances

Distribution system	Start volume in store (ML)	Total inflows (ML)	Outflows (ML)				End volume in store (ML)	Distribution system efficiency (%)
			Deliveries		Losses[1]	Total outflows		
			To rural customers	To other				
Irrigation distribution systems								
First Mildura Irrigation District	-	45,777	39,625		6,152	45,777	-	87%
Merbein Irrigation District	-	23,064	20,342		2,722	23,064	-	88%
Red Cliffs Irrigation District	-	35,709	32,267	1,000	2,442	35,709	-	93%
Robinvale Irrigation District	-	21,652	21,636		16	21,652	-	100%
Other rural distribution systems								
Cardross part of Cardross–Yelta waterworks district	-	-	-	-	-	-	-	-
Millewa Waterworks District[1]	4,491	16,350	11,705		4,351	16,057	4,785	73%

Note:

(1) For the Millewa waterworks district, the distribution system efficiency includes allowance for evaporation losses from Lake Cullulleraine (off-stream storage).

Distribution systems: Northern region

Table 8.2-16 summarises Lower Murray Water's urban distribution systems.

Table 8.2-16 Lower Murray Water urban distribution systems

System/towns supplied	Source of supply	Treatment plant location/ Comment
Kerang	Murray River, Loddon River, Torrumbarry Irrigation Area	Kerang
Koondrook	Murray River	Koondrook
Mildura urban system – Mildura (including Cardross, Koorlong and Nicholls Point), Merbein and Irymple	Murray River	Mildura
Millewa urban system – Werrimull, Meringur and Cullulleraine	Millewa waterworks district	Millewa
Murrabit	Murray River	Murrabit
Mystic Park	Victorian Mid-Murray Storage (Lake Kangaroo)	Raw water supply only (no treatment plant)
Piangil	Murray River	Piangil
Red Cliffs	Murray River	Red Cliffs
Robinvale	Murray River	Robinvale
Swan Hill urban system – Swan Hill, Lake Boga, Nyah, Nyah West, Woorinen South and Wakool Shire (NSW)	Murray River	Swan Hill

Table 8.2-17 shows Lower Murray Water's urban distribution systems' water balances.

Table 8.2-17 Lower Murray Water urban distribution systems' water balances

Area/system	Start volume in store (ML)	Total inflows (ML)	Outflows (ML)					End volume in store (ML)	Distribution system efficiency (%)
			Deliveries		Losses				
			To urban residential	To urban others	From treatment plants	From distribution systems(1)	Total outflows		
Kerang	6	1,139	755	184	-	200	1,139	6	82%
Koondrook	3	255	165	22	-	68	255	3	73%
Mildura system	48	13,919	8,937	2,490	-	2,492	13,919	48	82%
Millewa system	1	34	34	0	-	0	34	1	100%
Murrabit	2	35	17	6	-	12	35	2	65%
Mystic Park	0	13	6	1	-	6	13	0	55%
Piangil	1	106	48	48	-	10	106	1	91%
Red Cliffs(2)	7	1,274	634	654	-	(14)	1,274	7	101%
Robinvale	5	554	349	141	-	64	554	5	88%
Swan Hill system	14	4,240	2,643	992	-	605	4,240	14	86%

Notes:

(1) Distribution system losses are used as the balancing item.

(2) An unaccounted-for inflow (reported as a negative distribution system loss) explains the efficiency of 101%.

8.3 Gippsland region

8.3.1 East Gippsland Water

East Gippsland Water's service area spans 21,000 square kilometres. It extends east from Lindenow, through to the region's capital Bairnsdale, the holiday centres of Paynesville and Lakes Entrance, and on to the Wilderness Coast and Mallacoota near the New South Wales border. The corporation also serves as far north as Dinner Plain in the High Country of the Victorian Alps. Water services are provided to more than 23,000 customers via nine separate water supply systems.

Table 8.3-1 summarises East Gippsland Water's urban distribution systems.

Table 8.3-1 East Gippsland Water urban distribution systems

System/towns supplied	Source of supply	Treatment plant location
Bemm River	Bemm River	Bemm River
Buchan	Buchan River	Buchan
Cann River	Cann River	Cann River
Dinner Plain	Groundwater	Dinner Plain
Mallacoota	Betka River and groundwater	Mallacoota
Mitchell system – Bairnsdale, Paynesville, Lindenow, Lindenow South, Eagle Point, Newlands Arm, Raymond Island, Banksia Peninsula, Granite Rock, Wy Yung, Bruthen, Sarsfield, Nicholson, Johnsonville, Swan Reach, Metung, Lakes Entrance, Lake Bunga, Lake Tyers, Lake Tyers Beach and Nowa Nowa	Mitchell River at Glenaladale	Woodglen
Omeo	Butchers Creek	Omeo
Orbost system – Orbost, Newmerella and Marlo	Rocky and Brodribb rivers	Orbost
Swifts Creek	Tambo River	Swifts Creek

Table 8.3-2 shows East Gippsland Water's urban distribution systems' water balances.

Table 8.3-2 East Gippsland Water urban distribution systems' water balances

Area/system	Start volume in store (ML)	Total inflows (ML)	Outflows (ML)					End volume in store (ML)	Distribution system efficiency (%)
			Deliveries		Losses[1]				
			To urban residential	To urban others	From treatment plants	From distribution systems	Total outflows		
Bemm River	5	19	10	6	0	3	19	5	83%
Buchan	0	23	11	8	0	4	23	0	83%
Cann River	3	34	17	14	0	4	35	2	88%
Dinner Plain	1	42	17	9	0	16	42	1	62%
Mallacoota	55	161	91	48	0	22	161	55	86%
Mitchell system	817	5,226	2,620	1,259	0	1,033	4,912	1,131	79%
Omeo	13	48	25	16	0	15	56	5	73%
Orbost system	37	713	251	368	0	81	700	50	88%
Swifts Creek	2	32	15	10	0	6	31	3	80%

Notes:

(1) Distribution system losses are used as the balancing item.

8.3.2 Gippsland Water

Gippsland Water services an area of just over 5,000 square kilometres in the Latrobe Valley. The area has a population of more than 130,000 and major industries including dairy, energy, and pulp and paper.

Table 8.3-3 summarises Gippsland Water's urban distribution systems.

Distribution systems: Gippsland region

Table 8.3-3 Gippsland Water urban distribution systems

Area	System/towns supplied	Source of supply	Treatment plant location/ Comment
Macalister/ Thomson	Maffra system – Boisdale, Maffra and Stratford	Macalister River	Maffra
	Coongulla system – Coongulla and Glenmaggie	Lake Glenmaggie	Coongulla
	Heyfield	Thomson River	Heyfield
	Briagalong	Groundwater	Briagalong
Moe	Moe system – Moe, Newborough, Yallourn North, Trafalgar, Darnum and Yarragon	Narracan Creek and Tanjil River	Moe
Moondarra Reservoir	Moondarra system – Boolarra, Churchill, Cowwarr, Glengarry, Hazelwood North, Jumbuck, Morwell, Rosedale, Toongabbie, Traralgon, Tyers and Yinnar	Moondarra Reservoir	Morwell, Traralgon and Tyers
Sale	Sale and Wurruk	Groundwater	Sale
Warragul/Drouin	Warragul system – Buln Buln, Drouin, Nilma, Warragul and Warragul South	Tarago River	Warragul
Small towns in Latrobe and South Gippsland basins	Willow Grove	Blue Rock Reservoir	Willow Grove
	Neerim South and Noojee	Tarago Reservoir	Neerim South
	Boolarra	Walkleys/O'Gradys Creek	Boolarra (to be decommissioned)
	Erica and Rawson	Trigger Creek	Rawson
	Mirboo North	Little Morwell River	Mirboo North
	Thorpdale	Easterbrook Creek	Thorpdale
	Seaspray	Merrimans Creek	Seaspray

Table 8.3-4 shows Gippsland Water's urban distribution systems' water balances.

Table 8.3-4 Gippsland Water urban distribution systems' water balances

Area/system	Start volume in store (ML)	Total inflows (ML)	Outflows (ML)					Balancing item (ML)[2]	End volume in store (ML)	Distribution system efficiency (%)
			Deliveries		Losses		Total outflows			
			To urban residential	To urban others[1]	From treatment plants	From distribution systems				
Erica/Rawson	26	80	39	20	3	17	79	26	1	75%
Macalister/Thomson area	32	1,626	837	469	102	218	1,626	(5)	37	80%
Mirboo North	2	186	112	29	0	45	186		2	76%
Moe system	53	4,106	1,633	1,721	271	481	4,106	1	52	82%
Moondarra Reservoir system[3]	724	50,231	4,445	44,148	378	1,251	50,222	1	732	97%
Neerim South/Noojee	3	223	147	36	12	28	223	(1)	4	82%
Sale system	16	1,924	1,199	577	125	24	1,925	0	16	92%
Seaspray[4]	3	64	19	10	1	6	36	28	3	81%
Thorpdale	2	17	9	2	4	2	17		2	65%
Warragul/Drouin system	67	3,015	1,856	522	131	506	3,015	(19)	87	79%
Willow Grove	0	49	33	2	3	12	50	(1)	0	70%

Notes:
(1) Urban other includes non-residential use and includes major industry users in some systems.
(2) Distribution system losses are used as the balancing item in those systems that show a zero explicit balancing item. Where a separate balancing item has been included, the unaccounted-for flows have not been able to be attributed to any particular line item in the accounts.
(3) Boolarra system connected to the Moondarra system in July 2012 and is now reported in the Moondarra system.
(4) Volume of 28 ML reported in the balancing item represents water transferred to a connected storage.

The Thorpdale system, with the lowest efficiency of 65%, is also Gippsland Water's smallest system by volume supplied. The volume supplied to the system totalled 17 ML, which is small compared to the 57,864 ML total supplied to all systems. An overall efficiency was calculated at 94% for all systems combined.

8.3.3 Southern Rural Water (Macalister system)

Southern Rural Water is based in Maffra. It is responsible for rural water supplies across the whole of southern Victoria (except for water supplied by Wannon Water to its rural customers) from the Great Divide to the coast, and from the South Australian border to the New South Wales border. The majority of Southern Rural Water's customers are direct diverters from streams or groundwater, however it also operates three irrigation districts.

The largest of these is the Macalister Irrigation District, which is supplied principally from Lake Glenmaggie on the Macalister River and also from Cowwarr Weir on the Thomson River. The other two (Werribee and Bacchus Marsh irrigation districts) are reported in the Central Region section.

Table 8.3-5 shows the water balance for the Macalister Irrigation District.

