Victorian Water Accounts 2011–2012

A statement of Victorian water resources

Published by the Victorian Government
Department of Environment and Primary Industries
Melbourne, December 2013

Authorised by the Victorian Government, 8 Nicholson Street, East Melbourne.

Print managed by Finsbury Green. Printed on 100% recycled paper.

ISSN 1837-591X (print)

ISSN 1837-5928 (online)

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Acknowledgements

Edited by Ann White

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Foreword

Efficient management of all our water resources is a key focus for the Victorian Government.

We are in the process of tranforming Victoria's water systems. The *Living Victoria* policy is driving the adoption of whole-of-water-cycle management to make greater use of local rainwater, stormwater and recycled water for non-drinking purposes in our urban systems. We are also driving a range of initiatives across the state to modernise irrigation infrastructure.

Water reporting provides vital insight into Victoria's water availability and use at the bulk supply level. Through the Victorian Water Accounts, the water industry has access to information about water availability, distribution and use across Victoria.

The *Victorian Water Accounts 2011–2012* records a significant recovery in the total volume of water held in Victoria's storages and other resources.

The total available volume of Victoria's surface water, groundwater and recycled water in 2011–12 was around 32,200,000 ML - the second highest amount reported in the nine Victorian Water Accounts published to date.

Storage levels started the year at 9,807,307 ML (80% of capacity) and ended at 10,504,868 ML (85% of capacity), the highest values recorded for 10 years.

The increase in storage levels and water availability occurred despite more water being taken for consumptive purposes, due to only average rainfall. Around 4,100,000 ML was taken in 2011–12, the highest amount in the last five years.

This edition of the Victorian Water Accounts is the second year that the accounts report on our distribution systems, tracking water from where it is extracted in a waterway or aquifer to where it is delivered to the customer.

Over time this will provide an invaluable pointer to where efficiency gains might be made, ensuring Victoria makes the most of all its precious water resources.

PETER WALSH MLA
Minister for Water

Alphabetical listing of Victoria's river basins

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Introduction

Overview of the *Victorian Water Accounts 2011–2012*

The *Victorian Water Accounts 2011–2012* documents the key water resource management data for Victoria. This report is the ninth in a series that provides an overview of water availability and use across Victoria, and demonstrates the government's commitment to greater transparency and accountability in water resource information.

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.

The *Victorian Water Accounts 2011–2012* examines the entire state's water allocation and use for the 2011–2012 year at bulk supply level. It consolidates information from all Victorian water corporations, catchment management authorities, the Department of Environment and Primary Industries (DEPI), the Essential Services Commission (ESC), the Murray-Darling Basin Authority (MDBA), the Victorian Alpine Resorts Commission, power generators and other major users of water.

The *Victorian Water Accounts 2011–2012* 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 basin water accounts for each of Victoria's 29 river basins and the distribution system water accounts for each of the nineteen water corporations in Victoria. The basin 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. Because distribution system boundaries are not necessarily aligned with river basin boundaries, the distribution system water balances are reported by the Northern, Gippsland, Central and Western regions.

2011-12: the year in water

In contrast to 2010–11, when Victoria experienced rainfall totals significantly above average across most areas, rainfall in 2011–12 varied considerably; from below average in the west, to above average in the central and eastern areas of Victoria.

In western Victoria, rainfall in 2011–12 ranged between 60% and 100% of the long-term average, while across central and eastern Victoria, rainfall ranged between 100% and 200% of the long-term average. North and north-east Victoria experienced very wet conditions during late summer and early autumn 2012, with two to four times the long-term average rainfall for the January to March period. In some areas of the north-east, these were the highest rainfall totals on record for this period.

The average rainfall experienced in 2011–12 saw a decrease in streamflows across Victoria from the very wet conditions in 2010–11, however they were significantly greater than the low flows observed in Victorian Water Accounts from 2003–04 to 2009–10. Overall, the total streamflow volume for Victoria in 2011–12 was 123% of the long-term average, which is the second highest volume since the Victorian Water Accounts were first published for 2003–04.

The total volume of water stored in Victoria's major regional reservoirs started the year at 8,800,363 ML (84% of capacity) and ended at 9,233,836 ML (88% of capacity), the highest values recorded for 10 years. Storage levels increased during spring 2011, reaching a peak of 9,676,855 ML (92% of capacity) at the end October, and declined over summer to a minimum of 8,551,260 ML (81.6% of capacity) at the end of February 2012.

Melbourne's water storages started the year at 1,006,944 ML (56% of total capacity) and recovered to 1,271,032 ML (70% of total capacity) by the end of June 2012. For the third consecutive year, Melbourne's storage levels were higher at the end of the year than they were at the beginning of the year.

During 2011–12, stable or increasing groundwater level trends were shown at a larger number of Water Supply Protection Areas and Groundwater Management Areas compared to the trends in 2010–11. This can be attributed in part to decreasing demand for groundwater, as evidenced by reduced groundwater extraction figures over the past two years and increased availability of surface water resources. In addition, the increasing water levels in unconfined aquifers may be a recharge response to the wetter-than-average conditions in 2010–11 and 2011–12.

Improved water resource availability in Victoria

Victoria's water availability in 2011–12 benefited both consumptive and environmental users of water.

From a consumptive use perspective, increased water availability enabled:

- continued high levels of seasonal allocations of water in regulated water systems
- reduced restrictions on diversions from unregulated streams

- a continued decline in the number of towns on water restrictions, and in the severity of those restrictions.

The volume of water taken under consumptive entitlements in 2011–12 increased compared to 2010–11. The volume of water diverted for irrigation purposes in 2011–12 was one and a half times greater than the volume diverted in 2010–11. The total volume of water taken under bulk entitlements in 2011–12 was 53% of the total volume of bulk entitlements, up from 37% in 2010–11.

In 2011–12, the Victorian Environmental Water Holder oversaw the delivery of more than 516,000 ML of water to 35 river reaches and 10 wetlands, providing significant benefit to a wide range of water-dependent plants and animals. The average-to-wet seasonal conditions experienced across Victoria in 2011–12 resulted in many priority watering actions being met naturally, without the delivery of environmental water.

Conclusion

Sustainable management of our water resources requires adequate monitoring, accounting and reporting. The *Victorian Water Accounts 2011–2012* 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 2011–12

Part 1 of the *Victorian Water Accounts 2011–12* 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 acquifers
- Victoria's water entitlement and planning framework and the mechanisms it provides for responding to water availability
- the quantity of water allocated for consumption from reservoirs, streams and acquifers under entitlements issued by government, as well as quantities used and recycled
- water available to the environment
- Victoria's water trade activity

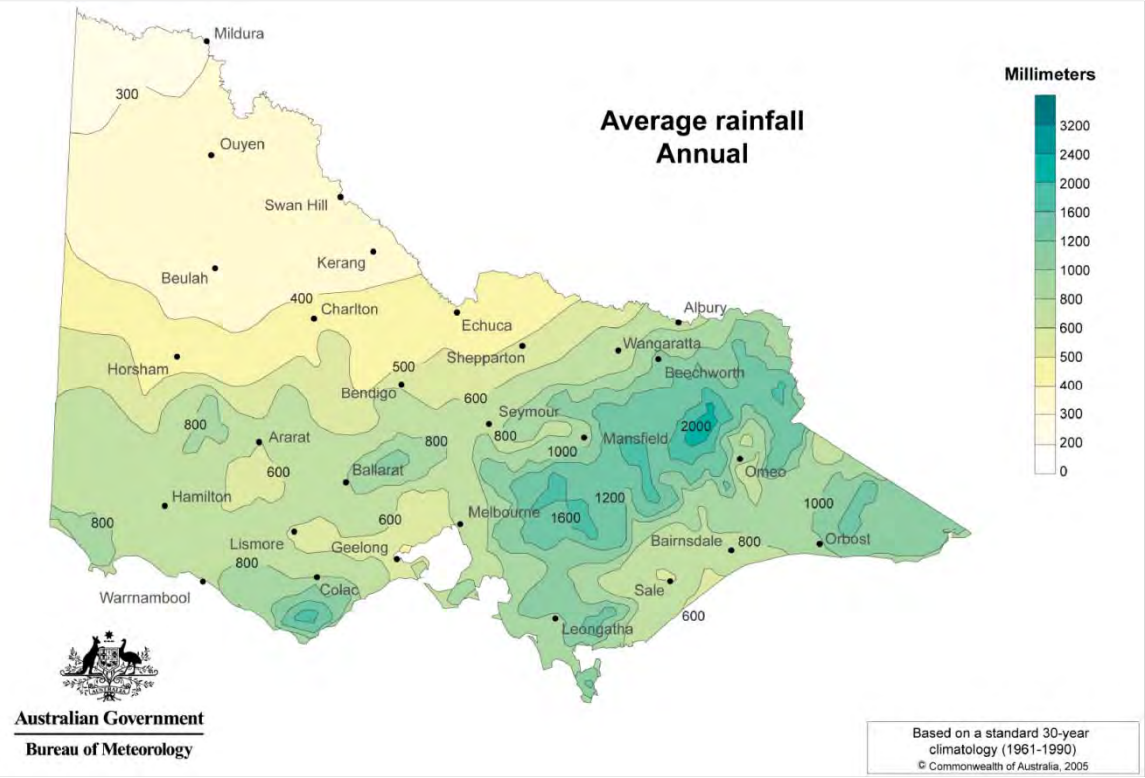
1 Water availability

This chapter presents an overview of surface water and groundwater availability in Victoria in 2011–12. 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



In 2011–12, Victoria's rainfall ranged from 200 to 300 millimetres in the north-west of the state, through to 1,800 to 2,400 millimetres in the alpine area of north east Victoria (Figure 1-2).

In western Victoria, rainfall in 2011–12 ranged between 60% and 100% of the long-term average; while across central and eastern Victoria, rainfall ranged between 100% and 200% of the long-term average (Figure 1-3). In general, central and eastern Victoria had higher than average rainfalls, with parts of the Snowy and Thomson basins having the highest rainfalls on record (Figure 1-4).

In contrast, 2011–12 rainfalls for the Glenelg, Hopkins and Wimmera basins in western Victoria were average to very much below average (Figure 1-4).

The difference in rainfall between the eastern and western basins of Victoria was reflected in evapotranspiration. Across the whole state average evapotranspiration in 2011–12 was estimated at 547 millimetres, the same as the long-term average (Appendix C). Across the eastern basins, evapotranspiration was generally slightly above average, reflecting the higher rainfall in this area, whereas in western Victoria it was slightly below average (Appendix C).

Figure 1-2 Victorian rainfall in 2011–12 (mm)

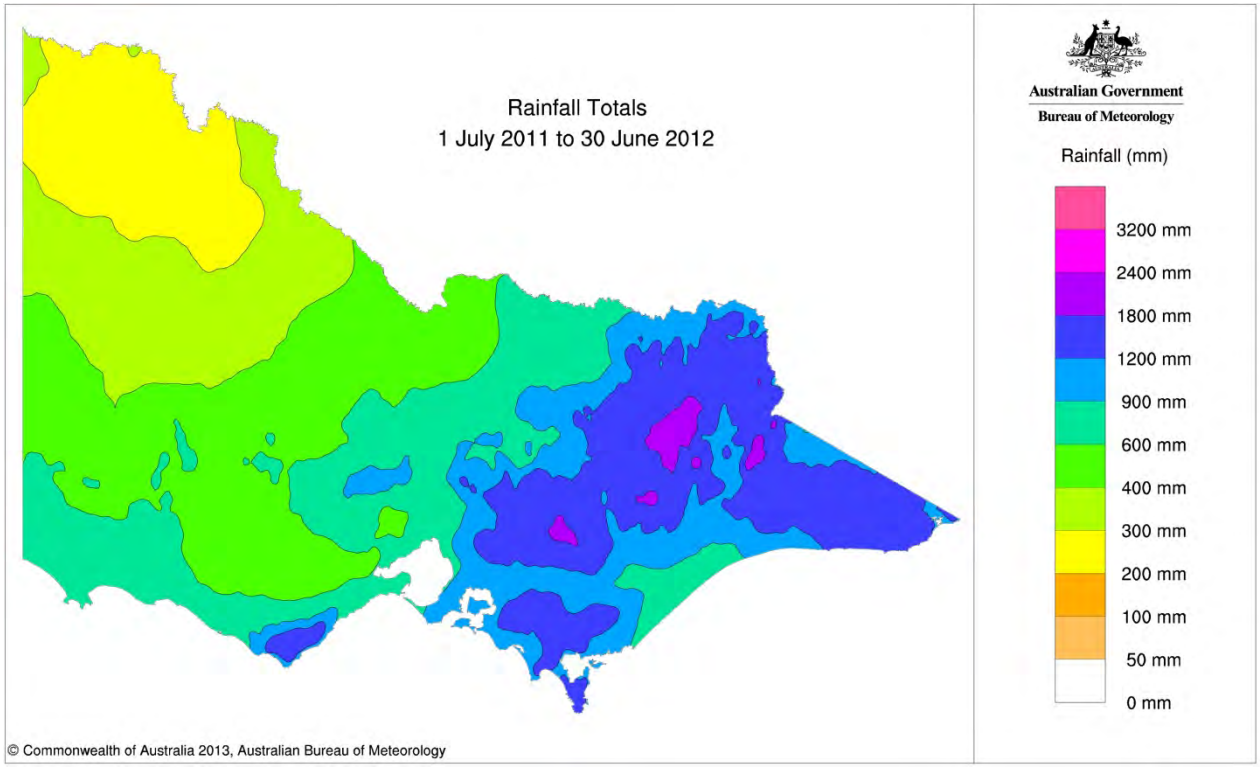


Figure 1-3 Victorian rainfall in 2011–12 as a percentage of long-term average rainfall

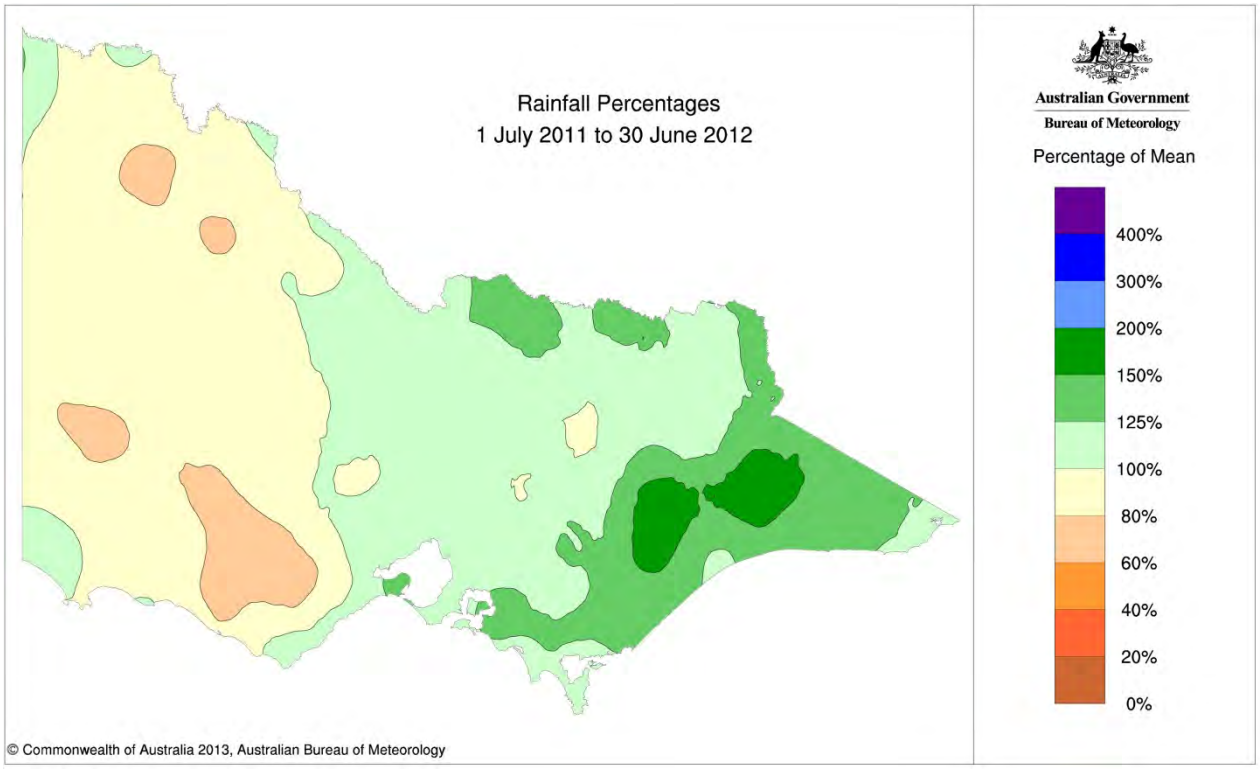
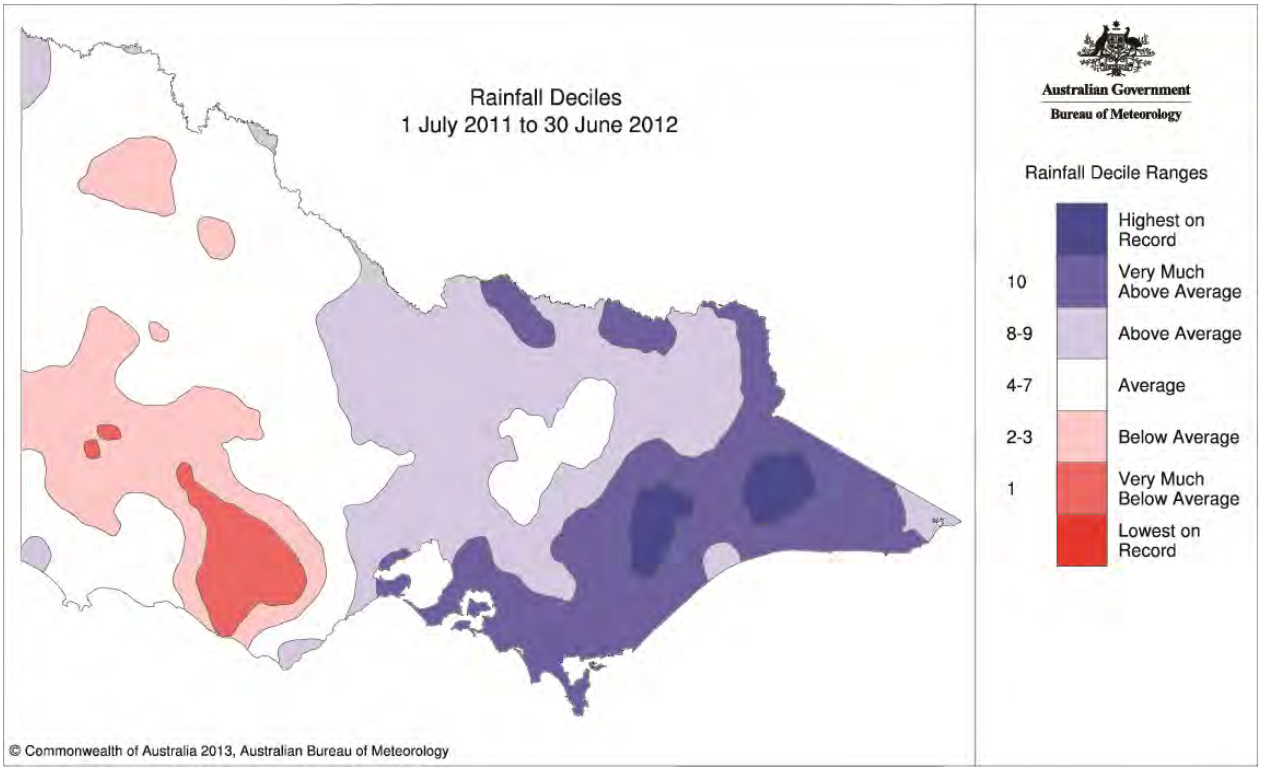


Figure 1-4 Victorian rainfall deciles in 2011–12



North and north-east Victoria experienced very wet conditions during late summer and early autumn 2012, with two to four times the long-term average rainfall for the January to March period (Figure 1-5). In some areas of the north-east, these were the highest rainfall totals on record for this period (Figure 1-6).

The high rainfall totals were the result of a slow moving low pressure trough and associated cloud band that brought severe thunderstorms and heavy, persistent rainfall between 27 February and 5 March 2012. This triggered widespread flash flooding across north-east Victoria and major flooding, particularly in Broken Creek.

Rainfall totals were largely close to or above average for the rest of Victoria for this period (Figure 1-5 and Figure 1-6).

In contrast, the autumn and early winter rainfall was below average across the north of the state and above average across the south-west (Figure 1-7 and Figure 1-8).

Figure 1-5 Victorian rainfall as a percentage of the long-term average for late summer to early autumn, 1 January 2012 to 31 March 2012

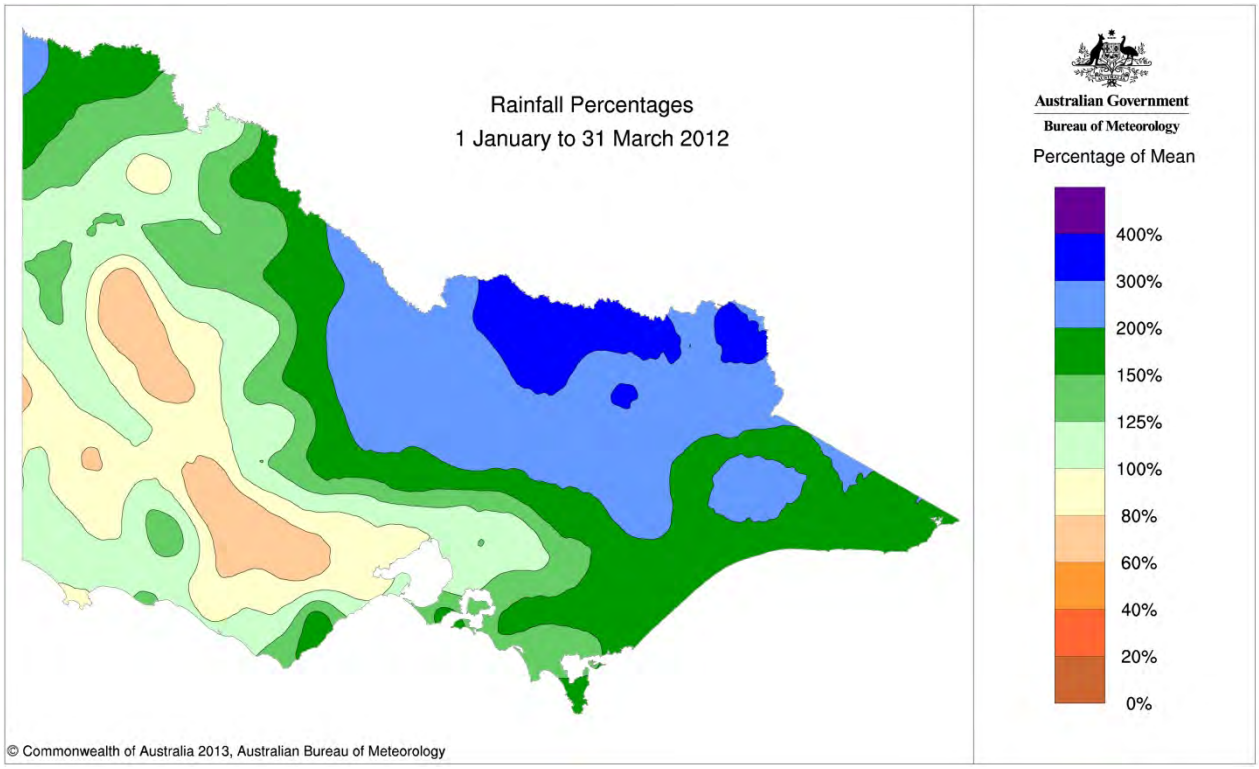


Figure 1-6 Victorian rainfall deciles for late summer to early autumn, 1 January 2012 to 31 March 2012

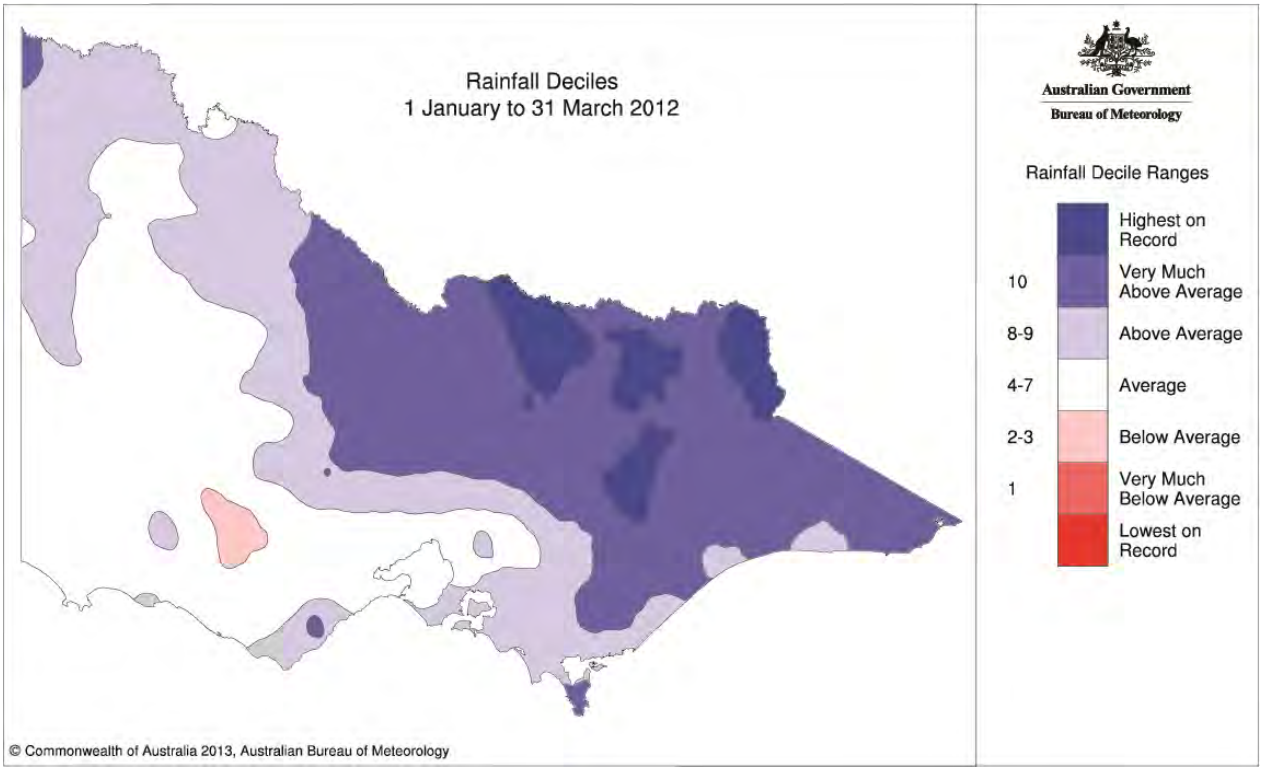


Figure 1-7 Victorian rainfall as a percentage of the long-term average for autumn to early winter, 1 April to 30 June 2012