Table 8.3-5 Southern Rural Water Macalister Irrigation District water balance

Distribution system	Start volume in store (ML)	Total inflows (ML)	Outflows (ML)					End volume in store (ML)	Distribution system efficiency (%)
			Deliveries		Losses[2]	Passed to other systems	Total outflows		
			To irrigation[1]	To other					
Macalister Irrigation District	-	198,851	166,878	-	30,468	1,505	198,851	-	85%

Notes:

(1) Deliveries to irrigation include supply to domestic and stock customers.

(2) Losses include 22,626 ML of outfalls, the remainder is back-calculated to represent losses.

8.3.4 South Gippsland Water

South Gippsland Water supplies 21 rural centres in South Gippsland, from Wonthaggi in the west to Yarram and Alberton in the east. It operates 10 separate urban distribution systems and covers a total area of around 4,000 square kilometres.

Table 8.3-6 summarises South Gippsland Water's urban distribution systems.

Table 8.3-6 South Gippsland Water urban distribution systems

System/towns supplied	Source of supply	Treatment plant location
Dumbalk	Tarwin River – east branch	Dumbalk
Fish Creek	Battery Creek	Fish Creek
Foster	Deep Creek/Foster Dam	Foster
Korrumburra	Coalition Creek storage network	Korrumburra
Leongatha and Koonwarra	Ruby Creek storage network	Leongatha
Loch system – Loch, Nyora and Poowong	Little Bass River	Poowong
Meeniyan	Tarwin River – west branch	Meeniyan
Toora system – Toora, Port Franklin, Welshpool and Port Welshpool	Agnes River	Toora
Wonthaggi system – Wonthaggi, Inverloch and Cape Patterson	Lance Creek and Lance Creek Reservoir	Lance Creek
Yarram system – Devon North, Alberton, Yarram and Port Albert	Tarra River	Devon North

Table 8.3-7 shows South Gippsland Water's urban distribution systems' water balances.

Table 8.3-7 South Gippsland Water urban distribution systems' water balances

Area/system	Start volume in store (ML)	Total inflows (ML)	Outflows (ML)					Balancing item (ML)[2]	End volume in store (ML)	Distribution system efficiency (%)
			Deliveries		Losses[1]					
			To urban residential	To urban others	From treatment plants	From distribution systems	Total outflows			
Dumbalk	0	31	10	5	10	6	30	1	0	50%
Fish Creek	123	99	13	63	2	0	78	21	123	97%
Foster	238	175	75	60	9	22	166	9	238	81%
Korrumburra	592	713	236	368	22	64	691	63	551	87%
Leongatha	1,685	1,707	357	1,122	65	85	1,629	442	1,320	91%
Loch system	140	231	74	267	11	22	374	(192)	189	91%
Meeniyan	5	66	32	15	5	10	61	5	5	77%
Toora system	58	513	64	118	60	60	303	210	58	60%
Wonthaggi system	4,200	1,822	912	579	91	163	1,745	540	3,737	85%
Yarram system	27	429	145	204	8	34	391	36	29	89%

Notes:

(1) Distribution system losses include treatment plant losses.

(2) A separate balancing item has been included as the unaccounted-for flows in these systems cannot be attributed to any particular line item in the accounts.

8.4 Central region

8.4.1 Westernport Water

Westernport Water supplies the towns and adjacent properties on Phillip Island, and on the eastern shore of Westernport Bay from The Gurdies to Dalyston. Water is sourced from:

- Candowie Reservoir, a storage on Tennant Creek in the South Gippsland basin
- direct diversion from the Bass River
- the Corinella aquifer, via three groundwater bores.

Water is treated at Candowie Reservoir and passed to the San Remo storage basin, from which it is delivered via a single integrated distribution system. A permanent population of about 16,000 is supplied, with the population swelling to about 60,000 in peak holiday periods.

Table 8.4-1 summarises Westernport Water's distribution system's water balances.

Table 8.4-1 Westernport Water distribution system's water balance

Westernport Water	Volume (ML)
Volumes in store	
Start volume in store (1 July 2012)	-
End volume in store (30 June 2013)	-
Change in storages	**-**
Inflows	
From Candowie Reservoir	1,637
From Bass River	201
Total inflows	**1,838**
Outflows	
Deliveries	
Residential customers	1,087
Non-residential customers	564
Owners corporations	61
Westernport Water operations	0
Total deliveries	***1,599***
Losses	
Treatment plant	36
Distribution system	90
Total losses	***126***
Total outflows	**1,838**
System efficiency (%)	**93%**

8.4.2 Melbourne Water

Melbourne Water operates a 'common' or wholesale distribution system for the greater Melbourne metropolitan area as well as for connected regional water authorities. It spans four river basins (Bunyip, Yarra, Maribyrnong and Werribee). Water is harvested from the Bunyip, Yarra, Thomson and Goulburn basins. The distribution system draws from several on-stream storages and includes four significant off-stream storages (Silvan, Cardinia, Sugarloaf and Greenvale reservoirs).

Melbourne Water supplies the three Melbourne retail water corporations (South East Water, Yarra Valley Water and City West Water). It also supplies Western Water and Gippsland Water and will in future supplement supplies to Barwon Water, South Gippsland Water and Westernport Water.

Most of the inflow comes from protected catchments in the Yarra, Bunyip and Thomson basins, and minimal treatment (chlorination) is required. However, about 20% comes from unprotected catchments and is fully treated by treatment plants at Sugarloaf, Tarago and Yan Yean storages.

Table 8.4-2 summarises Melbourne Water's distribution system's water balance.

Table 8.4-2 Melbourne Water distribution system's water balance

Melbourne Water	Volume (ML)
Volumes in store	
Start volume (1 July 2012)	
Silvan Reservoir	36,311
Cardinia Reservoir	217,739
Sugarloaf Reservoir	93,866
Greenvale Reservoir	20,956
Total start volume	***368,872***
End volume (30 June 2013)	
Silvan Reservoir	33,146
Cardinia Reservoir	208,916
Sugarloaf Reservoir	68,584
Greenvale Reservoir	20,112
Total end volume	***330,758***
Decrease in storages(1)	**38,114**
Inflows	
From Yarra basin to Silvan(2)	254,184
From Yarra basin to Cardinia(3)	0
From Yarra basin to Sugarloaf	69,956
From Goulburn River to Sugarloaf	0
From Yan Yean to Greenvale	0
From Tarago Reservoir	4,978
Rainfall on four main storages	16,507
Total inflows	**345,625**
Outflows	
Passed to other systems	
To South East Water	140,616
To Yarra Valley Water	149,635
To City West Water	103,231
To Western Water	10,433
To Gippsland Water	345
To Cardinia Creek from Cardinia	1,825
To Stonyford Creek from Silvan	730
Total passed to other systems	**406,815**
Losses	
Evaporation from four main storages	20,922
Treatment plant losses(4)	1,371
System losses(5)	2,353
Total losses	**24,646**
Total outflows	**431,461**
Balancing item (unaccounted-for inflow)	47,722
System efficiency (%)	**94%**

Notes:

(1) Storage figures do not include service reservoirs and tanks.
(2) Inflows from Yarra basin to Silvan include a transfer of 25,148 ML from Thomson to Yarra basin.
(3) Inflows from Yarra basin to Cardinia were all transferred from Silvan.
(4) Treatment plant losses due to water quality incident at Tarago treatment plant.
(5) System losses included treatment plant losses, but exclude aqueduct leaks as that is outside of the common distribution system.

Factors contributing to the unaccounted-for inflow include ungauged runoff from the catchments of reservoirs, as well as outflows passed to other systems being more accurately metered than inflows to the distribution system.

8.4.3 South East Water

South East Water is one of Melbourne's three retail water corporations. It obtains treated bulk water from Melbourne Water and operates a single integrated distribution system covering south-east Melbourne, the Mornington Peninsula and part of South Gippsland.

Table 8.4-3 shows South East Water's urban distribution system's water balance.

Table 8.4-3 South East Water urban distribution system's water balance

South East Water	Volume (ML)
Volumes in store	
Start volume (1 July 2012)	
Service basins	523
End volume (30 June 2013)	
Service basins	523
Change in storage	0
Inflows	
From Melbourne Water	140,627
Recycled – imported	1,367
Recycled – from local treatment plant	2,157
Total inflows	**144,151**
Outflows	
Deliveries	
To residential customers	93,124
To non-residential customers	31,337
To authorised non-metered	4,160
Recycled water used	3,091
Total deliveries	***131,712***
Losses	
System losses(1)	12,439
Total losses	***12,439***
Total outflows	**144,151**
System efficiency	**91%**

Note:

(1) The balancing item in this account is system losses (back-calculated from total inflows).

8.4.4 Yarra Valley Water

Yarra Valley Water is one of Melbourne's three retail water corporations. It obtains treated bulk water from Melbourne Water and operates a single integrated distribution system covering the part of greater Melbourne that is in the Yarra basin, extending to Warburton in the east and Wallan in the north. Table 8.4-4 shows Yarra Valley Water's urban distribution system's water balance.

Table 8.4-4 Yarra Valley Water urban distribution system's water balance

Yarra Valley Water	Volume (ML)
Volumes in store	
Start volume (1 July 2013)	-
End volume (30 June 2014)	-
Change in storage	-
Inflows	
From Melbourne Water	149,635
Recycled – from local treatment plant	17
Total inflows	**149,652**
Outflows	
Deliveries	
To residential customers	104,842
To non-residential customers	27,471
Recycled water used	0
Total deliveries	***132,313***
Losses	
System losses(1)	17,339
Total losses	***17,339***
Total outflows	**149,652**
System efficiency	**88%**

Note:

(1) System losses include both real losses of 14,266 ML (from leakage, bursts and background leakage) and apparent losses of 3,073 ML (which may include metering errors).

8.4.5 City West Water

City West Water is one of Melbourne's three retail water corporations. It obtains treated bulk water from Melbourne Water and operates a single integrated distribution system covering Melbourne's central business district and its inner and western suburbs. Table 8.4-5 shows City West Water's urban distribution system's water balance.

Table 8.4-5 City West Water urban distribution system's water balance

City West Water	Volume (ML)
Volumes in store	
Start volume (1 July 2012)	-
End volume (30 June 2013)	-
Change in storage	-
Inflows	
From Melbourne Water	103,231
Recycled/imported(1)	267
Total inflows	**103,498**
Outflows	
Deliveries	
To residential customers	53,023
To non-residential customers	40,602
Recycled water used	1,038
Total deliveries	***94,663***
Losses	
System losses(2)	8,834
Total losses	***8,834***
Total outflows	**103,498**
System efficiency	**91%**

Notes:

(1) The recycled/imported inflow amount represents a bulk purchase from Melbourne Water.

(2) The balancing item in this account is system losses (back-calculated from total inflows).

8.4.6 Western Water

Western Water is based in Sunbury and services a rapidly growing area to the west of, and adjacent to, Melbourne.

It operates a main integrated distribution system, with somewhat separate supplies to Woodend, Lancefield and Myrniong. While Woodend can be indirectly supplemented from the main integrated system, Lancefield and Myrniong cannot. Romsey is similar to Woodend: it utilises local water for most of the time but can be supplemented from the main integrated system in times of drought.

Table 8.4-6 summarises Western Water's urban distribution systems.

Table 8.4-6 Western Water urban distribution systems

Area	System/towns supplied	Source of supply	Treatment plant location
Main integrated system	Sunbury, Gisborne, Bacchus Marsh, Diggers Rest, Riddles Creek, Macedon, Melton, Mount Macedon, Romsey and Myrniong (*Myrniong is separate and not connected to the integrated system)*	Bulk supply from Melbourne Water, Rosslynne Reservoir system, Pykes Creek Reservoir, Merrimu Reservoir, Djerriwarrh Reservoir and Kerrie Reservoir	Melton, Gisborne, Romsey, Myrniong
Lancefield	Lancefield	Garden Hut Reservoir and groundwater	Lancefield
Woodend	Woodend	Campaspe Reservoir and Campaspe River tributaries, Mount Macedon storages and tributaries *(indirectly supplemented from integrated system in times of drought)*	Woodend

Table 8.4-7 shows Western Water's urban distribution systems' water balances.

Table 8.4-7 Western Water urban distribution systems' water balances

Area/system	Start volume in store (ML)	Total inflows (ML)	Outflows (ML)						Balancing item (ML)(1)	End volume in store (ML)	Distribution system efficiency (%)
			Deliveries		Losses						
			To urban residential	To urban others	From treatment plants	From distribution systems	Passed to other systems	Total outflows			
Main integrated system	643	13,138	8,782	1,549	31	1,499	64	11,925	1,496	360	87%
Lancefield	109	161	135	24	3	23	0	185	34	51	86%
Woodend	356	392	334	59	0	57	0	450	47	251	87%

Note:

(1) A separate balancing item has been included as the unaccounted-for flows in these systems cannot be attributed to any particular line item in the accounts.

8.4.7 Barwon Water

Barwon Water supplies the greater Geelong area (including the Bellarine Peninsula and towns as far west as Birregurra and Forrest), the Colac area, the Aireys Inlet area, the Lorne area and the Apollo Bay area.

Table 8.4-8 summarises Barwon Water's urban distribution systems.

Table 8.4-8 Barwon Water urban distribution systems

Area	System/towns supplied	Source of supply	Treatment plant location/Comment
Aireys Inlet	Aireys Inlet and Fairhaven	Painkalac Reservoir on the Painkalac Creek	Aireys Inlet
Apollo Bay	Apollo Bay, Marengo and Skenes Creek	Diversion weir on the West Barham River in the Otway Ranges	Treatment plant near Marengo
Colac (Colac and Gellibrand systems)	Colac urban, and rural areas and towns including Gellibrand, Pirron Yallock, Irrewarra, Coragulac, Alvie, Beeac and Cressy	Olangolah and West Gellibrand reservoirs, which are fed by streams in the Otway Ranges	Colac
Greater Geelong and Bellarine Peninsula – supplied from integrated Barwon River system, Moorabool River system, Barwon Downs borefield and Anglesea borefield	Greater Geelong urban (includes Anakie, Avalon, Balliang, Bamganie, Bannockburn, Batesford, Birregurra, Fyansford, Gheringhap, Inverleigh, Leopold, Lethbridge, Little River, Marshall, Maude, Meredith, Modewarre, Moorabool, Moriac, Mount Moriac, Murgheboluc, She Oaks, Shelford, Staughton Vale, Sutherlands Creek, Teesdale, Thompson, Winchelsea and Wurdiboluc) Bellarine Peninsula (includes Barwon Heads, Bellarine, Breamlea, Clifton Springs, Curlewis, Drysdale, Indented Head, Mannerim, Marcus Hill, Ocean Grove, Point Lonsdale, Portarlington, Queenscliff, St Leonards, Swan Bay and Wallington)	Barwon River system – West Barwon Reservoir on the West Barwon River	Wurdee Boluc
		Moorabool River system – various streams in the Moorabool basin	Moorabool treatment plant at She Oaks
		Barwon Downs borefield – Barwon Downs aquifer	At bores
		Anglesea borefield – Lower Eastern View formation	At bores
Lorne	Lorne township	Allen Reservoir on the St George River, just west of Lorne	Lorne

Table 8.4-9 shows Barwon Water's urban distribution systems' water balances.

Table 8.4-9 Barwon Water urban distribution systems' water balances

Area/system	Start volume in store (ML)	Total inflows (ML)	Outflows (ML)					Balancing item (ML)[1]	End volume in store (ML)	Distribution system efficiency (%)
			Deliveries		Losses					
			To urban residential	To urban others	From treatment plants	From distribution systems	Total outflows			
Aireys Inlet	2	206	143	10	39	14	206	0	2	74%
Apollo Bay	126	379	186	101	36	75	398	3	110	72%
Colac (incl. Gellibrand)	564	3,846	1,655	1,295	0	354	3,304	542	564	89%
Geelong/Bellarine	35,540	31,768	18,693	8,340	0	3,006	30,039	6,411	30,858	90%
Lorne	6	408	223	79	60	47	408	3	2	74%

Note:
(1) A separate balancing item has been included as the unaccounted-for flows in these systems cannot be attributed to any particular line item in the accounts.

8.4.8 Central Highlands Water

Central Highlands Water is based in Ballarat. It supplies water to the greater Ballarat region and to numerous other towns and districts, ranging from Ballan in the east to Landsborough and Navarre in the north-west and Rokewood in the south. Its supply and distribution systems spread across seven river basins, both north and south of the Great Dividing Range.

Table 8.4-10 summarises Central Highlands Water's urban distribution systems.

Table 8.4-10 Central Highlands Water urban distribution systems

Area	System/towns supplied	Source of supply	Treatment plant location/ Comment
Greater Ballarat (multiple basins)	Supplies suburbs and towns including Alfredton, Ballan, Ballarat, Black Hill, Brown Hill, Bungaree, Buninyong, Corindhap, Creswick, Golden Point, Gordon, Linton, Mt Clear, Scarsdale, Smythesdale, Snake Valley, Skipton and Wallace	White Swan Reservoir in the Barwon basin, Lal Lal Reservoir in the Moorabool basin, Ballarat West groundwater bores and the Goldfields Superpipe which extracts water from the Goulburn basin	
Maryborough and district (Loddon basin)	The second largest system managed by Central Highlands Water; supplies the towns and villages of Adelaide Lead, Alma/Moonlight, Betley, Carisbrook, Craigie, Daisy Hill, Havelock, Majorca, Maryborough, Rodborough, Simson/Bet Bet, Talbot and Timor/Bowenvale	Evansford and Talbot reservoirs (which source water from McCallums Creek) and Tullaroop Reservoir on the Loddon River	Single treatment plant at the central holding basin (Centenary Reservoir)
Individual or small groups of towns	Amphitheatre (Avoca basin)	Small reservoir on Forest Creek	None (non-potable supply)
	Avoca (Avoca basin)	Sugarloaf Reservoir in the Avoca basin	Avoca
	Beaufort and Raglan (Hopkins basin)	Musical Gully Reservoir, which captures water via diversion weirs from streams in the Hopkins basin	Supply to Raglan is untreated; supply to Beaufort is chlorinated at Musical Gully
	Blackwood and Barrys Reef (Werribee basin)	Blackwood Basin, which is supplied by diversion from Kyneton Gully Creek and Long Gully Creek; supplemented by emergency groundwater bore	Non-chemical (UV) disinfection at Blackwood Basin
	Clunes (Loddon basin)	Groundwater bore	Hardness removed and disinfected; treatment plant is adjacent to the bore
	Daylesford system – supplies Daylesford, Hepburn and Hepburn Springs (Loddon basin)	Three small storages supplied from various streams	Single treatment plant for the three towns
	Dean (Loddon basin)	Groundwater bore	Chlorine disinfection
	Forest Hill system (Loddon basin) – supplies Allendale, Newlyn, Smeaton, Kingston, Springmount, Broomfield and rural homes in the district	Three groundwater bores at Forest Hill	Hardness removed and disinfected; treatment plant is adjacent to the bores
	Landsborough and Navarre (Wimmera basin)	Landsborough Reservoir, which is supplied by diversions from several streams; supplemented by a drought relief bore	None (non-potable supply)
	Learmonth (Loddon basin)	Groundwater bore	High quality supply, little treatment is required
	Lexton (Loddon basin)	Lexton Reservoir, which captures water from springs in its catchment	Treatment plant at the reservoir
	Redbank (Avoca basin)	Redbank Reservoir on the upper Avoca River, with a supplementary groundwater bore	None (non-potable supply)
	Waubra (Loddon basin)	Two groundwater bores	Disinfected with chlorine at storage tanks

Table 8.4-11 shows Central Highlands Water's urban distribution systems' water balances. All Central Highlands Water reservoirs are on stream and hence not included in water balance calculations. Furthermore, White Swan Reservoir is treated in the basin chapters of the accounts as an on-stream storage and thus is not covered here. The headworks system, i.e. the channels connecting Moorabool Reservoir to White Swan, is also not covered in this account.

Distribution systems: Central region

Table 8.4-11 Central Highlands Water urban distribution systems' water balances

Area/system	Start volume in store (ML)	Total inflows (ML)(1)	Outflows (ML)					Balancing item (ML)	End volume in store (ML)	Distribution system efficiency (%)
			Deliveries		Losses		Total outflows			
			To urban residential	To urban others	From treatment plants	From distribution systems(2)				
Amphitheatre	-	14	12	1	0	1	14	0	-	94%
Avoca	-	189	82	27	0	12	121	68	-	90%
Beaufort and Raglan	-	141	98	33	8	40	179	(38)	-	73%
Blackwood and Barrys Reef	-	42	23	5	0	3	30	12	-	92%
Clunes	-	209	130	39	2	38	209	0	-	81%
Daylesford system	-	671	352	153	0	150	655	16	-	77%
Dean(3)	-	22	5	2	0	15	22	0	-	29%
Forest Hill system	-	173	106	13	0	54	173	0	-	69%
Greater Ballarat	-	11,371	7,064	3,043	0	1,264	11,371	0	-	89%
Landsborough and Navarre	-	35	16	6	4	5	31	4	-	70%
Learmonth	-	55	25	22	0	3	50	5	-	94%
Lexton	-	23	13	1	0	3	17	6	-	84%
Maryborough and district	-	1,399	812	291	0	122	1,225	175	-	90%
Redbank	-	3	4	0	0	(1)	3	0	-	120%
Waubra	-	26	19	1	0	2	22	4	-	93%

Notes:

(1) Inflow is flow measured into the distribution system, generally excluding water treatment plants.