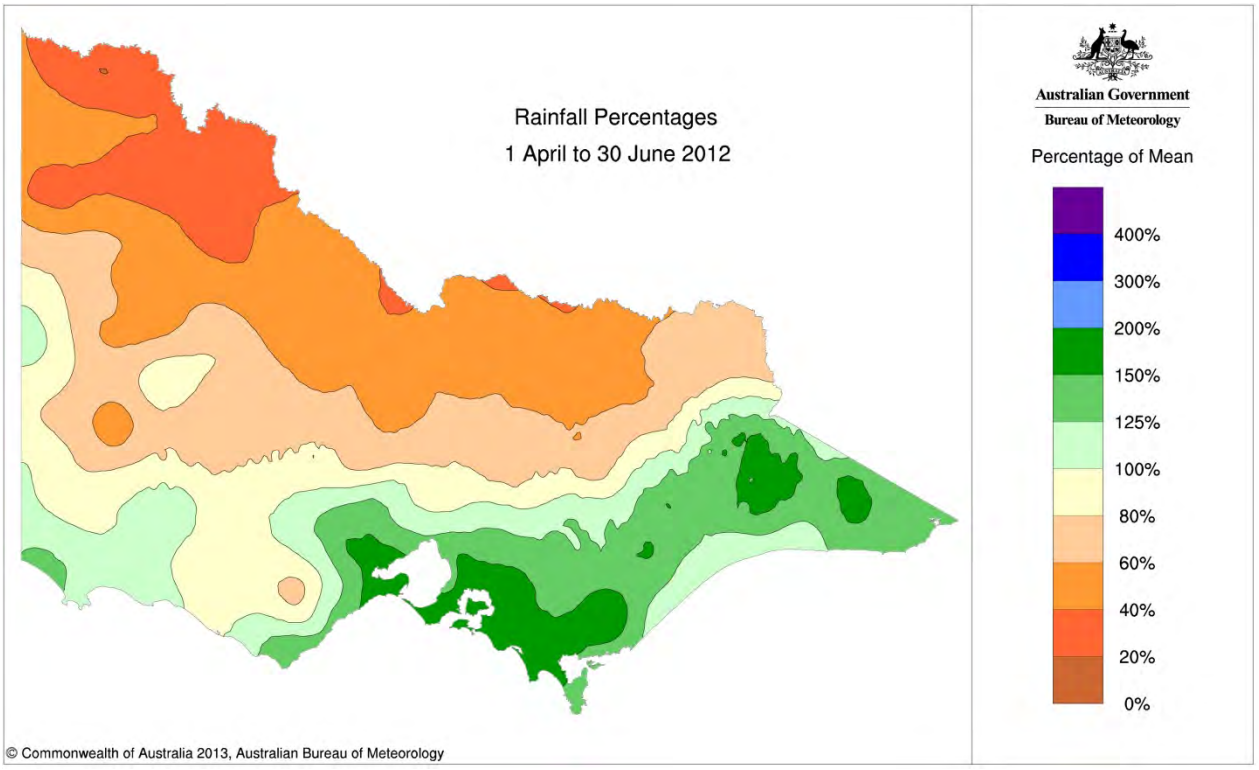
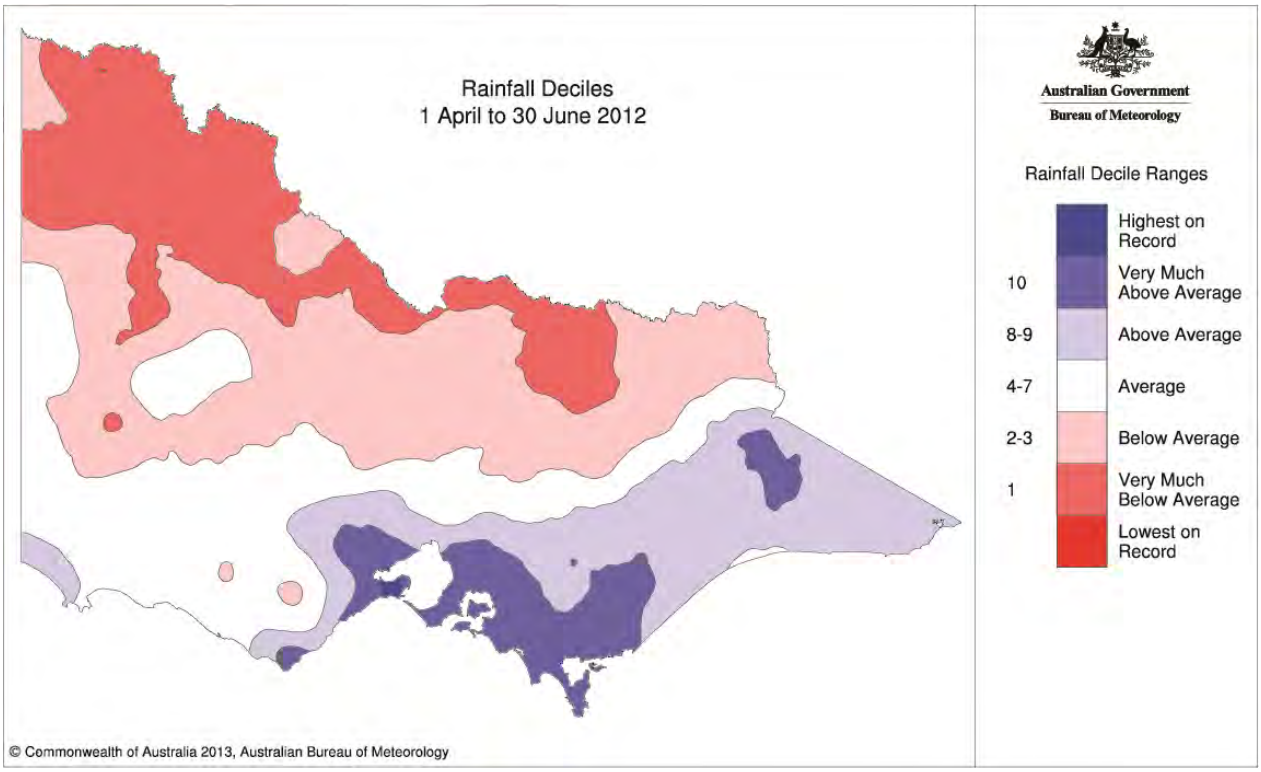


Figure 1-8 Victorian rainfall deciles for autumn to early winter, 1 April to 30 June 2012



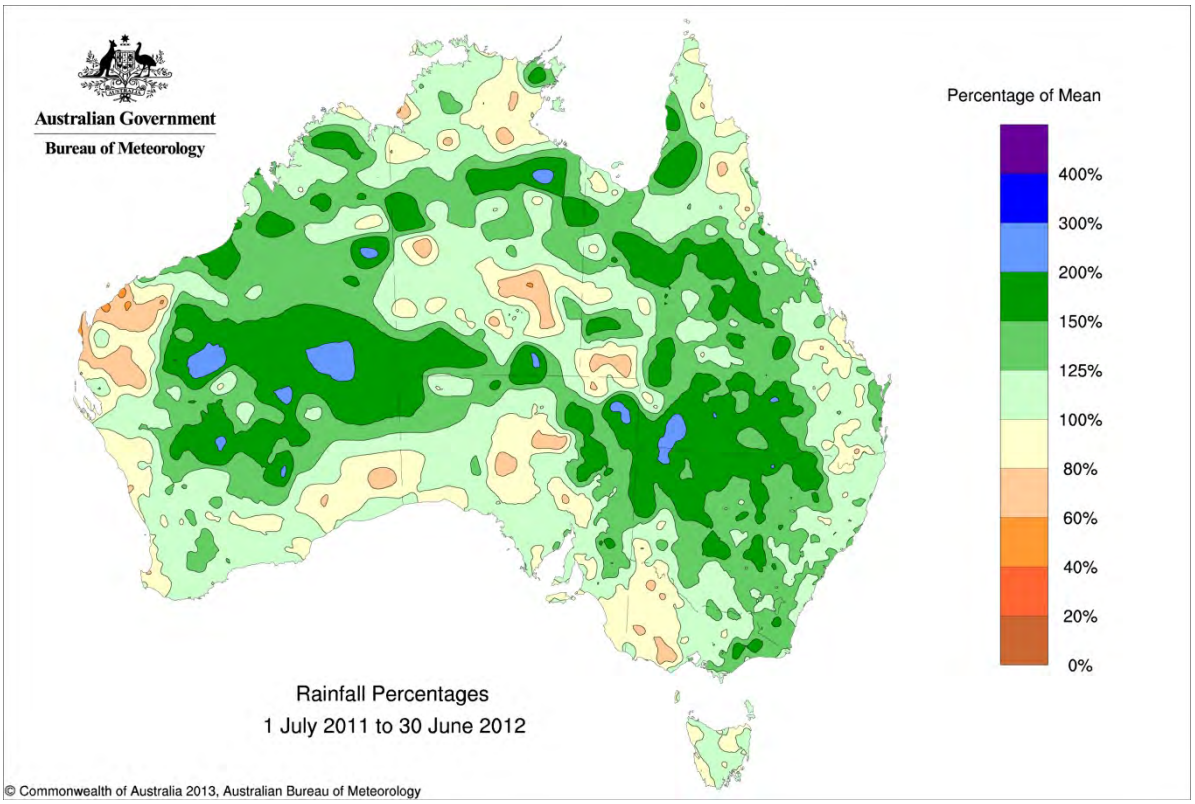
Rainfall totals above the long-term average also occurred over large areas of mainland Australia in association with a La Niña event in 2011–12 (Figure 1-9). The 2011–12 La Niña event was relatively late forming, with most indicators only reaching La Niña thresholds by mid-October 2011. It then gradually declined over late summer and concluded in late March 2012.

Several rainfall records were set during the 2011–12 La Niña. The Bureau of Meteorology reported the second wettest November and spring on record for Western Australia, and second wettest March for New South Wales.

Much of inland southern and far northern Queensland, most of New South Wales, northern Victoria, and central Australia, experienced flooding at least once between late November 2011 and March 2012.

The Bureau of Meteorology reported that when combined with the 2010–11 La Niña event, the two events yielded Australia's wettest 24-month period on record, April 2010 to March 2012, and Australia's wettest two calendar-year period, 2010-12.

Figure 1-9 Australian rainfall as a percentage of long-term average, 1 July 2011 to 30 June 2012



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 in the water resource reporting section on **www.depi.vic.gov.au**.

In 2011–12, local factors resulted in streamflows greater than average in 14 basins and below average in 12 basins (Table 1-1). Some of the basins that had streamflows substantially higher than average in 2010–11, such as the Campaspe, Loddon and Wimmera basins, had streamflows well below average in 2011–12 (Table 1-1). In contrast, the Tambo basin, which had below-average streamflows in 2010–11, had well above average streamflows in 2011–12. Overall, the total streamflow volume for Victoria was 123% of the long-term average (Table 1-2), the second highest volume since the first Victorian water accounts were first published for 2003–04.

The highest-yielding river basins in 2011–12, relative to their long-term averages, were the Snowy, Tambo, East Gippsland and South Gippsland basins. All experienced streamflows greater than 200% of the long-term average.

In 2010–11, the Tambo basin had the lowest streamflow relative to the long-term average, however in 2011–12 this basin recovered to 282% of the long-term average, illustrating the large difference in rainfall in this area between the two consecutive years.

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

Basin	Average annual streamflow (ML)	2011–12 streamflow[1]		2010–11 streamflow[1]	
		(ML)	(% of average)	(ML)	(% of average)
Murray	7,618,000	9,175,099	120%	15,846,500	208%
Kiewa	689,000	850,533	123%	1,164,500	169%
Ovens	1,758,000	1,747,302	99%	3,470,000	197%
Broken	308,000	469,470	152%	686,800	223%
Goulburn[2]	3,363,000	2,890,919	86%	5,777,400	172%
Campaspe	352,000	155,699	44%	815,600	232%
Loddon	373,000	195,230	52%	2,178,600	584%
Avoca	136,200	26,975	20%	188,200	138%
Mallee[3]	0	0	-	0	-
Wimmera	316,400	145,567	46%	646,900	240%
East Gippsland	714,000	1,647,803	231%	791,600	111%
Snowy[4]	1,022,000	2,796,999	274%	1,014,200	99%
Tambo	297,800	839,137	282%	185,000	62%
Mitchell	884,500	1,264,868	143%	969,700	110%
Thomson	1,101,760	1,788,987	162%	970,500	88%
Latrobe	847,400	1,338,357	158%	1,099,600	130%
South Gippsland	911,500	1,854,567	203%	1,568,000	172%
Bunyip	541,000	1,033,964	191%	1,185,400	219%
Yarra	1,054,000	1,200,267	114%	1,453,600	138%
Maribyrnong	113,000	60,885	54%	249,400	221%
Werribee	102,000	64,557	63%	267,000	262%
Moorabool	97,000	109,037	112%	262,800	271%
Barwon	360,000	191,647	53%	352,100	98%
Corangamite	316,000	164,247	52%	518,600	164%
Otway Coast	884,000	780,800	88%	1,463,700	166%
Hopkins	635,000	303,486	48%	1,072,400	169%
Portland Coast	361,000	437,172	121%	522,300	145%
Glenelg	964,000	648,620	67%	993,800	103%
Millicent Coast[3]	0	0	-	0	-
Total	**26,119,560**	**32,182,195**	**123%**	**45,714,200**	**175%**

Notes:

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

(2) Includes 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. In 2011–12 licensed diversions were estimated to be 0 ML. 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).

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	32,182,195	123%

Continuous records of streamflows for nine selected locations, as well as for the total inflows into Melbourne's major storages, show a range from well below average to well above average in 2011–12 (Figure 1-10 to Figure 1-19).

The Goulburn River at Doherty's (Figure 1-10) and Snowy Creek at Granite Flat (Figure 1-14) both experienced average flows in 2011–12.

Above-average flows were recorded for 2011–12 at the Avoca River at Coonooer (Figure 1-12) and the Mitchell River at Glenaladale (Figure 1-15).

The remaining five locations had well below average total streamflows in 2011–12 (Figure 1-11, Figure 1-13, Figure 1-16, Figure 1-17 and Figure 1-18), with the Loddon River at Vaughan, Deep Creek at Bulla and the Werribee River at Ballan equivalent to the average flows experienced during the drought.

Streamflows influence Victoria's water storages (section 1.3). For example, the annual inflows to Melbourne's harvesting reservoirs in the Yarra and Thomson basins in 2011–12 were 110% of the long-term average of the available period of record, compared to 69% of the average during the recent drought (Figure 1-19).

Figure 1-10 Annual streamflow at Goulburn River

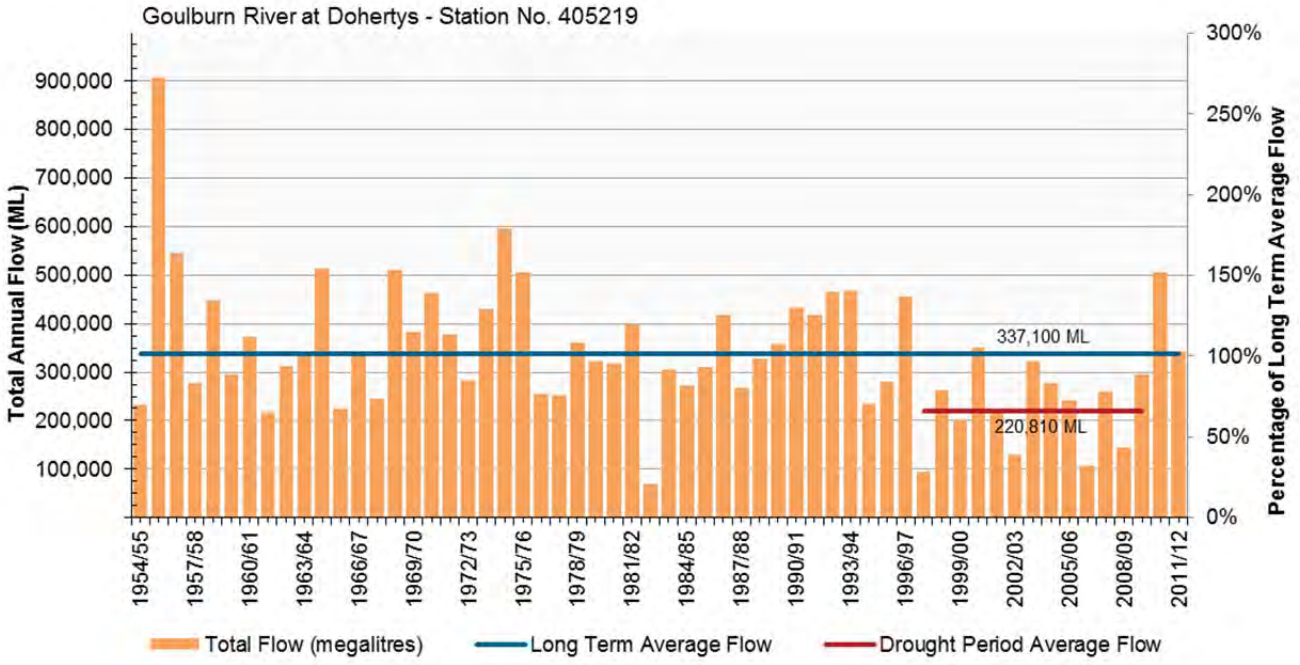


Figure 1-11 Annual streamflow at Loddon River

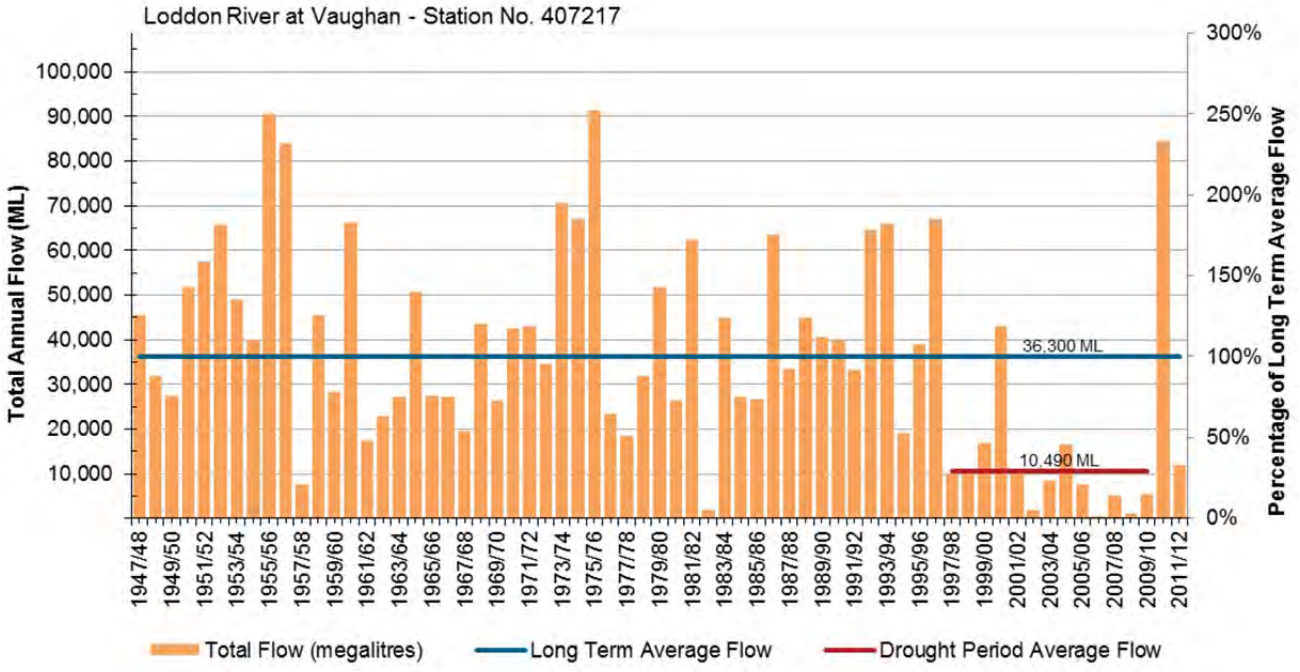


Figure 1-12 Annual streamflow at Avoca River

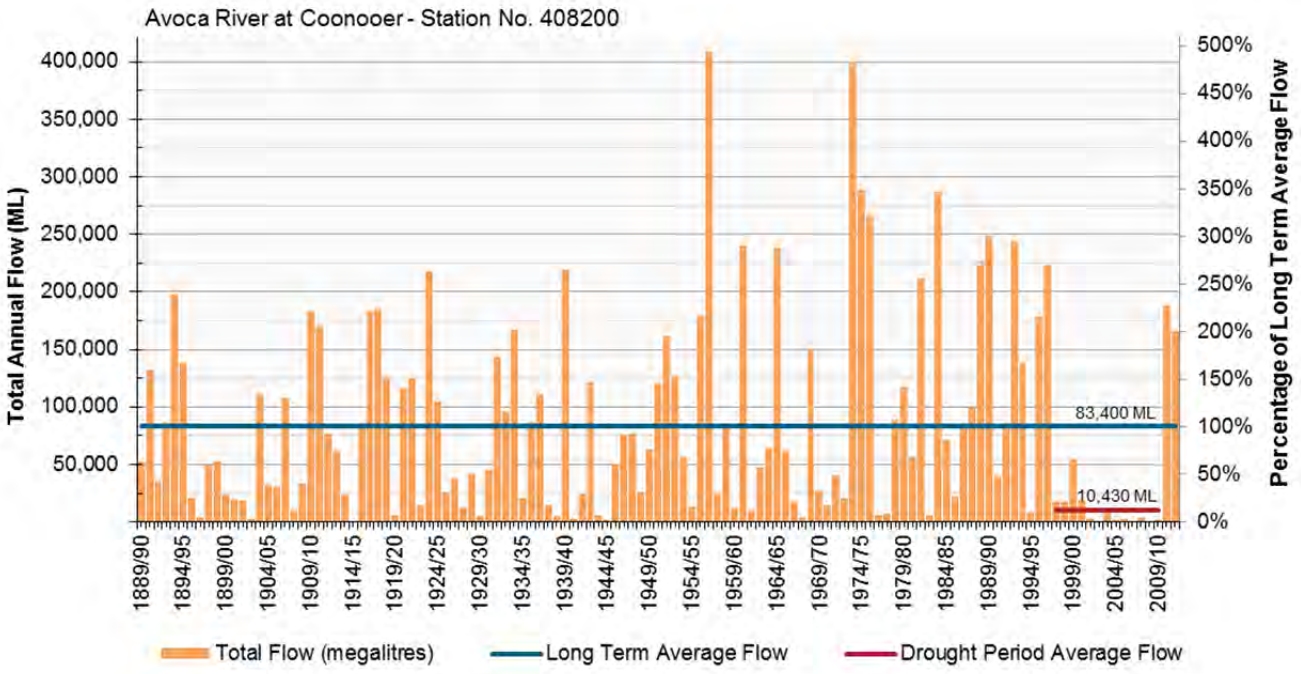


Figure 1-13 Annual streamflow at Wimmera River

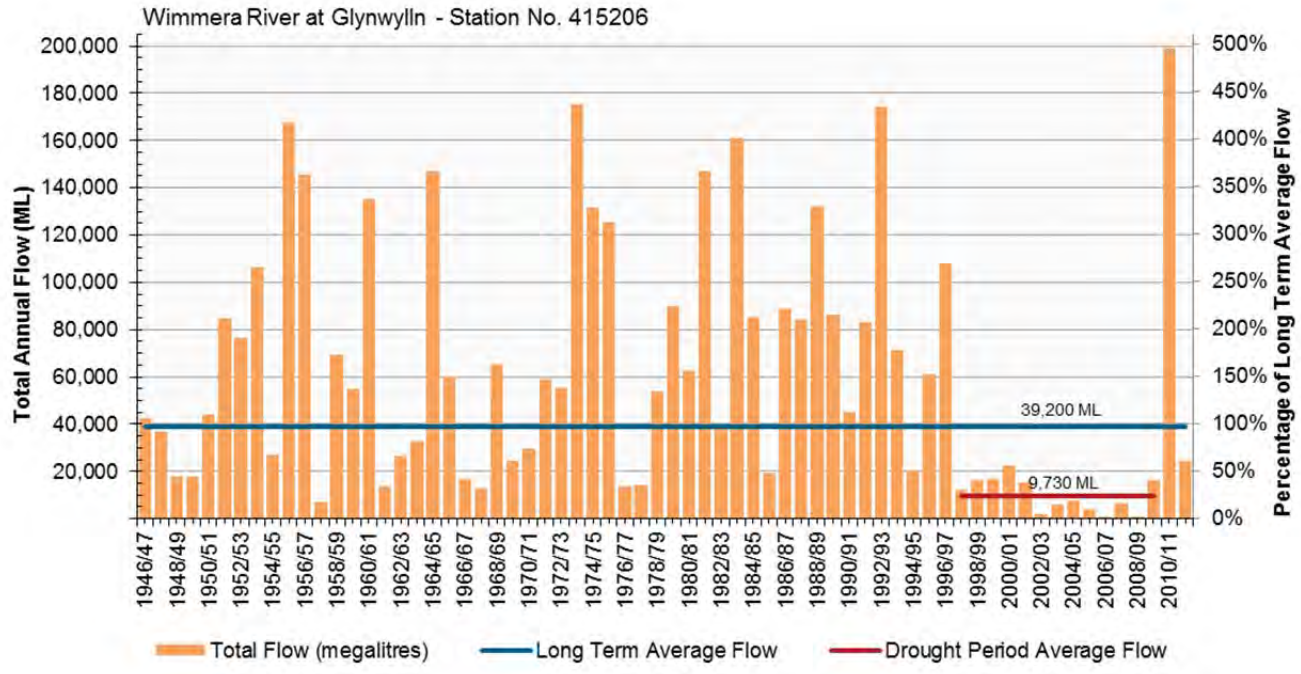


Figure 1-14 Annual streamflow at Snowy Creek

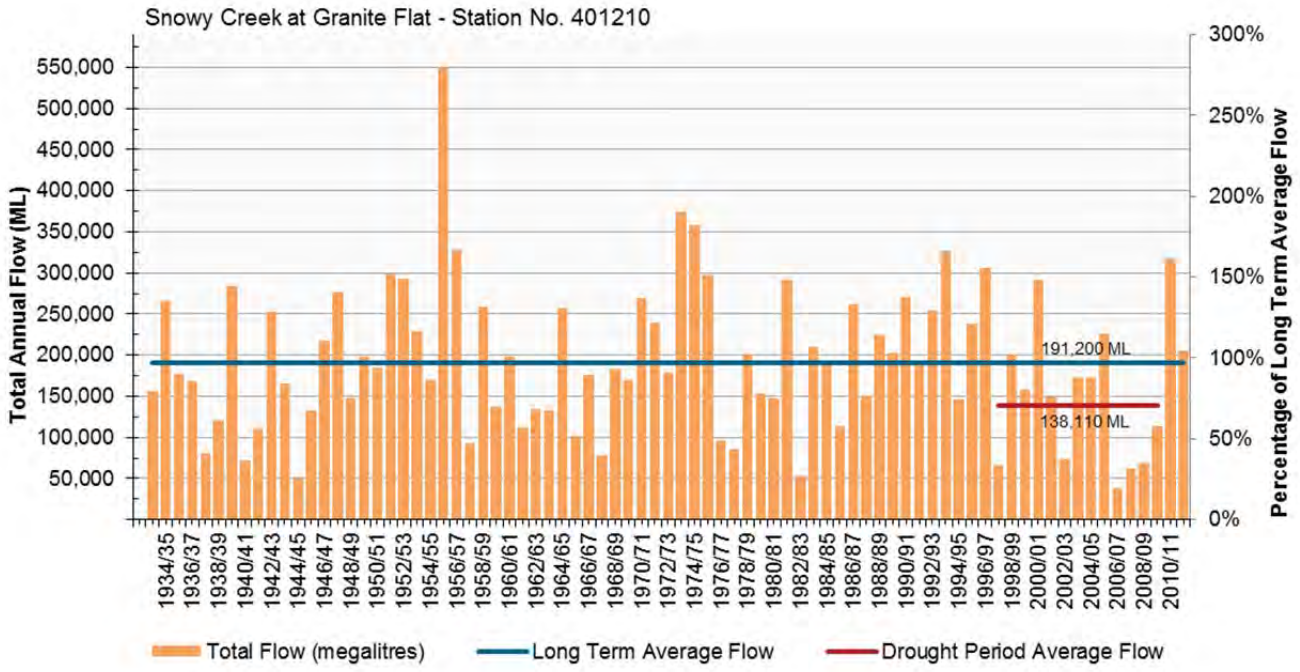


Figure 1-15 Annual streamflow at Mitchell River

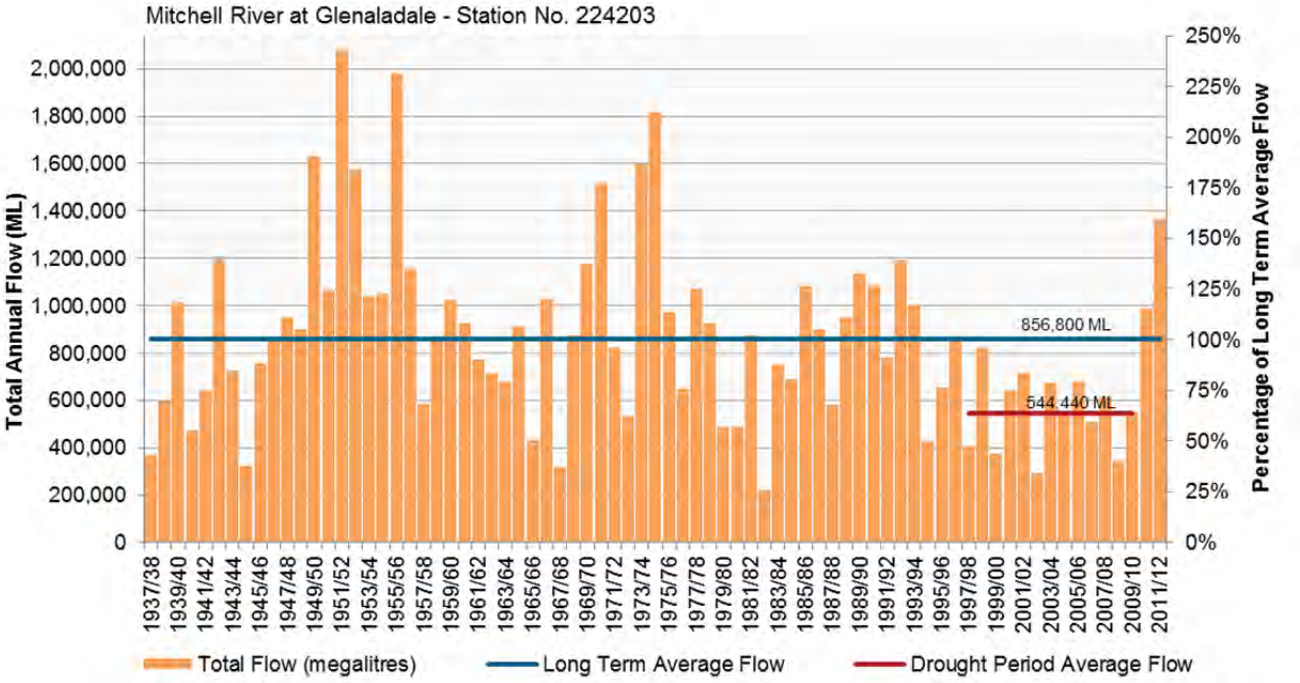


Figure 1-16 Annual streamflow at Deep Creek

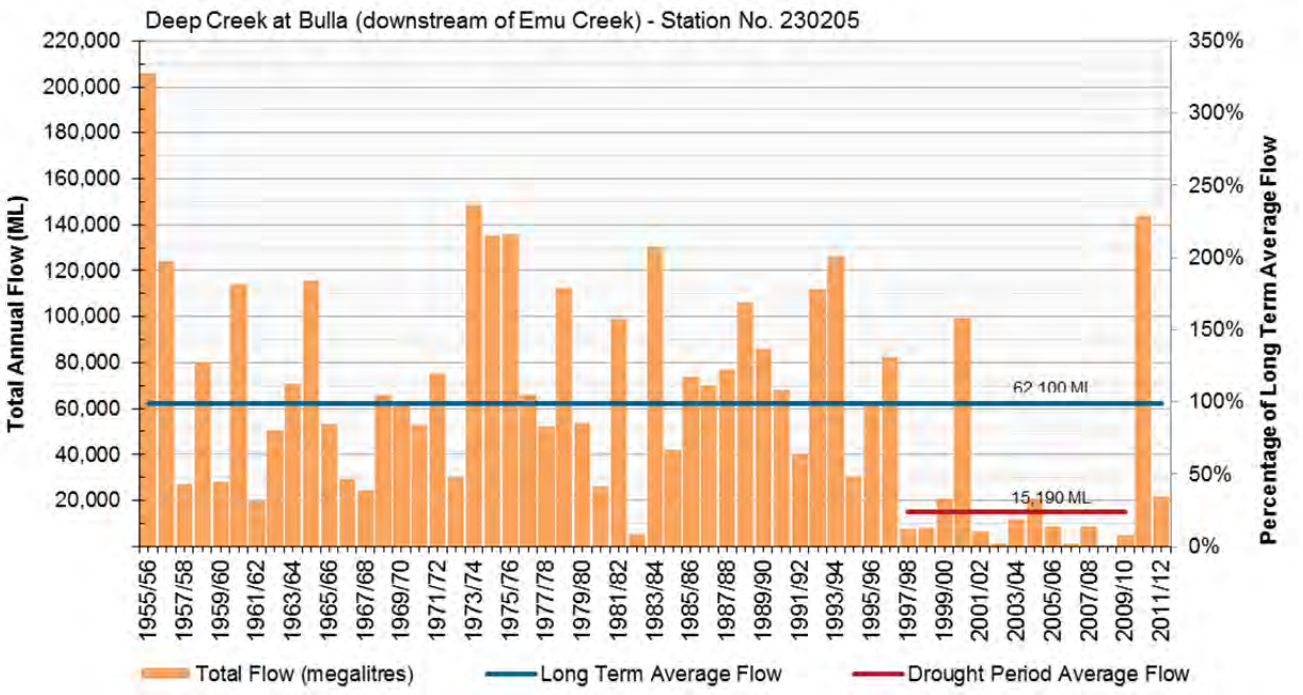


Figure 1-17 Annual streamflow at Werribee River

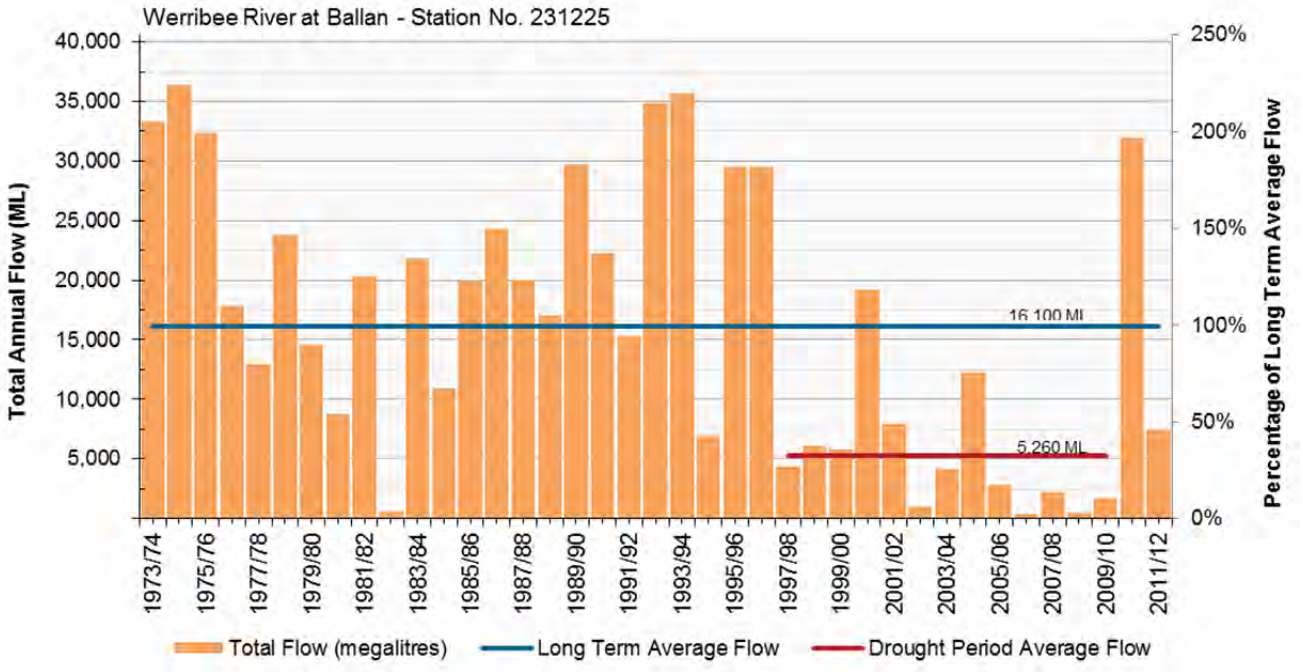


Figure 1-18 Annual streamflow at Moorabool River

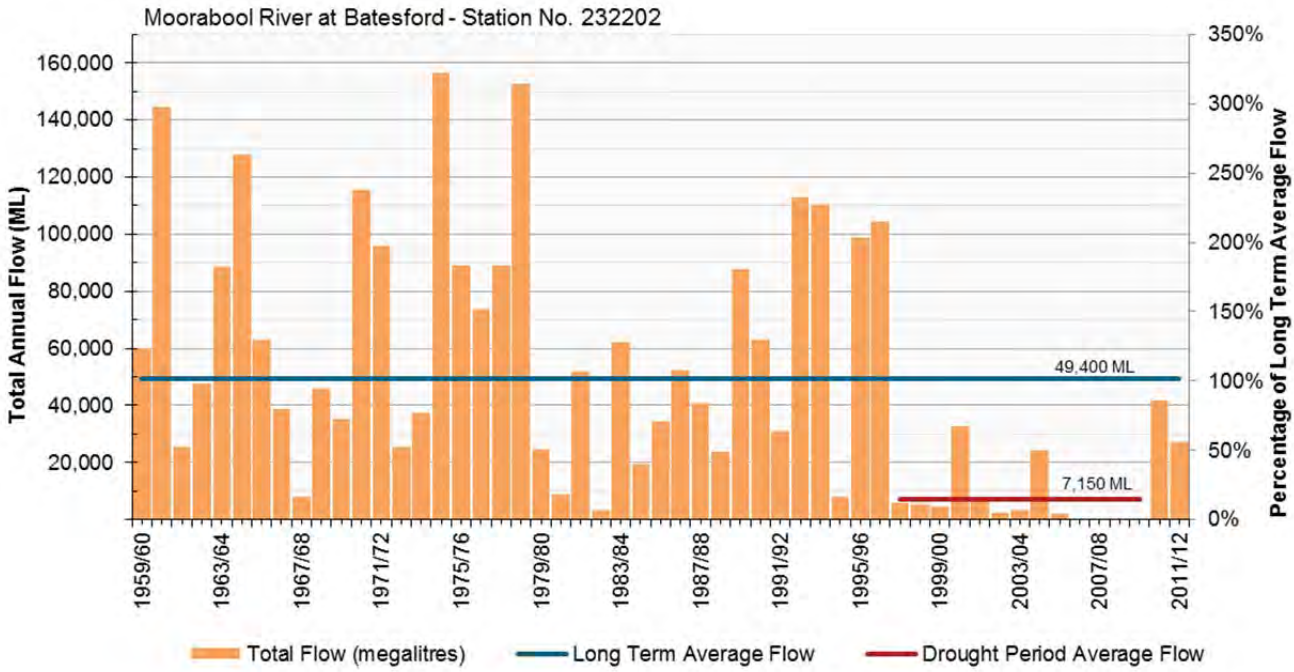
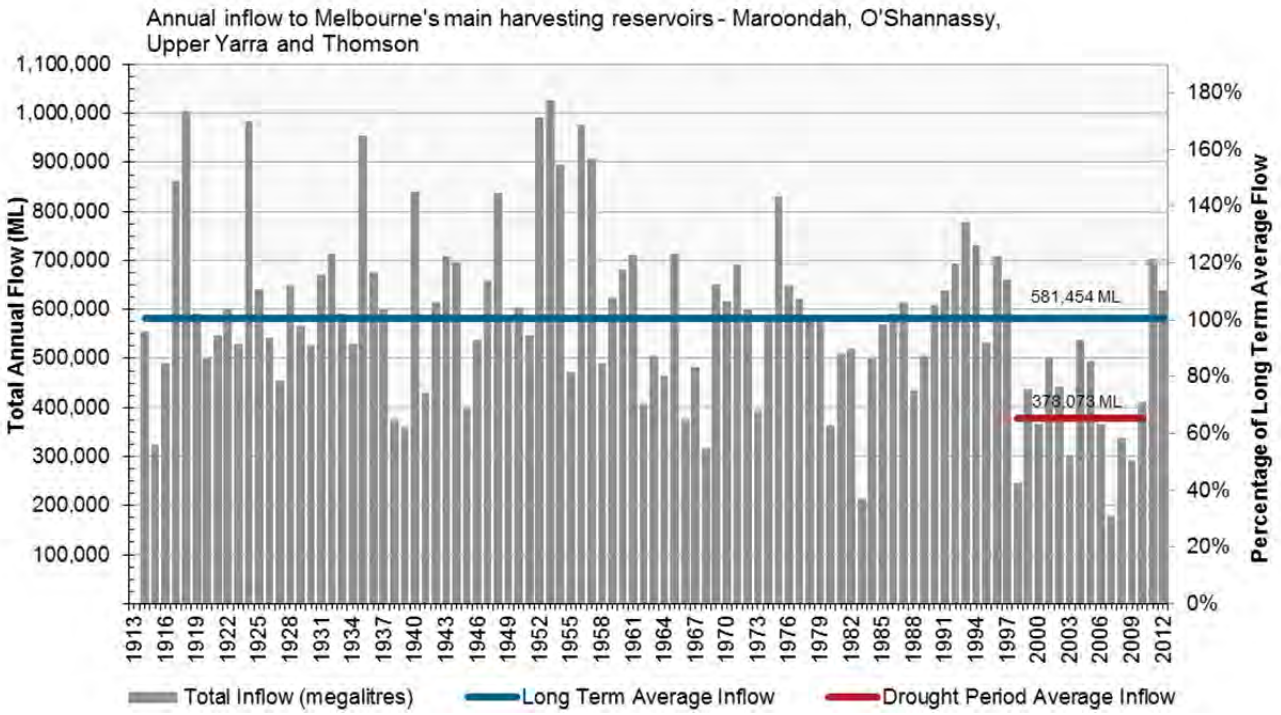


Figure 1-19 Annual inflows to Melbourne's storages



1.2.1 Other factors affecting water availability across Victoria

In 2011–12 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. High-alert status indicates that direct use for drinking water, domestic and stock watering and recreational activities (swimming, diving,

etc.) should be avoided. When a bloom occurs in a drinking water supply, water corporations notify the public and activate their risk management plans to ensure that treatment removes the algae or that the water source is taken off-line.

Significant high-alert cyanobacteria blooms were recorded in 21 major water bodies and water supplies across Victoria during 2011–12 (Table 1-3). This is an improvement on the 42 alerts recorded in 2010–11 and includes three outbreaks reported in 2010–11 that continued into 2011–12.

Table 1-3 Significant high-alert cyanobacteria blooms for 2011–12

Basin	Location	Major use	Duration
Campaspe	Lake Eppalock	Drinking, domestic and stock, irrigation, recreation	October 2011 to May 2012
	Malmsbury Reservoir	Drinking	May 2012
	Waranga Channel(1)	Drinking, domestic and stock, irrigation	June and July 2011
Goulburn	Lake Eildon	Drinking, domestic and stock, irrigation, recreation	December 2011
Latrobe	Lake Narracan	Drinking, domestic and stock, irrigation, recreation	December 2011 to March 2012
Loddon	Evansford Reservoir (1)	Drinking	April 2011 to August 2011