(2) Distribution system losses are used as the balancing item in those systems that show a zero explicit balancing item. Where a separate balancing item has been included, the unaccounted-for flows have not been able to be attributed to any particular line item in the accounts.

(3) Metering issues have been identified by Central Highlands Water and these may explain the large losses in this system.

8.5 Western region

8.5.1 Wannon Water

Wannon Water's region extends over 24,500 square kilometres from the South Australian border in the west, to Balmoral in the north, to Lismore in the east and to the lower Gellibrand River catchment on the south coast. The Warrnambool City, Corangamite Shire, Glenelg Shire, Moyne Shire and Southern Grampians Shire councils are all within its service area.

Most of Wannon Water's distribution systems supply both towns and rural customers and are shown as consolidated systems. Table 8.5-1 summarises Wannon Water's combined distribution systems.

Table 8.5-1 Wannon Water combined distribution systems

Area	System/towns supplied	Source of supply	Treatment plant location
Balmoral	Balmoral	Rocklands Reservoir	Balmoral
Dilwyn aquifer	Portland, Heywood, Dartmoor, Port Fairy, Port Campbell, Peterborough and Timboon	Groundwater flow – numerous bores in localities serviced	Portland, Heywood, Dartmoor, Port Fairy and Port Campbell
Glenthompson	Glenthompson	Local surface water catchments into Glenthompson and Railway reservoirs, bulk supply from GWMWater	Glenthompson
Grampians	Hamilton, Cavendish, Dunkeld and Tarrington	Victoria Ranges catchment (small streams and groundwater flow extracted from bores) and Rocklands Reservoir	Hamilton, Cavendish and Dunkeld
Konongwootong	Rural customers only	Local surface water catchment into Konongwootong Reservoir	n/a
Newer Volcanic Aquifer	Darlington, Caramut, Penshurst, Macarthur and Mortlake	Groundwater flow extracted at bores in localities serviced	Darlington, Caramut, Penshurst and Macarthur
Otways (Otway system)	Warrnambool, Simpson, Cobden, Camperdown, Glenormiston, Lismore, Derrinallum, Terang, Mortlake, Purnim, Allansford and Koroit	Arkins Creek catchment, Gellibrand River catchment, groundwater flow extracted from bores near Carlisle River and at Albert Park, Warrnambool	Warrnambool, Simpson, Cobden, Camperdown, Terang and Purnim
Port Campbell Limestone aquifer	Casterton, Coleraine, Sandford, Merino and Warrnambool	Groundwater flow extracted at Tullich borefield and at Albert Park, Warrnambool	Casterton

Table 8.5-2 shows Wannon Water's combined distribution systems' water balances. The volume of water in storage and total inflow volumes are calculated at the system level, hence data for these items is not available for individual towns. Similarly, reticulation system loss volumes are not available for individual townships for the Otway system and as such are presented at the system level.

Table 8.5-2 Wannon Water combined distribution systems' water balances

Area/system	Start volume in store (ML)	Total Inflows (ML)	Outflows (ML)							Balancing item (ML)	End volume in store (ML)	Distribution efficiency (%)
			Deliveries		Losses							
			To urban residential	To urban other	To rural customers	Treatment plant losses	Reticulation system losses[1]	Passed to other systems	Total outflows			
Balmoral	**0**	**57**	**15**	**8**	**19**	**10**	**4**	**0**	**55**	**2**	**0**	**75%**
Dilwyn Aquifer												
Portland	-	-	746	685	1	89	430	0	1,950	-	-	
Heywood	-	-	99	42	3	11	24	0	178	-	-	
Dartmoor	-	-	14	1	0	0	10	0	25	-	-	
Port Fairy	-	-	271	346	0	0	49	0	666	-	-	
Port Campbell	-	-	26	30	0	0	13	0	69	-	-	
Peterborough	-	-	21	12	9	0	8	0	49	-	-	
Timboon	-	-	60	48	69	0	41	0	219	-	-	
Total	**30**	**3,062**	**1,236**	**1,163**	**82**	**100**	**575**	**0**	**3,156**	**(94)**	**30**	**79%**
Glenthompson	**81**	**45**	**8**	**1**	**18**	**9**	**3**	**0**	**39**	**19**	**68**	**70%**

Distribution systems: Western region

Area/system	Start volume in store (ML)	Total Inflows (ML)	Outflows (ML)							Balancing item (ML)	End volume in store (ML)	Distribution efficiency (%)
			Deliveries		Losses			Passed to other systems	Total outflows			
			To urban residential	To urban other	To rural customers	Treatment plant losses	Reticulation system losses(1)					
Grampians (excl. Balmoral)												
Cavendish	-	-	9	2	1	0	1	-	13	-	-	
Hamilton(2)	-	-	727	218	148	76	239	-	1,408	-	-	
Dunkeld	-	-	52	18	10	0	21	-	100	-	-	
Tarrington	-	-	24	2	6	0	12	-	44	-	-	
Total	**2,267**	**1,280**	**811**	**240**	**165**	**76**	**273**	**57**	**1,622**	**123**	**1,802**	**79%**
Konongwootong	**695**	**144**	**0**	**0**	**54**	**0**	**90**	**0**	**144**	**72**	**623**	**37%**
Newer Volcanic Aquifer												
Caramut(3)	-	-	9	4	5	0	10	-	28	-	-	
Penshurst	-	-	45	16	4	15	22	-	103	-	-	
Macarthur	-	-	16	3	1	15	2	-	37	-	-	
Darlington	-	-	2	0	2	0	1	-	5	-	-	
Total	**-**	**204**	**73**	**24**	**11**	**30**	**35**	**31**	**204**	**-**	**-**	**68%**
Otway system												
Allansford	-	-	54	44	15	0	-	-	113	-	-	
Camperdown	-	-	242	129	531	0	-	-	902	-	-	
Cobden	-	-	111	318	114	81	-	-	623	-	-	
Koroit	-	-	100	88	1	0	-	-	190	-	-	
Lismore & Derrinallum	-	-	45	17	61	0	-	-	123	-	-	
Mortlake	-	-	87	44	2	0	-	-	133	-	-	
Noorat & Glenormiston	-	-	30	55	65	0	-	-	150	-	-	
North Otway Pipeline	-	-	0	9	1,361	0	-	-	1,370	-	-	
Purnim	-	-	0	0	21	0	-	-	21	-	-	
Simpson	-	-	12	63	17	0	-	-	92	-	-	
Terang	-	-	153	52	7	0	-	-	212	-	-	
Warrnambool	-	-	2,168	1,330	25	50	-	-	3,573	-	-	
Total	**1,995**	**9,245**	**3,002**	**2,148**	**2,220**	**131**	**889**	**-**	**8,389**	**755**	**2,097**	**88%**
Port Campbell limestone aquifer												
Tullich pipeline	-	-	0	0	2	0	0	-	2	-	-	
Casterton	-	-	112	53	8	42	101	-	316	-	-	
Coleraine(4)	-	-	60	22	8	0	23	-	112	-	-	
Sandford	-	-	9	3	10	0	8	-	30	-	-	
Merino	-	-	15	5	16	0	12	-	48	-	-	
Total	**-**	**892**	**196**	**83**	**43**	**42**	**144**	**383**	**891**	**1**	**-**	**79%**

Notes:

(1) Reticulation system losses are generally back-calculated for individual towns, so balancing items represent distribution losses in supplying water to the towns.

(2) Hamilton includes rural deliveries from the Hamilton Pipeline.

(3) Caramut includes rural deliveries from the Caramut Pipeline.

(4) Coleraine includes rural deliveries from the Coleraine Pipeline.

8.5.2 Grampians Wimmera Mallee Water

Grampians Wimmera Mallee Water (GWMWater) is based in Horsham and supplies water to urban and rural customers via the extensive Wimmera–Mallee pipeline system. It supplies the larger urban areas in the south (Ararat, Stawell and Horsham) via separate distribution systems. It supplies many towns from groundwater.

GWMWater services a large area – about 25% of Victoria – in the north-west of the state. It sources most of its water from a complex system of storages in the Grampians, but the northern part of the rural pipeline system is supplied from the Murray.

The rural pipeline system has been divided for reporting purposes into seven distribution systems, each of which supplies several towns. These are presented for simplicity as consolidated reports for the urban and rural systems.

Table 8.5-3 summarises GWMWater's combined distribution systems.

Table 8.5-3 Grampians Wimmera Mallee Water combined distribution systems

Area	System/towns supplied	Source of supply	Treatment plant location/ Comment
Northern Mallee Pipeline	Supplies rural customers around Ouyen and urban customers in Chillingollah, Chinkapook, Ouyen, Manangatang, Nandaly, Nullawil, Patchewollock, Speed, Tempy, Underbool, Waitchie and Walpeup	Murray River at Wemen, Piangil, Nyah and Swan Hill	Treatment plants at Ouyen and Underbool; chlorinators at Manangatang, Nullawil and Walpeup; untreated at Chillingollah, Chinkapook, Nandaly, Patchewollock, Speed, Tempy and Waitchie
Wimmera Mallee Pipeline Supply Systems 1 and 7	Supplies rural customers in the south-west Wimmera and urban customers in Pimpinio, Dimboola, Antwerp, Yaapeet, Jeparit, Rainbow and Tarranyurk	Wimmera headworks at Lake Bellfield and/or Taylors Lake	Treatment plants at Dimboola and Rainbow; untreated at Pimpinio, Antwerp, Yaapeet, Jeparit and Tarranyurk
Wimmera Mallee Pipeline Supply System 2	Supplies rural customers as far north as Lascelles, and urban customers in Jung, Murtoa, Warracknabeal, Brim, Beulah, Hopetoun, Woomelang and Lascelles	Wimmera headworks at Lake Bellfield and/or Taylors Lake	Treatment plants at Warracknabeal, Murtoa and Hopetoun; chlorinators at Jung, Brim, Beulah and Woomelang; untreated at Lascelles
Wimmera Mallee Pipeline Supply System 3	Supplies rural customers to the north-east of Horsham and urban customers in Birchip, Glenorchy, Marnoo, Minyip, Rupanyup and Watchem	Wimmera headworks at Lake Bellfield and/or Taylors Lake	Treatment plants at Birchip and Rupanyup; chlorinator at Minyip; Glenorchy, Marnoo and Watchem are untreated
Wimmera Mallee Pipeline Supply System 4	Supplies rural customers to the north-east of Horsham and urban customers in Charlton, Donald, St Arnaud and Wycheproof	Wimmera headworks at Lake Bellfield and/or Taylors Lake	Treatment plants at Charlton and St Arnaud; chlorinator at Donald; chlorinator at Wycheproof
Wimmera Mallee Pipeline Supply System 5	Supplies rural customers to the south and west of Swan Hill and urban customers in Berriwillock, Sea Lake, Culgoa, Lalbert and Ultima	Murray River at Swan Hill	Chlorinators at Sea Lake, Lalbert and Ultima; untreated at Berriwillock and Culgoa
Wimmera Mallee Pipeline Supply System 6	Supplies rural customers to the west and south of Horsham	Wimmera headworks on Moora Channel supplied from either Lake Wartook or Moora Moora Reservoir into the Brimpaen storages	Raw water supply only; untreated at Clear Lake and Noradjuha

Distribution systems: Western region

GWMWater also operates some 18 purely urban distribution systems, summarised in Table 8.5-4.

Table 8.5-4 Grampians Wimmera–Mallee Water urban distribution systems

Area	System/towns supplied	Source of supply	Treatment plant location/ Comment
Ararat system	Ararat and surrounds	Mount Cole Reservoir and Lake Fyans	Ararat
Halls Gap system	Halls Gap and Pomonal	Lake Bellfield	Halls Gap
Horsham system	City of Horsham and surrounds, including Haven and Natimuk	Lake Wartook and Laharum groundwater bores	Mount Zero
Loddon Basin	Quambatook	Normanville D&S system	Chlorinated
Stawell system	Stawell, Great Western	Fyans Creek and Lake Fyans	Stawell and Great Western
Willaura system	Willaura, Lake Bolac, Moyston and Wickliffe	Mt William, Stony and Masons creeks; groundwater bores (unincorporated area)	Willaura serves Willaura and Lake Bolac; untreated at Moyston and Wickliffe
Towns supplied from ground water	Apsley	West Wimmera	Untreated
	Cowangie	Murrayville	Untreated
	Goroke	West Wimmera	Untreated
	Edenhope	West Wimmera	Treatment plant at Edenhope
	Harrow	West Wimmera	Untreated
	Kaniva	West Wimmera	Untreated
	Kiata	West Wimmera	Untreated
	Lillimur	West Wimmera	Untreated
	Miram	Murrayville	Untreated
	Murrayville	West Wimmera	Untreated
	Nhill	West Wimmera	Untreated
	Serviceton	Glenelg Catchment Unit	Untreated
	Streatham & Westmere	West Wimmera	Untreated

Table 8.5-5 shows GWMWater's combined distribution systems' water balances.

Table 8.5-5 Grampians Wimmera Mallee Water combined distribution systems' water balances

Area/system	Start volume in store (ML)	Total Inflows (ML)	Outflows (ML)						Balancing item (ML)	End volume in store (ML)	Distribution efficiency (%)
			Deliveries			Losses					
			To urban residential	To urban other	To rural customers	Treatment plant losses	Reticulation system losses(1)	Total outflows			
Northern Mallee Pipeline	106	2,481	597	326	1,430	0	129	2,481	1	106	95%
Wimmera Mallee Pipeline Supply Systems 1 and 7	0	1,114	328	144	441	0	202	1,114	0	0	82%
Wimmera Mallee Pipeline Supply System 2	0	1,811	653	197	633	0	328	1,811	0	0	82%
Wimmera Mallee Pipeline Supply System 3	0	1,125	239	61	621	0	204	1,125	0	0	82%
Wimmera Mallee Pipeline Supply System 4	0	1,425	460	213	494	0	258	1,425	0	0	82%
Wimmera Mallee Pipeline Supply System 5	0	1,161	93	55	213	0	80	442	719	0	82%
Wimmera Mallee Pipeline Supply System 6	79	564	57	18	375	0	99	549	(2)	96	82%

Notes:

(1) Distribution system losses are used as the balancing item in those systems that show a zero explicit balancing item. Where a separate balancing item has been included, the unaccounted-for flows have not been able to be attributed to any particular line item in the accounts.

Table 8.5-6 shows GWMWater's urban distribution systems' water balances.

Table 8.5-6 Grampians Wimmera Mallee Water urban distribution systems' water balances

Area/system	Start volume in store (ML)	Total inflows (ML)	Outflows (ML)					Balancing item (ML)[1]	End volume in store (ML)	Distribution system efficiency (%)
			Deliveries		Losses		Total outflows			
			To urban residential	To urban others	From treatment plants	From distribution systems				
Surface water systems										
Ararat system	1,000	1,305	690	380	0	203	1,273	372	659	84%
Buangor	27	12	11	1	0	0	12	(1)	28	99%
East Grampians system (Willaura)	86	149	116	79	0	0	196	(1)	40	100%
Elmhurst	25	21	15	4	0	3	21	14	11	87%
Horsham system	177	2,866	1,724	459	0	683	2,866	(1)	178	76%
Quambatook	0	126	32	30	0	64	126	0	0	49%
Stawell system	286	1,388	651	743	0	261	1,654	(215)	235	84%
Groundwater systems										
Apsley	0	33	26	6	0	1	33	0	0	97%
Cowangie	0	12	1	2	0	9	12	0	0	22%
Goroke	0	62	37	8	0	17	62	0	0	73%
Edenhope	0	145	85	25	0	36	145	0	0	75%
Harrow	0	54	25	4	0	25	54	0	0	54%
Kaniva	0	232	141	72	0	19	232	0	0	92%
Kiata	0	4	2	0	0	2	4	0	0	55%
Lillimur	0	8	7	0	0	1	8	0	0	91%
Miram	0	2	2	0	0	0	2	0	0	95%
Murrayville	0	144	73	58	0	14	144	0	0	90%
Nhill	1	450	296	120	0	34	450	1	0	92%
Serviceton	0	9	5	1	0	3	9	0	0	64%
Streatham & Westmere	7	40	8	4	0	28	41	0	7	30%

Note:

(1) Where a separate balancing item has been included, the unaccounted-for flows have not been able to be attributed to any particular line item in the accounts.

Abbreviations

AWRC	Australian Water Resources Council
CEWH	Commonwealth Environmental Water Holder
CMA	Catchment management authority
DEPI	Department of Environment and Primary Industries
ESC	Essential Services Commission
FMID	First Mildura Irrigation District
GL	Gigalitre
GMA	Groundwater Management Area
GMU	Groundwater management unit
MDBA	Murray–Darling Basin Authority
ML	Megalitre
PCV	Permissible consumptive volume
PWSR	Permanent water saving rules
REALM	Resource allocation model
TCSA	Tertiary confined sand aquifer
UA	Unincorporated area
VEWH	Victorian Environmental Water Holder
WSPA	Water Supply Protection Area

Glossary

Allocation: The assignment of a water entitlement to a person or authority by government. See also 'seasonal irrigation water 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'.

Blackwater: Occurs when accumulations of organic matter, such as leaves, twigs and nutrients, decay in wetlands or waterways after being washed in by a flood, drawing oxygen from the water. The water turns to a black colour and can have a very low level of dissolved oxygen, which can cause stress to fish, crayfish and other animals.

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.

Carry-over: Provides the right to take unused allocations at the end of one season into the subsequent season. Carry-over 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 runoff 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.

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 Environment 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.

Environmental Water Reserve (EWR): The share of water resources set aside to maintain the environmental values of a water system and other water services that depend on the environmental condition of the system.

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.

Flow stress ranking procedure project: Undertaken by DEPI, the project measured how much the current flow conditions of a stream differ from the flow conditions if no water is extracted from the stream.

Fresh: A flow pulse in a river which is higher than the median flow at that time of year. It may occur naturally or be the result of a decision to release water from a reservoir. A fresh can occur at any time of year.

Gigalitre: One thousand megalitres.

Groundwater: Groundwater is 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 entitlement limit: The amount of water which can be allocated in an aquifer under licences and is defined by the permissible consumptive volume.

Groundwater management unit (GMU): 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.

Heritage river: A river protected in Victoria for its special features under the *Heritage River 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 approximately 25 by 25 kilometres.

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.

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.

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 can be taken in a GMA under a ministerial declaration.

Potable: Suitable for drinking.

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 EWR.

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 DSE 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 use.

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: 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 irrigator's share of the water available for an irrigation season, determined by a water corporation and expressed as a percentage of the irrigator's water share. It is sometimes shortened to 'allocation'.

Sewage: The waterborne wastes of a community.

Small catchment dam: A farm 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 and irrigation use 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 a number of options to mitigate the impact of the Snowy Scheme on environmental flows.

South Australia/Victoria Designated Area: Area extending 20km 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 bed, river or brook.

Stream Flow Management Plan: A management plan prepared for a WSPA to manage the surface water resources of the area.

Sustainable diversion limit: The maximum volume which can be diverted from a catchment while protecting the environmental values of the catchment's waterways.

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 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 that does not contain any dams or major diversion weirs which 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.

Wastewater: The volume of sewage that enters a 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 an irrigator or water authority. Water entitlements include bulk entitlements, environmental entitlements, water rights, sales water, 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. Water shares may be high reliability or low reliability, and 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 through the development of a management plan which aims for equitable management and long-term sustainability.

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, fresh or saline.

Yield: The quantity of water that a storage or aquifer produces.