	Gum Lagoon	Drinking, domestic and stock, irrigation, recreation	January 2012
	Gunbower Creek at Cohuna	Drinking, domestic and stock, irrigation, recreation	July and August 2011
	Gunbower Creek at Leitchville	Drinking, domestic and stock, irrigation, recreation	July and August 2011
	Laanecoorie Reservoir	Drinking, domestic and stock, irrigation, recreation	February to April 2012
	Lockington Water Storage	Non-potable town supply	November 2011
	Loddon River at Laanecoorie	Drinking, domestic and stock, irrigation, recreation	August 2011
	Mysia Service Basin	Non-potable town supply	October and November 2011
	Talbot Reservoir (1)	Drinking	April 2011 to July 2011, February to March 2012
Moorabool	Moorabool Reservoir	Drinking	February to May 2012
Murray	Murray River at Echuca	Drinking, domestic and stock, irrigation, recreation	July and August 2011
South Gippsland	Candowie Reservoir	Drinking	November 2011 and March 2012
Thomson	Gippsland Lakes	Recreation	December 2011 to February 2012
Werribee	Melton Reservoir	Drinking, domestic and stock, irrigation, recreation	November 2011, March to May 2012
	Merrimu Reservoir	Drinking	June 2012
	Pykes Creek Reservoir	Drinking, domestic and stock, irrigation, recreation	April and May 2012

Note:

(1) Blooms reported in 2010–11 that continued into 2011–12.

1.3 Storages

Victoria's major water storages are capable of holding around 12,294,861 ML. Of this, Melbourne's storage capacity is 1,812,175 ML and the combined capacity of the state's major regional storages is 10,482,686 ML.

In 2011–12 Victoria's storage levels started the year at 9,807,307 ML (80% of capacity) and ended at 10,504,868 ML (85% of capacity), the highest values recorded for 10 years. The combined volume of water stored in Victoria's reservoirs at the end of each month varies both within a given year and between years (Figure 1-20 and Figure 1-21).

Storage levels in Victoria's major regional reservoirs started the year at 8,800,363 ML (84% of capacity) and ended at 9,233,836 ML (88% of capacity). Storage levels increased during spring, reaching a peak of 9,676,855 ML (92% of capacity) at the end October, and declined over summer to a minimum of 8,551,260 ML (81.6% of capacity) at the end of February (Figure 1-20).