Appendix A: Storage levels

Basin	Reservoir	On-stream/ Off-stream	Storage capacity (ML)	% full at 1 July 2012	% full at 30 June 2013
Murray	Lake Victoria (Victoria's share only)	On-stream	338,500	71%	72%
	Menindee Lakes (Victoria's share only)	On-stream	785,000	92%	69%
	Lake Hume (Victoria's share only)	On-stream	1,502,579	95%	74%
	Lake Dartmouth (Victoria's share only)	On-stream	1,928,116	88%	97%
	Lake Cullulleraine	On-stream	5,270	83%	91%
Kiewa	Rocky Valley	On-stream	28,294	71%	73%
	Lake Guy	On-stream	1,416	18%	27%
	Clover Pondage	Off-stream	255	53%	101%
	Pretty Valley Basin	Off-stream	500	100%	100%
Ovens	Lake William Hovell	On-stream	13,500	101%	101%
	Lake Buffalo	On-stream	23,900	61%	53%
Broken	Lake Nillahcootie	On-stream	40,400	101%	62%
	Loombah-McCall Say	On-stream	1,747	83%	67%
Goulburn	Lake Eildon	On-stream	3,334,158	90%	70%
	Goulburn Weir	On-stream	25,500	99%	98%
	Sunday Creek Reservoir	On-stream	1,700	97%	97%
	Greens Lake	Off-stream	32,440	53%	32%
	Waranga Basin	Off-stream	432,362	85%	38%
Campaspe	Upper Coliban Reservoir	On-stream	37,770	100%	100%
	Lauriston Reservoir	On-stream	19,790	77%	77%
	Malmsbury Reservoir	On-stream	12,034	46%	46%
	Lake Eppalock	On-stream	304,651	89%	76%
	Campaspe Weir	Off-stream	2,624	101%	100%
Loddon	Newlyn Reservoir	On-stream	3,012	84%	46%
	Tullaroop Reservoir	On-stream	72,950	85%	60%
	Cairn Curran Reservoir	On-stream	147,130	89%	66%
	Laanecoorie Reservoir	On-stream	7,940	37%	61%
	Hepburn Lagoon	On-stream	2,457	70%	40%
	Evansford Reservoir	Off-stream	1,346	93%	66%
	Sandhurst Reservoir	Off-stream	2,590	51%	51%
	Spring Gully Reservoir	Off-stream	1,680	13%	13%
East Gippsland	None	-	-	-	-
Snowy	None	-	-	-	-
Tambo	None	-	-	-	-
Mitchell	None	-	-	-	-
Thomson	Lake Glenmaggie	On-stream	177,640	89%	59%
	Thomson Reservoir	On-stream	1,068,000	64%	74%
Latrobe	Blue Rock	On-stream	208,188	101%	99%
	Lake Narracan	On-stream	7,230	41%	67%
	Moondarra Reservoir	On-stream	30,300	100%	100%
South Gippsland	Lance Creek Reservoir	On-stream	4,200	100%	100%
	Hyland Reservoir	On-stream	671.1	100%	100%
	Western Reservoir	On-stream	1,137	100%	100%
	Candowie Reservoir(1)	On-stream	4,463	100%	28%
Bunyip	Tarago Reservoir	On-stream	37,580	60%	83%

Basin	Reservoir	On-stream/ Off-stream	Storage capacity (ML)	% full at 1 July 2012	% full at 30 June 2013
Yarra	Upper Yarra Reservoir	On-stream	200,579	72%	48%
	O'Shannassy Reservoir	On-stream	3,123	103%	75%
	Maroondah Reservoir	On-stream	22,179	101%	33%
	Yan Yean Reservoir	On-stream	30,266	91%	88%
	Cardinia Reservoir	Off-stream	286,911	76%	73%
	Greenvale Reservoir	Off-stream	26,839	78%	75%
	Silvan Reservoir	Off-stream	40,445	90%	82%
	Sugarloaf Reservoir	Off-stream	96,253	98%	71%
Maribyrnong	Rosslynne Reservoir	On-stream	25,368	72%	86%
Werribee	Melton Reservoir	On-stream	14,364	97%	20%
	Merrimu Reservoir	On-stream	32,516	77%	83%
	Pykes Creek Reservoir	On-stream	22,119	97%	77%
	Djerriwarrh Reservoir	On-stream	1,014	98%	81%
Moorabool	Korweinguboora Reservoir	On-stream	2,091	100%	10%
	Bostock Reservoir	On-stream	7,455	100%	82%
	Lal Lal Reservoir	On-stream	59,549	91%	84%
	Wilsons Reservoir	On-stream	1,010	42%	30%
	Moorabool Reservoir	On-stream	6,192	95%	65%
	Upper Stony Creek Reservoir	Off-stream	9,494	58%	55%
Barwon	West Barwon Dam	On-stream	21,504	100%	66%
	White Swan Reservoir	On-stream	14,107	73%	67%
	Gong Gong Reservoir	On-stream	1,902	44%	93%
	Wurdee Boluc Reservoir	Off-stream	40,431	72%	61%
Corangamite	None	-	-	-	-
Otway Coast	West Gellibrand Reservoir	On-stream	1,856	100%	100%
Hopkins	None	-	-	-	-
Portland Coast	None	-	-	-	-
Glenelg	Rocklands Reservoir	On-stream	348,300	31%	23%
	Moora Moora Reservoir	On-stream	6,300	49%	31%
	Konongwootong Reservoir	On-stream	1,920	36%	32%
	Hamilton System Reservoirs	On-stream	2,654	80%	64%
Millicent Coast	None	-	-	-	-
Wimmera	Taylors Lake	On-stream	35,770	40%	28%
	Lake Lonsdale	On-stream	65,480	43%	9%
	Wartook Reservoir	On-stream	29,300	70%	52%
	Lake Bellfield	On-stream	78,560	85%	78%
	Fyans Lake	On-stream	18,460	68%	67%
	Batyo Lake	On-stream	3,590	21%	1%
	Dock Lake	On-stream	3,850	0%	0%
	Green Lake	On-stream	5,350	67%	51%
	Pine Lake	On-stream	62,000	13%	7%
	Toolondo Reservoir	On-stream	92,430	26%	19%
Mallee	None	-	-	-	-
Avoca	None	-	-	-	-

Note:

(1) Total capacity of Candowie Reservoir at 1 July 2012 was 2,263 ML and at 30 June 2013 was 4,463 ML. Calculation of percentage full for each date is based upon the capacity that was available at the time.

Appendix B: Groundwater entitlement and use

GMU	PCV	Allocation limit at 30/06/13 (ML)	Licences				Domestic and stock		Total use (licensed + domestic and stock)
			Licensed entitlements (ML)	No. of licences	No. of metered bores	Metered use (ML)	No. of domestic and stock bores(1)	Estimated use (ML)(2)	
Goulburn–Murray Water									
WSPA (approved plan)									
Shepparton WSPA	-	201,425	201,425	1,164	1,059	39,579	1,658	3,316	42,895
Katunga WSPA(3)	60,577	42,474	60,678	257	145	23,708	834	1,668	25,376
Upper Ovens WSPA	4,010	4,010	3,703	108	126	667	303	606	1,273
WSPA (draft plan)									
Loddon Highlands WSPA	20,697	20,697	20,694	187	255	7,052	784	1,568	8,620
Lower Campaspe Valley WSPA	55,875	55,875	55,874	143	134	27,260	462	924	28,184
GMA									
Alexandra GMA	1,937	1,937	1,707	9	9	253	17	34	287
Barnawartha GMA	2,100	2,100	375	4	2	22	27	54	76
Kinglake GMA	2,015	2,015	1,851	64	73	231	230	460	691
Lower Ovens GMA	25,200	25,200	19,913	266	252	5,343	1,872	3,744	9,087
Mid-Goulburn GMA	14,900	14,900	12,465	64	50	3,477	208	416	3,893
Mid-Loddon GMA	34,037	34,037	34,037	106	109	17,207	378	756	17,963
Mullindolingong GMA(4)	6,980	6,980	1,604	43	15	35	59	118	153
Unincorporated areas									
Goulburn–Murray Water unincorporated areas	-	-	33,604	634	621	3,489	5,219	10,438	13,927
GWMWater									
WSPA (approved plan)									
Murrayville WSPA	10,883	10,883	9,634	32	46	5,568	98	196	5,764
West Wimmera GMA(5)	-	53,327	53,327	173	243	17,866	626	1,252	19,118
Unincorporated areas									
GWMWater unincorporated areas	-	-	15,275	46	31	3,870	463	926	4,796
Southern Rural Water									
WSPA (approved plan)									
Koo Wee Rup WSPA	12,915	12,915	12,625	369	260	3,474	1,164	1,746	5,220
Nullawarre WSPA(6)	21,280	21,280	22,741	235	163	11,614	942	1,413	13,027
Warrion WSPA(6)	13,836	13,836	14,081	143	141	4,530	304	456	4,986
Yangery WSPA(6)	14,103	14,103	14,343	157	181	3,059	826	1,239	4,298
Yarram WSPA(6)	25,317	25,317	25,689	91	89	11,668	291	437	12,105
WSPA (draft plan)									
Bungaree WSPA	5,321	5,321	5,293	106	147	2,729	212	318	3,047
Condah WSPA(6)	7,437	7,437	7,475	40	45	3,380	49	73	3,453
Denison WSPA(6)(7)	17,743	17,743	18,501	126	123	10,209	207	311	10,520

GMU	PCV	Allocation limit at 30/06/13 (ML)	Licences				Domestic and stock		Total use (licensed + domestic and stock)
			Licensed entitlements (ML)	No. of licences	No. of metered bores	Metered use (ML)	No. of domestic and stock bores(1)	Estimated use (ML)(2)	
Deutgam WSPA	5,100	5,100	5,082	148	194	1389	125	188	1,577
Glenelg WSPA(6)	32,660	32,660	32,659	84	98	8,938	1,132	1,698	10,636
Sale WSPA(6)	21,212	21,212	21,238	113	116	12,739	353	530	13,269
Wandin Yallock WSPA(6)	2,924	2,924	3,008	194	210	450	78	117	567
Wy Yung WSPA(4)	7,463	7,463	7,462	60	72	932	31	47	978
GMA									
Colongulac GMA	4,695	4,695	4,068	68	68	1,215	124	186	1,401
Cardigan GMA	3,967	3,967	3,887	25	23	563	96	144	707
Corinella GMA	2,550	2,550	662	14	10	74	84	126	200
Cut Paw Paw GMA	3,650	3,650	515	5	4	208	0	0	208
Frankston GMA	3,200	3,200	1,671	30	23	218	116	174	392
Gellibrand GMA	-	0	0	0	0	0	2	3	3
Gerangamete GMA(8)	20,000	20,000	20,000	1	6	0	2	3	3
Giffard GMA(6)	5,670	5,670	5,689	17	19	1,504	70	105	1,609
Glenormiston GMA(6)	2,565	2,565	2,691	42	24	1,167	96	144	1,311
Hawkesdale GMA	16,161	16,161	12,454	119	103	5,939	1,117	1,676	7,615
Heywood GMA	8,500	8,500	7,006	92	68	1,726	1,185	1,778	3,504
Jan Juc GMA(9)	11,250	11,250	11,250	3	7	3,505	4	6	3,511
Lancefield GMA	1,485	1,485	1,378	14	20	224	61	92	315
Leongatha GMA	6,500	6,500	1,841	34	14	180	81	122	302
Merrimu GMA	451	451	440	14	19	28	8	12	40
Moe GMA	8,200	8,200	3,993	98	32	908	130	195	1,103
Moorabbin GMA	2,700	2,700	2,614	57	70	1,053	299	449	1,501
Nepean GMA(4)(10)	6,013	6,013	6,110	75	78	3,159	2,125	2,125	5,284
Newlingrook GMA	1,977	1,977	1,958	6	6	326	7	11	336
Orbost GMA(6)	1,201	1,201	1,217	4	5	300	3	5	304
Paaratte GMA	4,606	4,606	3,212	6	1	345	2	3	348
Portland GMA	7,795	7,795	7,794	8	7	2,692	3	5	2,696
Rosedale GMA(4)(10)(11)	22,313	22,313	22,372	65	52	18,923	186	279	19,202
Stratford GMA(4)(11)	27,645	27,645	27,645	8	6	17,711	1	2	17,713
Tarwin GMA	1,300	1,300	38	3	1	13	663	995	1,008
Wa De Lock GMA(4)(7)	30,172	30,172	29,287	254	176	8,181	410	615	8,796
Unincorporated areas									
Southern Rural Water unincorporated areas	-	-	71,542	1,521	819	12,986	7,593	11,390	24,375
Total	**631,088**	**867,738**	**967,695**	**7,749**	**6,396**	**313,883**	**33,420**	**55,687**	**369,569**

Notes:

(1) The number of domestic and stock bores includes all bores from the groundwater management system that are less than 30 years old. Bore depths (where recorded) have been taken into account 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 a more accurate estimate.