Melbourne's water storages started the year at 1,006,944 ML (56% of total capacity) and recovered to 1,271,032 ML (70% of total capacity) by the end of June 2012 (Figure 1-21). For the third consecutive year, 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 later 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 this section (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 2002 to 30 June 2012

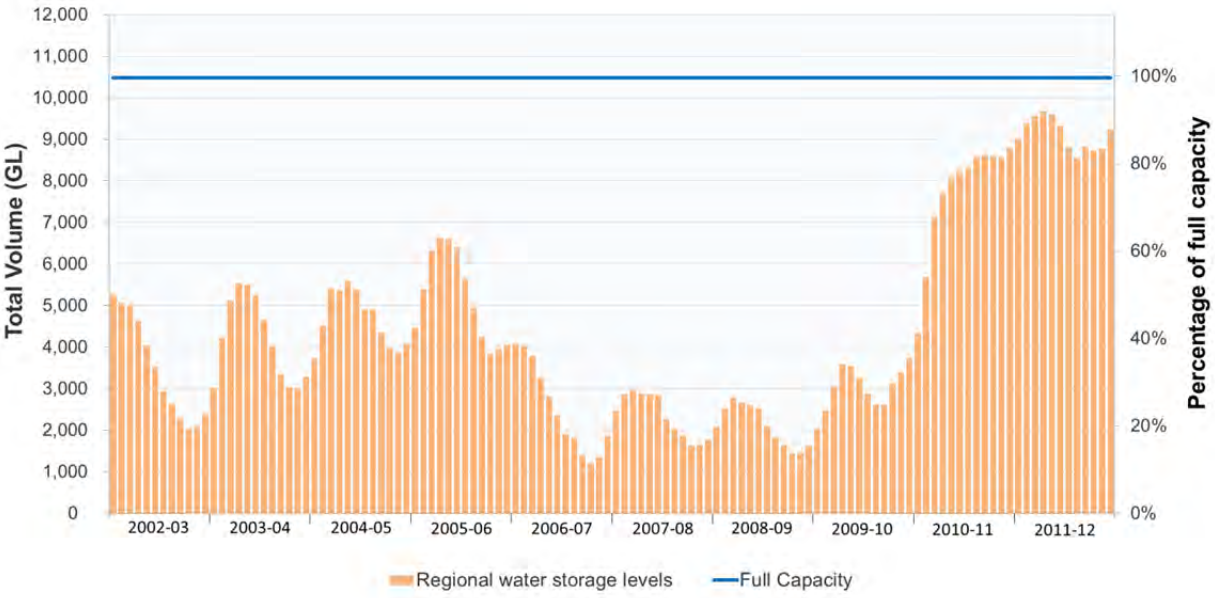
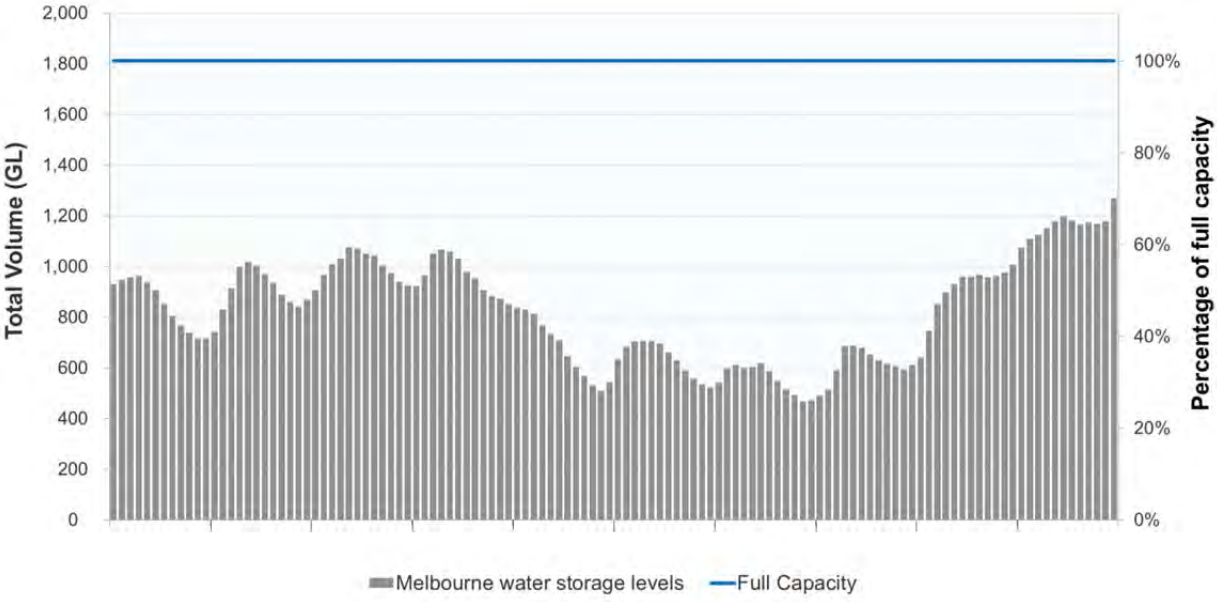


Figure 1-21 Volume in Melbourne Water Corporation storages, 1 July 2002 to 30 June 2012

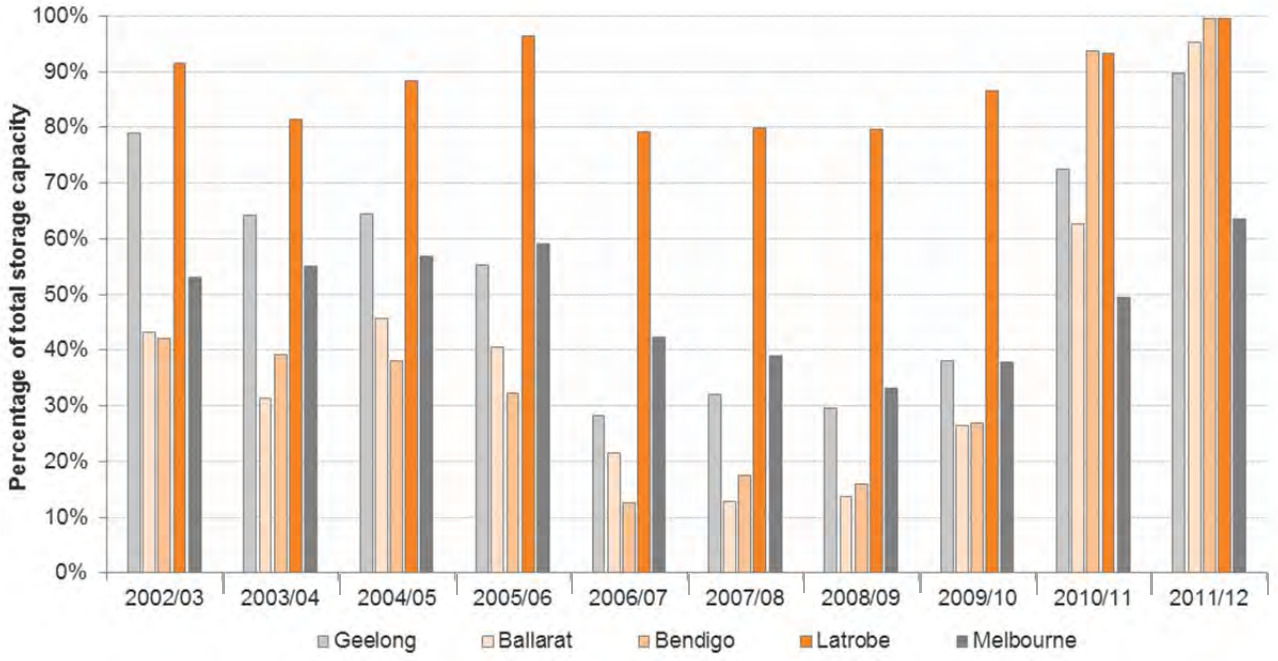


The total volume of water stored in Victoria's major reservoirs has historically been at its highest following winter and spring inflows, hence storage levels at the end of October are traditionally considered to be a good indication of water availability for the remainder of that year.

Figure 1-22 presents October storage levels, as a percentage of storage capacity, from 2002–03 to 2011–12 for Melbourne and selected major regional centres.

During the drought, October storage levels generally declined from 2002–03 to 2006–07 (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 2011, the Bendigo and Latrobe storages were close to full capacity for the first time in over a decade (Figure 1-22). While not at capacity, the volumes in storage at the end of October 2011 for Ballarat, Geelong and Melbourne were at their highest in over a decade (Figure 1-22).

Figure 1-22 Water in reservoirs for major urban centres at the end of October in each year between 2002–2011, percentage of total storage capacity



1.4 Groundwater

Groundwater is water that exists in the spaces and fractures in rock and sediment beneath the 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 change in aquifer storage resulting from differences between what flows into (recharge) and what flows 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 currently managed through Groundwater Management Units (GMUs), of which there are three types: Water Supply Protection Areas (WSPAs), Groundwater Management Areas (GMAs) and Unincorporated Areas.

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. Representative or key bore sites have been selected across GMUs in Victoria for the analysis and reporting of groundwater trends.

During 2011–12, stable or increasing groundwater level trends were shown at a larger number of WSPAs (Table 1-4, Figure 1-23) and GMAs (Table 1-5, Figure 1-24) compared to the trends in 2010–11. This can be attributed to decreasing demand for groundwater, as evidenced by reduced groundwater extraction figures over the past two years and increased availability of surface water resources. In addition, the increasing water levels in some unconfined aquifers may be a recharge response to the wetter than average conditions in 2010–11 and 2011–12.

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

Water Supply Protection Area	Groundwater level trend 2011–12				Groundwater level trend June 2011
	September 2011	December 2011	March 2012	June 2012	
Lower Campaspe Valley	Stable	Stable	Increasing	**Increasing**	Stable
Katunga	Stable	Stable	Increasing	**Increasing**	Stable
Loddon Highlands	Stable	Stable	Increasing	**Increasing**	Stable
Shepparton Irrigation Region	Declining	Declining	Declining	**Declining**	Declining
Upper Ovens	Increasing	Increasing	Stable	**Stable**	Increasing
Apsley	Stable	Stable	Stable	**Stable**	Stable
Kaniva	Stable	Stable	Stable	**Stable**	Stable
Murrayville	Stable	Stable	Stable	**Stable**	Stable
Neuarpur	Declining	Declining	Stable	**Stable**	Declining
Telopea Downs	Stable	Stable	Stable	**Stable**	Stable
Bungaree	Increasing	Increasing	Increasing	**Increasing**	Increasing
Condah	Stable	Stable	Increasing	**Increasing**	Stable
Denison(1)	Stable	Stable	Stable	**Stable**	Stable
Deutgam	Stable	Stable	Increasing	**Increasing**	Increasing
Glenelg(2)	Stable	Stable	Stable	**Stable**	Declining
Koo Wee Rup	Stable	Stable	Increasing	**Increasing**	Declining
Nullaware	Increasing	Increasing	Increasing	**Increasing**	Increasing
Sale	Declining	Declining	Stable	**Stable**	Declining
Wandin Yallock	Increasing	Increasing	Increasing	**Increasing**	Increasing
Warrion	Stable	Increasing	Increasing	**Increasing**	Stable
Wy Yung	Stable	Stable	Stable	**Increasing**	Stable
Yangery	Increasing	Increasing	Increasing	**Increasing**	Increasing
Yarram(2)	Declining	Declining	Stable	**Stable**	Declining

Notes:

(1) Inadequate SOBN coverage: insufficient state observation bores in this GMU to adequately define the groundwater resource or changes to the resource over time.

(2) Limited SOBN coverage: distribution of state observation bores in this GMU not sufficient to provide a baseline understanding of the groundwater resource in the area.

Figure 1-23 Groundwater trends in Water Supply Protection Areas

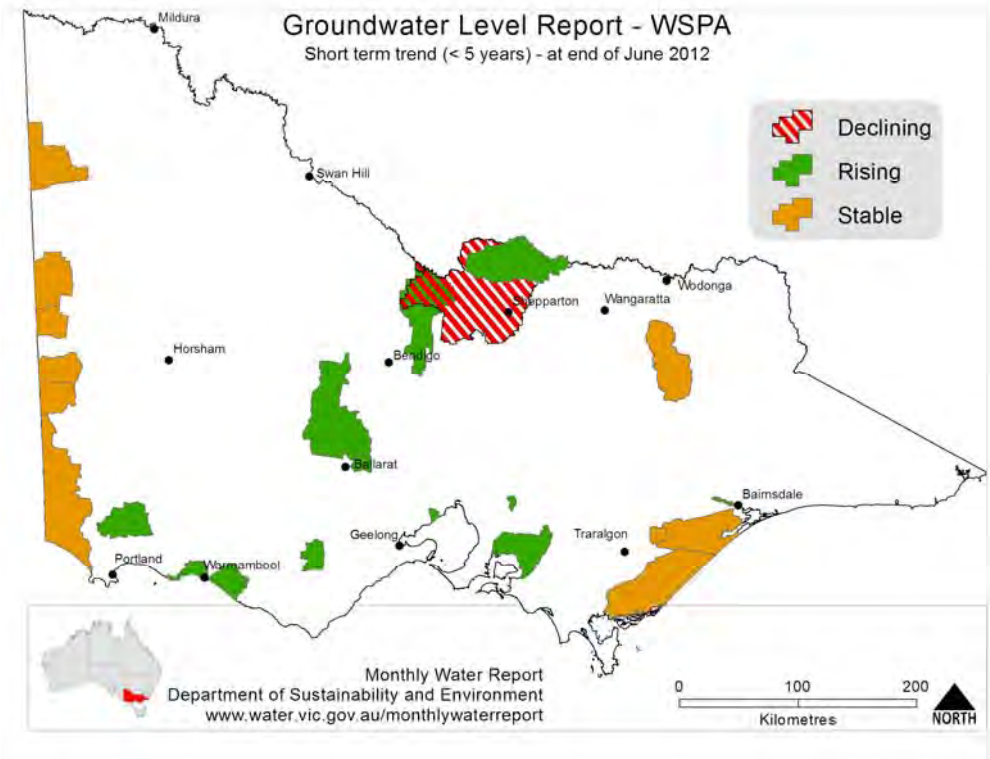


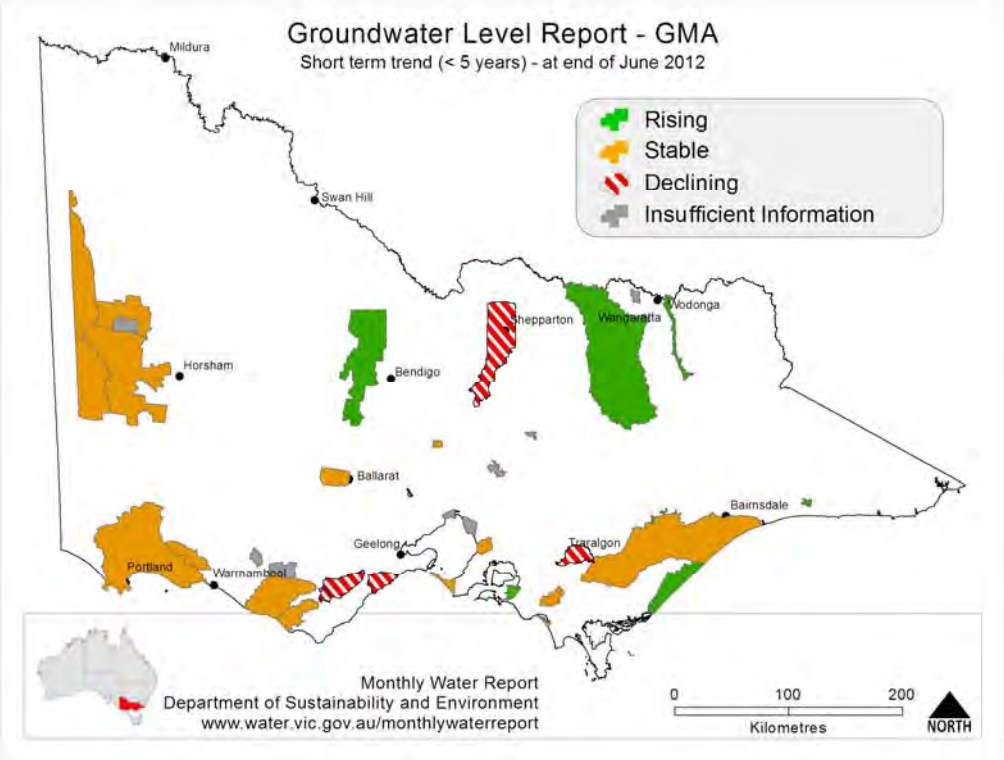
Table 1-5 Groundwater level trends in Groundwater Management Areas

Groundwater Management Area[1]	Groundwater level trend 2011–12				Groundwater level trend June 2011
	September 2011	December 2011	March 2012	June 2012	
Cardigan	Declining	Stable	Stable	**Stable**	Declining
Corinella	Stable	Stable	Increasing	**Increasing**	Declining
Frankston	Stable	Stable	Stable	**Stable**	Stable
Gellibrand	Declining	Declining	Declining	**Declining**	Declining
Gerangamete	Declining	Declining	Declining	**Declining**	Declining
Giffard	Stable	Stable	Increasing	**Increasing**	Increasing
Goroke	Stable	Stable	Stable	**Stable**	Stable
Hawksdale	Stable	Stable	Stable	**Stable**	Stable
Jan Juc	Declining	Declining	Declining	**Declining**	Declining
Kaniva TSCA	Stable	Stable	Stable	**Stable**	Stable
Lancefield	Stable	Stable	Stable	**Stable**	Stable
Leongatha	Stable	Stable	Increasing	**Stable**	Stable
Little Desert	Stable	Stable	Stable	**Stable**	Stable
Lower Ovens	Increasing	Increasing	Increasing	**Increasing**	Stable
Merrimu	Declining	Declining	Declining	**Declining**	Declining
Mid Goulburn	Declining	Declining	Declining	**Declining**	Declining
Mid Loddon	Increasing	Increasing	Increasing	**Increasing**	Increasing
Moe	Declining	Declining	Declining	**Declining**	Declining
Mullindolingong	Increasing	Increasing	Increasing	**Increasing**	Increasing
Nepean	Stable	Stable	Stable	**Stable**	Stable
Newlingrook	Stable	Stable	Stable	**Stable**	Declining
Nhill	Stable	Stable	Stable	**Stable**	Stable
Orbost	Stable	Stable	Increasing	**Increasing**	Increasing
Paaratte	Stable	Stable	Stable	**Stable**	Stable

Note:

(1) There are insufficient state observation bores to adequately define the groundwater resource or changes to the resource over time in the following Groundwater Management Areas: Alexandra, Balrootan, Barnawartha, Colongulac, Cut Paw Paw, Glenormiston, Heywood, Kinglake and Moorabbin.

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.

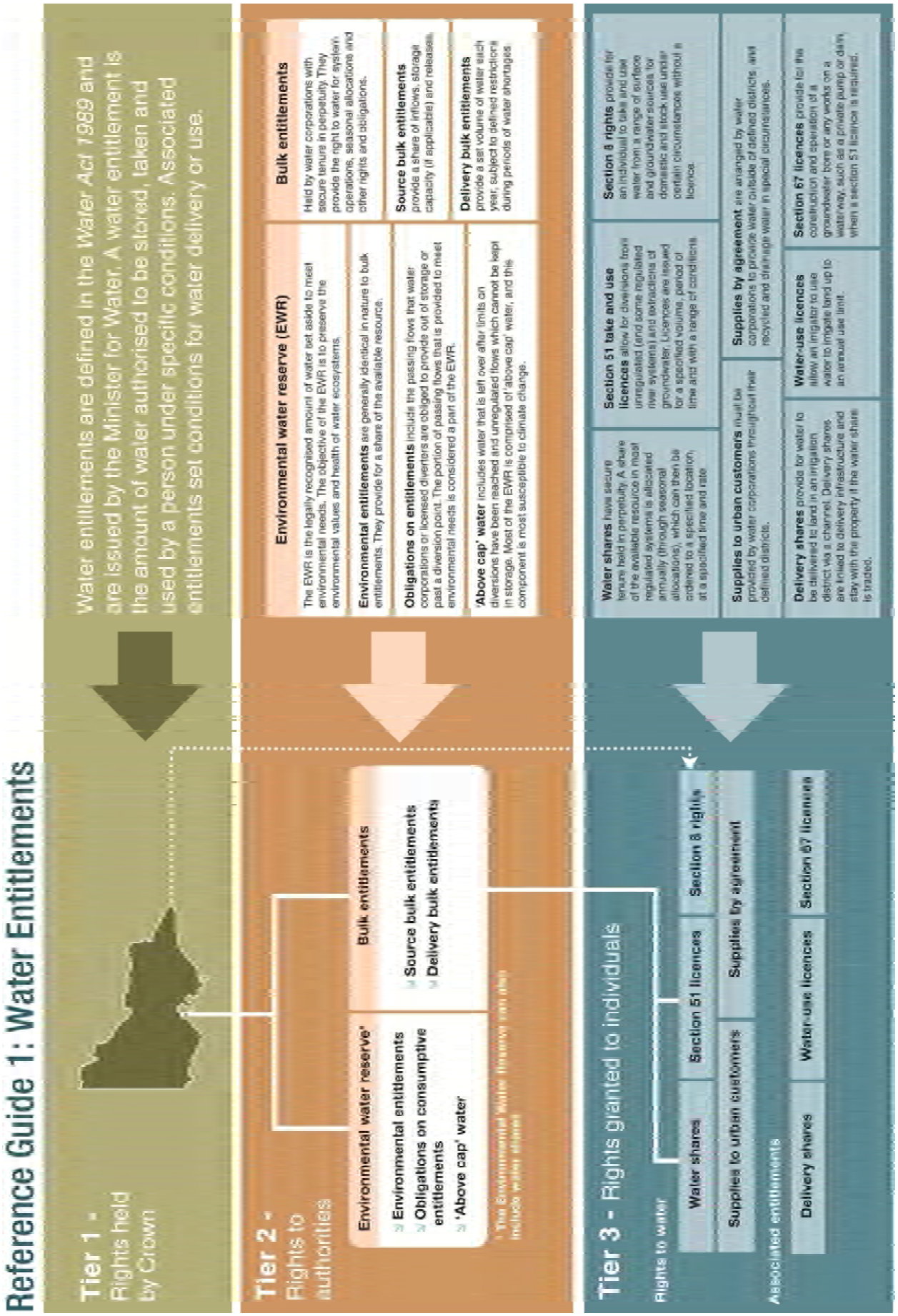
2.1 Victoria's water entitlement and planning framework

The establishment of the Victorian Water Entitlement Framework in the *Water Act 1989* 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 limit 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 2011–12).
- 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 1989* 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 2011–12.

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 2011–12 is presented in Chapter 5.

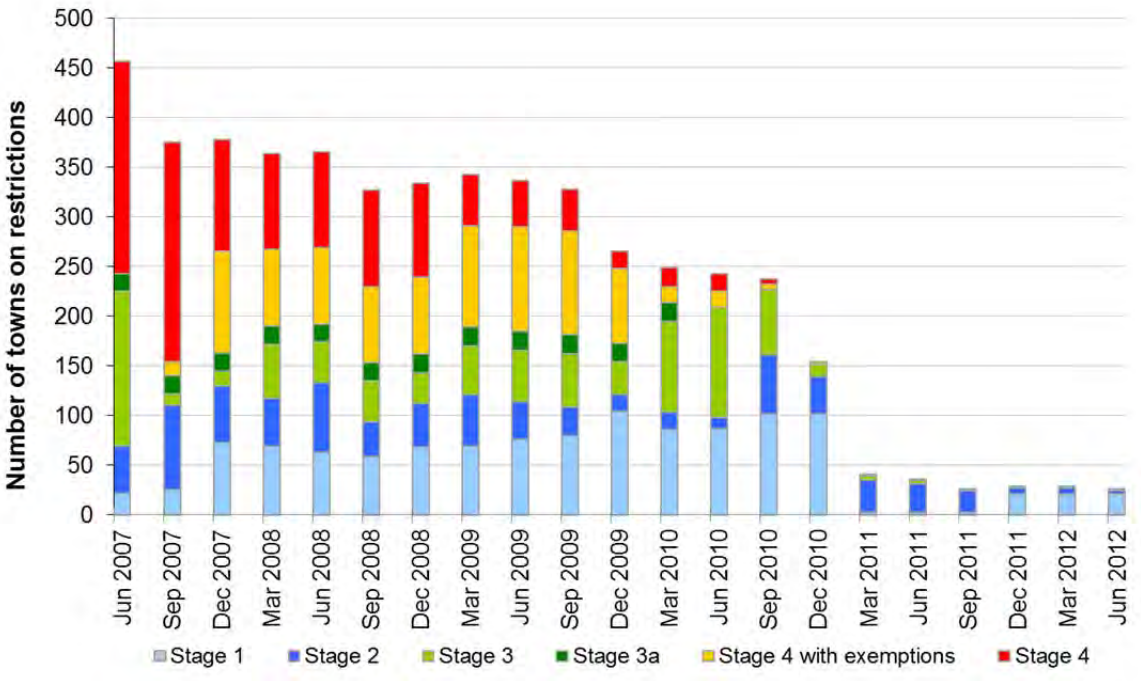
2.2.1 Urban water restrictions

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.

A large number of towns were subject to restrictions during the Millennium Drought. In 2011–12 both the number of towns on water restrictions and the severity of these restrictions continued to decline relative to the height of the drought in 2007 (Figure 2-2).

Figure 2-2 Number of Victorian towns on restrictions, June 2007 to June 2012



In July 2011, Central Highlands Water eased restrictions from Stage 3 to Stage 2 for Blackwood and Barrys Reef and removed Stage 2 restrictions for Daylesford, Hepburn and Hepburn Springs. North East Water also removed Stage 4 restrictions for Bundalong in July 2011. Central Highlands Water removed Stage 2 restrictions for towns supplied from the Forest Hill system in September 2011. Stage 2 restrictions for Metropolitan Melbourne and Western Water's neighbouring towns were eased to Stage 1 in December 2011.

Lower Murray Water implemented Stage 3 restrictions for Robinvale during August and September 2011 while the town's water treatment plant was being upgraded. Barwon Water implemented Stage 2 restrictions for Apollo Bay, Skenes Creek and Marengo from late October 2011 to April 2012 to ensure the small supply system could cope with the tourist influx over the summer and autumn.

Restrictions were applied all year for a small number of towns in western Victoria due to infrastructure constraints.

At the end of 2011–12, some 26 towns remained on water restrictions. Around 500 towns were on water restrictions and were subject to permanent water saving rules (PWSR).

Table 2-1 Urban water restrictions in 2011–12

Water corporation	Water system and towns	Level and duration of restrictions in 2011–12
Barwon Water	Marengo system (Apollo Bay, Skenes Creek, Marengo)	PWSR applied 1 July to 29 October, 29 April to 30 June Stage 2 restrictions applied 30 October to 28 April
	All other towns	PWSR applied all year
Central Highlands Water	Avoca	Stage 2 restrictions applied all year
	Blackwood system (Blackwood, Barrys Reef)	Stage 3 restrictions applied from 1 July to 21 July Stage 2 restrictions applied 22 July to 30 June
	Forest Hill system (Allendale, Broomfield, Kingston, Newlyn, Smeaton, Springmount)	Stage 2 restrictions applied 1 July to 29 September PWSR applied 30 September to 30 June
	Daylesford system (Daylesford, Hepburn, Hepburn Springs)	Stage 2 restrictions applied 1 July to 21 July PWSR applied 22 July to 30 June
	Redbank	Stage 2 restrictions applied all year
	All other towns	PWSR applied all year
Coliban Water	Raywood, Sebastian	Stage 3 restrictions applied all year
	All other towns	PWSR applied all year
East Gippsland	All towns	PWSR applied all year
Gippsland Water	All towns	PWSR applied all year
Goulburn Valley Water	All towns	PWSR applied all year
GWMWater	Edenhope, Harrow	Stage 1 restrictions applied all year
	All other towns	PWSR applied all year
Lower Murray Water	Robinvale	Stage 3 restrictions applied 1 August to 22 September PWSR applied 1 July to 30 July, 23 September to 30 June
	All other towns	PWSR applied all year
North East Water	Bundalong	Stage 4 restrictions applied 1 July to 26 July PWSR applied 27 July to 30 June
	All other towns	PWSR applied all year
South Gippsland Water	All towns	PWSR applied all year
Wannon 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 2 restrictions applied 1 July to 5 December PWSR applied 6 December to 30 June
	All other towns	PWSR applied all year
Westernport Water	All towns	PWSR applied all year
Melbourne Metrpolitan Retailers (Yarra Valley Water, South East Water, City West Water)	Metropolitan Melbourne	Stage 2 restrictions applied 1 July to 30 November Stage 1 applied 1 December to 30 June

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 2011–12 (Table 2-2). Low reliability allocations reached 100% in the Broken, Bullarook and Campaspe systems but remained at 0% in the Murray and Goulburn systems.

In southern Victoria, low reliability allocations reached 100% for both high reliability and low reliability entitlements in the Macalister Irrigation District for the second year in a row. Allocations in the Werribee and Bacchus Marsh irrigation districts reached 100% for high reliability water shares and 75% for low reliability water shares.

Table 2-2 Seasonal water allocations in declared water systems

Water system	Water shares	2011–12			2010–11
		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	50	100	**100**	100
	Low reliability	0	0	**0**	0
Goulburn	High reliability	78	100	**100**	100
	Low reliability	0	0	**0**	0
Broken	High reliability	34	100	**100**	100
	Low reliability	0	100	**100**	100
Campaspe	High reliability	100	100	**100**	100
	Low reliability	54	100	**100**	100
Loddon	High reliability	78	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	**100**	100
Werribee and Bacchus Marsh	High reliability	100	100	**100**	100
	Low reliability	5	35	**75**	55

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.

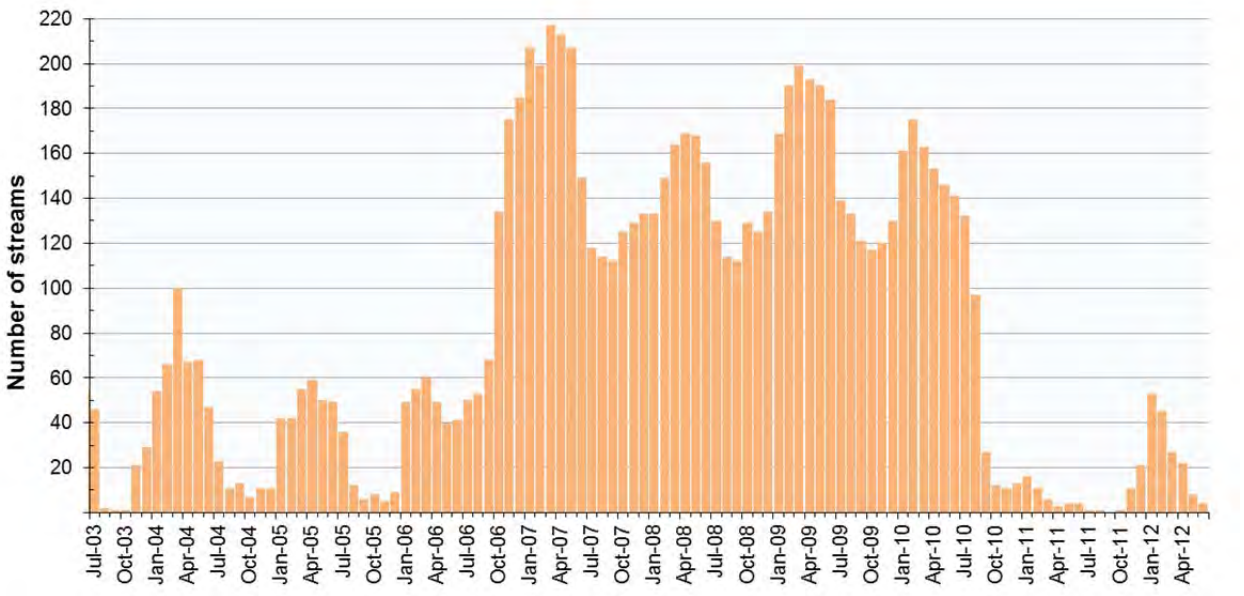
(3) Goulburn–Murray Water announces final allocations in April while Southern Rural Water announces final allocations in June.