(3) Katunga WSPA licensed entitlement greater than the PCV is due to administrative error. PCV to be amended.

(4) Mullindolingong GMA, Wy Yung WSPA, Nepean GMA, Rosedale GMA, Stratford GMA and Wa De Lock GMA PCVs consist of the sum of the PCV for all zones within the GMU.

(5) The PCV for West Wimmera GMA has not yet been declared as at 30 June 2013, however it was declared on 8 August 2013 and will be reported in the 2013/14 Water Accounts. The declaration applies separately to the tertiary limestone aquifer and tertiary confined sand aquifer.
(6) The licensed entitlements are greater than the PCV due to the Dairy Shed Water Licence Transition Scheme. The PCVs were amended to reflect the increase in the 2013/14 water year.
(7) The volume of use in Wa De Lock GMA and Denison WSPA includes metered extractions for salinity control (Wa De Lock GMA 735 ML and Denison WSPA 1,285 ML).
(8) The PCV for the Gerangamete GMA is aligned with Barwon Water's groundwater licence which allows extraction from the Gerangamete GMA of a maximum of 20,000 ML in any one year, 80,000 ML over a consecutive 10-year period and 400,000 ML over a 100-year period.
(9) 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 39,250 ML includes 4,250 ML and the five-year bulk entitlement of 35,000 ML.
(10) Nepean GMA and Rosedale GMA are currently subject to PCV review.
(11) The use volume reported in Rosedale and Stratford GMA includes metered extractions from Latrobe Valley mines (Rosedale GMA 10,846 ML and Stratford GMA 17,664 ML).

Appendix C: Evapotranspiration estimates

Evapotranspiration is modelled as the sum of transpiration by plants, evaporation from soil and open water surfaces, and evaporation from the wet surfaces of plants soon after rainfall. This appendix presents modelled basin estimates of evapotranspiration.

Evapotranspiration amounts vary considerably across Victoria depending on a range of factors, including water availability. Averaged across Victoria as a whole, evapotranspiration in 2012–13 was estimated to be 476 millimetres, which is about 13% lower than the long-term average from 1961 to 1990. Modelled estimates are presented in Figure C-1, which shows all basins across Victoria having evapotranspiration estimates for 2012–13 lower than the long-term average. In Figure C-1, evapotranspiration is expressed as millimetres per unit area to allow easy comparison between catchments of different sizes.

The difference between the modelled evapotranspiration volumes for 2012–13 and the long-term averages varied between basins. The difference was greatest in the north-west, where evapotranspiration was typically about 25% less than the long-term average, whereas in the south-east evapotranspiration was generally about 5% less than the long-term average (Figure C-1). These differences broadly reflect rainfall over the year, with much of Victoria receiving below-average rainfall, and average to above-average rainfall across parts of the state's south-east.

Figure C-1 Modelled evapotranspiration per unit area (mm) in 2012–13

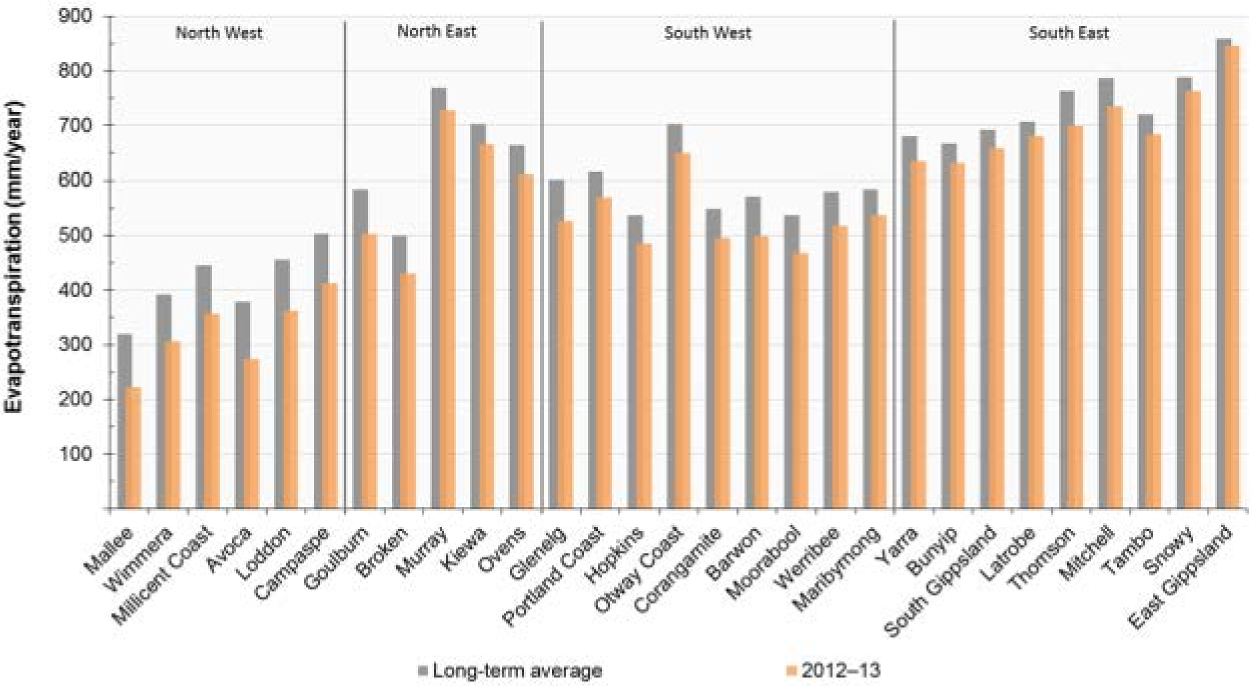
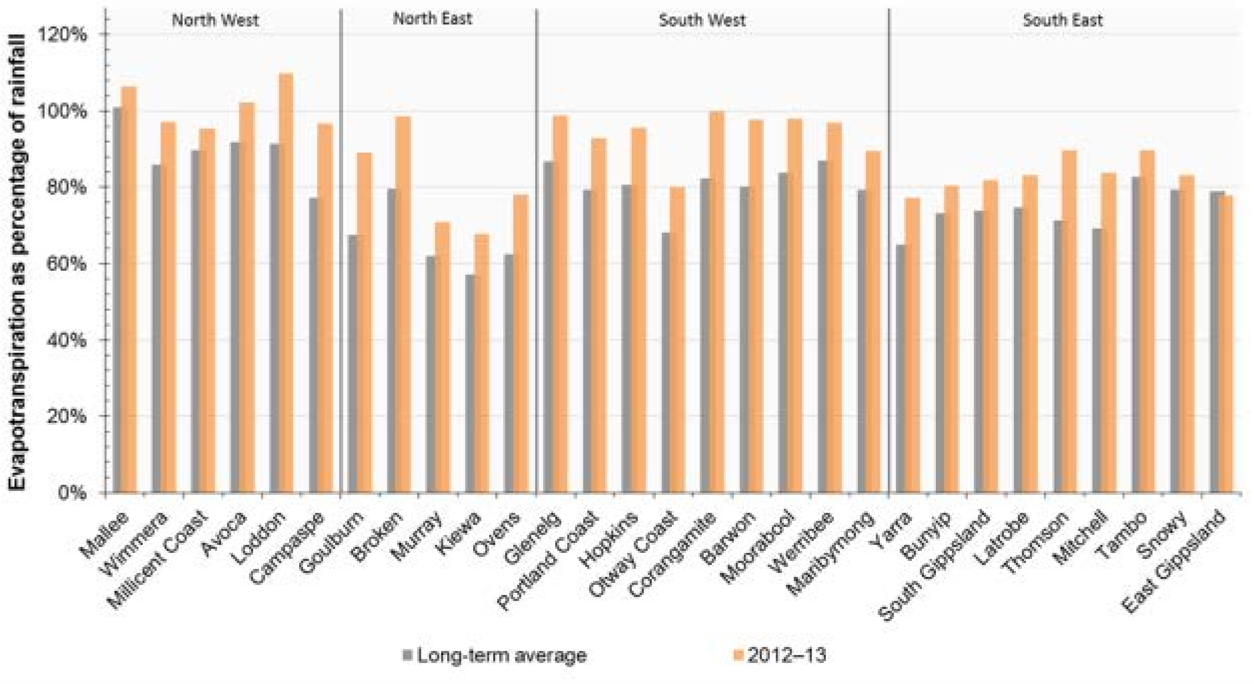


Figure C-2 illustrates evapotranspiration as a proportion of rainfall in Victoria's basins. In 2012–13, the proportion of evapotranspiration to rainfall was greater than the long-term average in all basins except for East Gippsland (Figure C-2). This is consistent with lower than average rainfall across the state for 2012–13, as the proportion of evapotranspiration to rainfall generally increases with reductions in rainfall. As a result, significantly less rainfall remained for streamflow and groundwater recharge in 2012–13 than would be the case in an average year. In a small number of basins, the estimated volume of evapotranspiration in 2012–13 exceeded the total rainfall volume for that period. This can be influenced by a variety of factors, including evapotranspiration from soil moisture and groundwater, which are not solely dependent on rainfall within the year in question.

Figure C-2 Modelled evapotranspiration as a percentage of rainfall in 2012–13



North-east Victoria (Goulburn to Murray basins)

Lower than average rainfall over north-eastern Victoria in 2012–13 resulted in estimates of evapotranspiration that were below average for the north-eastern basins. The estimated evapotranspiration ranged from 431 millimetres in the Broken basin to 727 millimetres in the Murray basin, and comparisons with the long-term average ranged from 5% below average in the Murray and Kiewa basins to 14% below average in the Goulburn and Broken basins (Figure C-1).

In 2012–13, evapotranspiration as a proportion of rainfall in the north-eastern basins ranged from 9% above average to 21% above average. The Broken basin was estimated to have the north-east region's highest evapotranspiration as a proportion of the year's rainfall (99%, compared to the long-term average of 80%), and the lowest was in the Kiewa basin (68% compared to the long-term average of 57%) (Figure C-2).

South-east Victoria (East Gippsland to Yarra basins)

Lower than average rainfall over most of south-eastern Victoria resulted in estimates of evapotranspiration that were generally slightly below average for the south-eastern basins. In 2012–13, the estimated evapotranspiration ranged from 631 millimetres in the Bunyip basin to 845 millimetres in the East Gippsland basin, and comparisons with the long-term average ranged from 2% below average in the East Gippsland basin to 8% below average in the Thomson basin (Figure C-1).

In 2012–13, evapotranspiration as a proportion of rainfall in the south-eastern basins varied between 1% below average to 18% above average. The Thomson basin was estimated to have the south-east region's highest evapotranspiration as a proportion of the year's rainfall (90% compared to the average of 71%), and the lowest was in the Yarra basin (77%, compared to the average of 65%) (Figure C-2).

South-west Victoria (Maribyrnong to Glenelg basins)

Lower than average rainfall over south-western Victoria resulted in estimates of evapotranspiration that were below average for the south-western basins. In 2012–13, the estimated evapotranspiration ranged from 468 millimetres in the Moorabool basin to 649 millimetres in the Otway Coast basin, and comparisons with the long-term average ranged from 12% below average in the Moorabool basin to 8% below average in the Portland Coast basin (Figure C-1).

In 2012–13, evapotranspiration as a proportion of rainfall in the south-western basins varied between 10% above average to 18% above average. The Corangamite basin was estimated to have the south-west region's highest evapotranspiration as a proportion of rainfall in 2012–13, (100% compared to the long-term average of 82%) and the Otway Coast basin the lowest (80% compared with the long-term average of 68%) (Figure C-2).

North-west Victoria (Mallee to Campaspe basins)

Lower than average rainfall over north-western Victoria resulted in estimates of evapotranspiration that were below average for the north-western basins. In 2012–13, the estimated evapotranspiration ranged from 222 millimetres in the Mallee basin to 413 millimetres in the Campaspe basin, and comparisons with the long-term average ranged from 18% below average in the Campaspe basin to 31% below average in the Mallee basin (Figure C-1).

In 2012–13, evapotranspiration as a proportion of rainfall ranged from 5% above average to 19% above average for the north-western basins. The Loddon basin was estimated as having the north-west region's highest evapotranspiration as a proportion of rainfall (110%, compared to the average of 91%) and the lowest was in the Millicent Coast basin (95%, compared to the average of 90%) (Figure C-2).

Key assumptions and data limitations

These estimates of evapotranspiration presented in this appendix are based on results from the SoilFlux model, which is a one dimensional water balance model. Modelling evapotranspiration requires many approximations and assumptions, which limit the accuracy of the estimates. Major assumptions and limitations of the method used to derive the estimates of evapotranspiration include:

- not accounting for water applied by irrigation
- not allowing for changes in water storage (that is, rises and falls in the water table and soil moisture) or lateral flow
- using land use information from 2009, which has been condensed from the Victorian Land Use Information System into 10 representative land use types to facilitate water balance modelling
- using one-kilometre gridded data for land use, geology, depth to groundwater, and rainfall.

The basin areas used to report evapotranspiration estimates are slightly different from 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.

Appendix D: Bulk entitlement holders

River 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 – First Mildura Irrigation Trust) Conversion Order 1999	Lower Murray 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 Ltd
	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 (Porepunkah) Conversion Order 1999	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 and St James – North East Water) Conversion Order 2004	North East Water
	Bulk Entitlement (Loombah McCall-Say) Conversion Order 2001	North East Water

River basin	Entitlements	Holder
Goulburn	*Bulk Entitlement (Broadford, Kilmore and 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
	BE (Goulburn Channel System – CW) Order 2012	Coliban Water
	BE (Goulburn Channel System – GVW) Order 2012	Goulburn Valley Water
	BE (Goulburn River – GVW) Order 2012	Goulburn Valley Water
	Goulburn River Environmental Entitlement 2010	Victorian Environmental Water Holder
	Bulk Entitlement (Goulburn System – City West Water) Order 2012	City West Water
	Environmental Entitlement (Goulburn System – NVIRP Stage 1) 2012	Victorian Environmental Water Holder
	Bulk Entitlement (Goulburn System – Snowy Environmental Reserve) Order 2004	Victorian Environmental Water Holder
	Bulk Entitlement (Goulburn System – South East Water) Order 2012	South East Water
	Bulk Entitlement (Goulburn System – Yarra Valley Water) Order 2012	Yarra Valley Water
	Bulk Entitlement (Longwood) Conversion Order 1995	Goulburn Valley Water
	Bulk Entitlement (Mansfield) Conversion Order 1995	Goulburn Valley Water
	Bulk Entitlement (Marysville) Conversion Order 1995	Goulburn Valley Water
	Bulk Entitlement (Pyalong) Conversion Order 1997	Goulburn Valley Water
	Bulk Entitlement (Quambatook – Grampians Wimmera Mallee Water) Order 2006	Grampians Wimmera Mallee Water
	Bulk Entitlement (Rubicon – Southern Hydro Ltd) Conversion Order 1997	AGL Hydro Ltd
	Silver and Wallaby Creeks Environmental Entitlement 2006	Victorian Environmental Water Holder
	Bulk Entitlement (Silver & Wallaby Creeks – Melbourne Water for City West Water Limited) Conversion Order 2006	City West Water
	Bulk Entitlement (Silver & Wallaby Creeks – Melbourne Water for South East Water Limited) Conversion Order 2006	South East Water
	Bulk Entitlement (Silver & Wallaby Creeks – Melbourne Water for Yarra Valley Water Limited) Conversion Order 2006	Yarra Valley 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 Rochester) Conversion Order 1999*	Coliban Water
	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

Appendix D: Bulk entitlement holders

River basin	Entitlements	Holder
	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
	Transfer of Bulk Entitlement (Thomson River – Melbourne Water Corporation) Conversion Order 2001 to City West Water Limited 2006	Melbourne Water
	Transfer of Bulk Entitlement (Thomson River – Melbourne Water Corporation) Conversion Order 2001 to South East Water Limited 2006	Melbourne Water
	Transfer of Bulk Entitlement (Thomson River – Melbourne Water Corporation) Conversion Order 2001 to Yarra Valley Water Limited 2006	Melbourne Water
	Bulk Entitlement (Thomson River – Environment) Order 2005	Victorian Environmental Water Holder
Latrobe	*Bulk Entitlement (Boolarra) Conversion Order 1997*	Gippsland Water
	Bulk Entitlement (CGRWA – 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
	Latrobe River 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 (Yallourn Energy Ltd for Gippsland and Southern Rural Water Authority) Conversion Order 1996	Southern Rural Water
	Bulk Entitlement (Yallourn Energy Ltd for Loy Yang Power Ltd) Conversion Order 1996	AGL Loy Yang Partnership
	Bulk Entitlement (Yallourn Energy Ltd for SECV) Conversion Order 1996	Minister for Environment and Climate Change (on behalf of Victorian Government)
	Bulk Entitlement (Yallourn Energy Ltd) Conversion Order 1996	TRUEnergy
South Gippsland	*Bulk Entitlement (Devon North Alberton – Yarram and 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

River basin	Entitlements	Holder
	Bulk Entitlement (Loch, Poowong and Nyora) Conversion Order 1997	South Gippsland Water
	Bulk Entitlement (Meeniyan) Conversion Order 1997	South Gippsland Water
	Bulk Entitlement (Desalinated Water – City West Water Limited) Order 2010	Melbourne Water
	Bulk Entitlement (Desalinated Water – South East Water Limited) Order 2010	Melbourne Water
	Bulk Entitlement (Desalinated Water – Yarra Valley Water Limited) Order 2010	Melbourne Water
	Bulk Entitlement (Seaspray) Conversion Order 1997	Gippsland Water
	Bulk Entitlement (Toora Port Franklin – Welshpool and 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 for City West Water Limited) Conversion Order 2009	Melbourne Water
	Bulk Entitlement (Tarago and Bunyip Rivers – Melbourne Water for South East Water Limited) Conversion Order 2009	Melbourne Water
	Bulk Entitlement (Tarago and Bunyip Rivers – Melbourne Water for Yarra Valley Water Limited) Conversion Order 2009	Melbourne Water
Yarra	*Bulk Entitlement (Melbourne Headworks System – Barwon Water) Order 2010*	Barwon Water
	Bulk Entitlement (Melbourne Headworks System – South Gippsland Water) Order 2010	South Gippsland Water
	Bulk Entitlement (Melbourne Headworks System – Western Water) Order 2010	Western Water
	Bulk Entitlement (Melbourne Headworks System – Westernport Water) Order 2010	Westernport Water
	Bulk Entitlement (Yarra River – Melbourne Water for City West Water Limited) Conversion Order 2006	Melbourne Water
	Bulk Entitlement (Yarra River – Melbourne Water for South East Water Limited) Conversion Order 2006	Melbourne Water
	Bulk Entitlement (Yarra River – Melbourne Water for Yarra Valley Water Limited) Conversion Order 2006	Melbourne Water
	Bulk Entitlement (Yarra Environment 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 and Barry's Reef) Conversion Order 1998	Central Highlands Water
	Bulk Entitlement (Myrniong) Conversion Order 2004	Western Water
	Werribee River Environment Entitlement 2011	Victorian Environmental Water Holder
	Bulk Entitlement (Werribee System – Irrigation) Conversion Order 1997	Southern Rural Water
	Bulk Entitlement (Werribee System – Western Water) Conversion Order 2004	Western Water
Moorabool	*Bulk Entitlement (Lal Lal – Barwon) Conversion Order 1995*	Barwon Water
	Bulk Entitlement (Lal Lal – Central Highlands) Conversion Order 1995	Central Highlands Water
	Bulk Entitlement (Meredith) Conversion Order 1995	Barwon Water
	Moorabool River Environment Entitlement 2010	Victorian Environmental Water Holder

Appendix D: Bulk entitlement holders

River basin	Entitlements	Holder
Barwon	*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 River Environmental Entitlement 2011	Victorian Environmental Water Holder
	Bulk Entitlements (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	Grampians Wimmera Mallee Water
	Bulk Entitlement (Willaura System – Wannon Water) Conversion Order 2012	Wannon Water
	Bulk Entitlement (Wimmera and Glenelg Rivers – Coliban Water) Conversion Order 2010	Coliban Water
	Bulk Entitlement (Wimmera and Glenelg Rivers – GWMWater) Conversion Order 2010	Grampians Wimmera Mallee Water
	Bulk Entitlement (Wimmera and Glenelg Rivers – Wannon Water) Conversion Order 2010	Wannon Water
	Bulk Entitlement (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