2.2.3 Restrictions on diversions from unregulated streams

Streamflow 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 2011–12 followed this general trend.

Figure 2-3 Number of Victorian unregulated streams on restrictions, 2003–04 to 2011–12



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.

For 2011–12, seasonal allocations applied for the following management areas:

- Lower Campaspe Valley WSPA – Zone 1028 (75% allocation)
- Loddon Highlands WSPA (80% allocation)
- Katunga WSPA (70% allocation)
- West Wimmera GMA – Neuarpur sub-zone 1 (96% allocation).

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. Table 2-3 summarises the towns that received carted water in 2011–12. In contrast to recent years in which water carting was required to address water scarcity, it was necessary to cart water to several towns in 2011–12 due to poor water quality that resulted from major flooding in late summer. Many towns in the Wimmera-Mallee region continued to receive carted water due to ongoing poor water quality resulting from major flooding in the previous year.

Table 2-3 Towns receiving carted water 2011–12

Basin	Water corporation	Town(s) receiving water	Source of water	Period
Loddon	Coliban Water	Mitiamo	Pyramid Hill	24 February to 30 June
		Raywood, Sebastian	Bendigo	All year
		Serpentine	Bendigo	1 July to 4 April
Murray		Gunbower	Echuca	14 March to 30 June
Ovens	North East Water	Bundalong	Yarrawonga	1 July to 1 August
Wimmera and Avoca	GWMWater	Beulah, Brim, Donald, Jung, Lalbert, Manangatang, Minyip, Quambatook, Rupanyup, Ultima, Woomelang, Wycheproof	Grampians headworks system	1 July to 29 October

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 2011–12 and 2010–11. 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 2010–11 and 2011–12

Entitlement type	Volume 2011–12 (ML)	Volume 2010–11 (ML)
Surface water		
Bulk entitlements(1)	5,800,890	5,699,675
Licences(2)	410,556	425,755
Small catchment dams(3)	522,949	523,200
Total surface water entitlements	***6,734,395***	***6,648,630***
Groundwater		
Licences	976,839	957,630
Bulk entitlements	7,000	7,000
Total groundwater entitlements	***983,839***	***964,630***
Total entitlements	**7,718,234**	**7,616,260**

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 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.

The availability and use of Victoria's water resources for 2011–12 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 2011–12 was approximately 32,200,000 ML. Of this, approximately 4,100,000 ML (or 12%) was taken for consumptive purposes in 2011–12.

The volume of water taken under surface water entitlements in 2011–12 accounted for 90% of the total volume of water taken for consumptive purposes.

Surface water availability in 2011–12 was far greater than the total volume of water granted in surface water entitlements. The volume of surface water taken in 2011–12 was only 55% of the total entitlement volume.

Table 3-2 Victoria's water availability and water taken for consumptive use in 2011–12

Water source	Available resource (ML)	Total entitlements (ML)	Total taken (ML)
Surface water[(1)]	32,182,195	6,734,395	3,696,110
Groundwater[(2)]	1,023,924	983,839	316,322
Recycled water	473,602	Not applicable	86,934

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 Part 2.

(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 River basins in Victoria

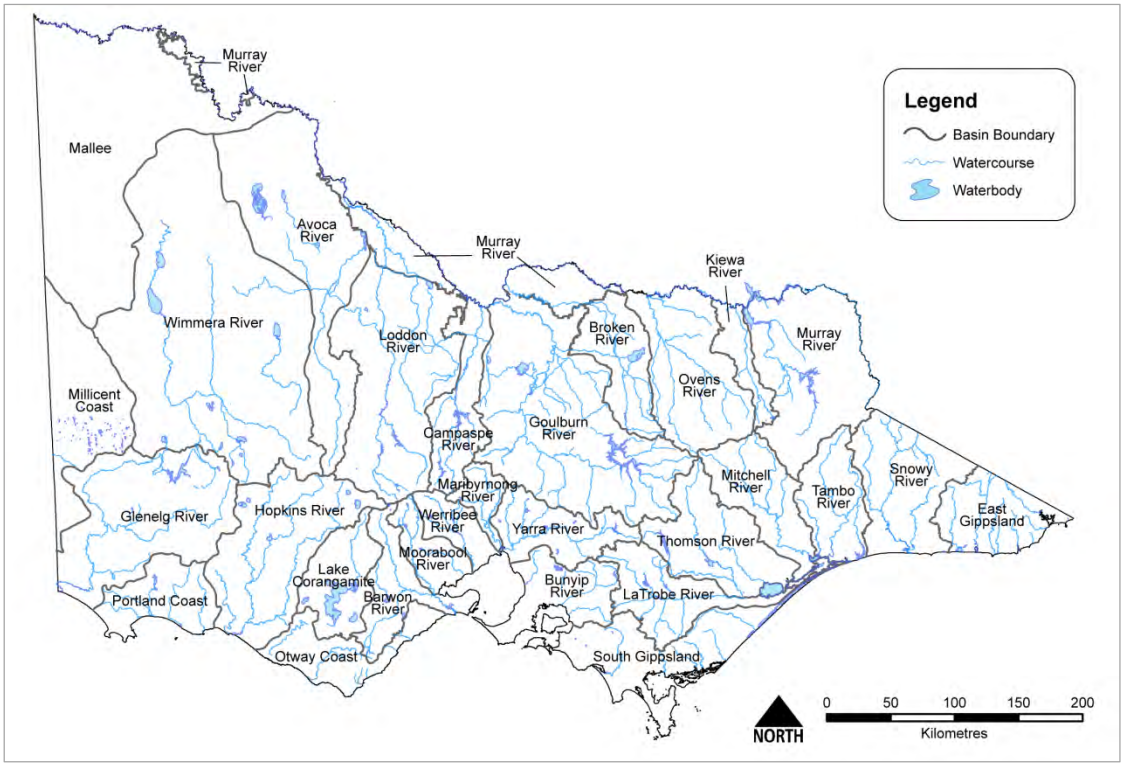


Table 3-3 summarises the volume of water taken under bulk entitlements, licences and small catchment dams in each basin in 2011–12. More detail on diversions under surface water entitlements in each basin can be found in Part 2.

The bulk entitlement volumes for some basins have changed compared to the values reported in the 2010–11 accounts.

Bulk entitlements were established for Bunagor, Elmhurt, Molesworth, Strathbogie, Trentham and Willaura in 2011–12. The establishment of these bulk entitlements has brought to an end the process to convert water corporations' historic, ill-defined rights to take water into formal bulk entitlements. Bulk entitlements granted to the Melbourne water retail businesses to take water produced by the Wonthaggi Desalination Plant are now included in the South Gippsland basin.

However, the difference in bulk entitlement volumes to 2010–11 is mostly attributable to a change in the way the total volume of water defined in bulk entitlements in each basin has been determined (refer to Chapter 6.1).

The volume of water taken under bulk entitlements in 2011–12 was 53% of the total volume of bulk entitlements, and the volume of water taken under licences was 19% 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 2011–12

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 volume taken (%)	Volume taken (ML)
Murray	2,068,341	1,285,918	62%	84,910	6,989	8%	6,445
Kiewa	1,076	481	45%	20,673	2,290	11%	3,927
Ovens	50,245	8,064	16%	27,309	2,350	9%	15,888
Broken	25,279	4,143	16%	12,357	323	3%	15,738
Goulburn	1,948,161	1,004,938	52%	47,096	9,818	21%	47,513
Campaspe	134,574	27,889	21%	7,508	460	6%	28,776
Loddon	42,649	8,680	20%	34,348	4,205	12%	50,037
Avoca	278	116	42%	3,032	37	1%	12,693
Mallee	0	0	n/a	0	0	n/a	0
Wimmera	125,950	36,607	29%	2,586	466	18%	14,337
East Gippsland	622	156	25%	660	66	10%	1,100
Snowy	2,201	701	32%	3,992	385	10%	3,356
Tambo	342	21	6%	4,194	528	13%	3,971
Mitchell	9,208	3,887	42%	16,391	5,086	31%	4,558
Thomson	399,660	148,407	37%	17,246	7,092	41%	6,984
Latrobe	216,842	120,653	56%	19,198	9,974	52%	20,547
South Gippsland	167,015	7,564	5%	12,844	3,254	25%	24,256
Bunyip	39,595	11,718	30%	19,167	3,982	21%	15,525
Yarra	400,000	343,400	86%	43,251	12,420	29%	15,824
Maribyrnong	9,918	1,427	14%	1,993	439	22%	7,782
Werribee	37,675	21,455	57%	1,098	275	25%	9,347
Moorabool	40,600	12,242	30%	3,610	1,220	34%	22,197
Barwon	55,733	30,225	54%	5,650	1,668	30%	30,898
Corangamite	0	0	n/a	1,242	185	15%	12,366
Otway Coast	19,667	14,194	72%	6,724	2,078	31%	12,728
Hopkins	705	200	28%	11,253	2,693	24%	64,538
Portland Coast	0	0	n/a	1,177	125	11%	16,135
Glenelg	4,554	1,410	31%	1,042	253	24%	55,483
Millicent Coast	0	0	n/a	4	4	100%	0
Total	**5,800,890**	**3,094,497**	**53%**	**410,556**	**78,665**	**19%**	**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.

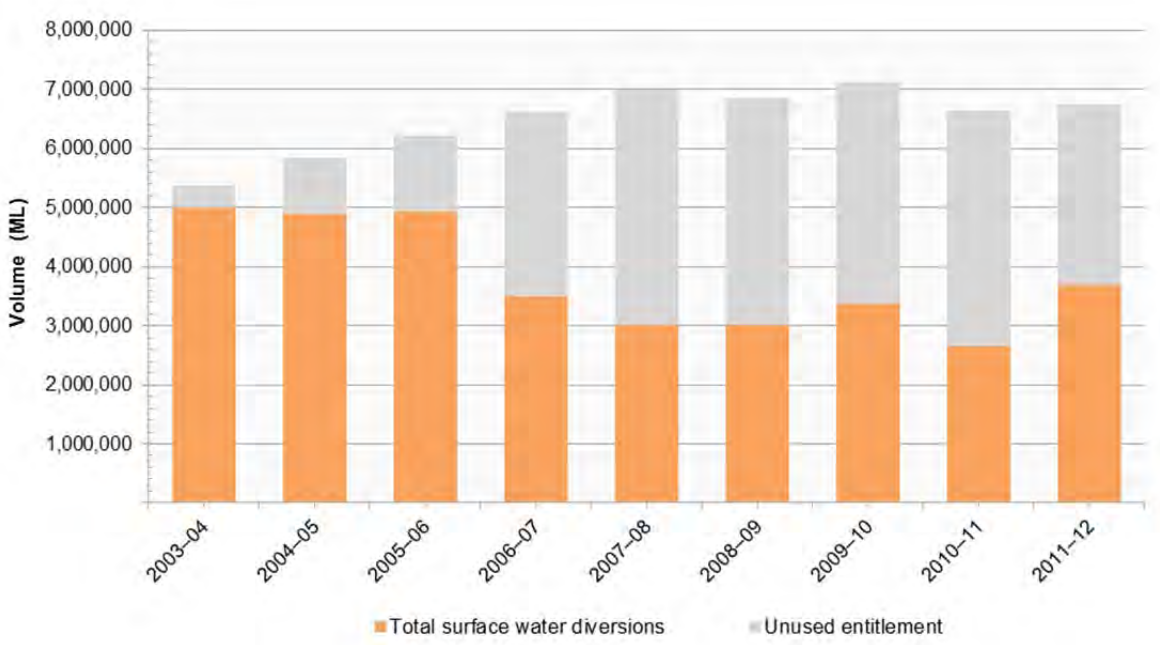
(2) Includes only licences issued for unregulated rivers. Licences within regulated water supply systems are not included as they are part of rural water corporations' bulk entitlements.

Figure 3-2 shows the volume of water taken under surface water entitlements over the past nine 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 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. The total volume of surface water entitlements in 2010–11 and 2011–12 is lower than previous years due to a change in the way the total bulk entitlement volume is determined, see Chapter 6.1.

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).

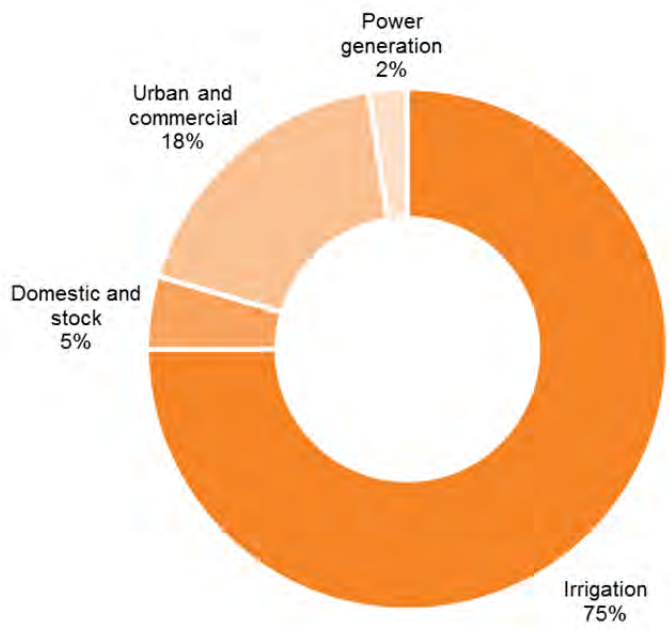
As shown in Table 3-4, the volume of water taken under consumptive entitlements in 2011–12 increased, compared to 2010–11. The volume of water diverted for irrigation purposes in 2011–12 was one and a half times greater than the volume diverted in 2010–11. In contrast, the volume of water diverted for urban and commercial purposes decreased compared to 2010–11. 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 75% of all diversions. This portion has increased compared to 2010–11.

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

Consumptive end use	2011–12		2010–11	
	Volume diverted (ML)	Proportion of total consumptive diversions (%)	Volume diverted (ML)	Proportion of total consumptive diversions (%)
Irrigation	2,746,202	75%	1,762,560	62%
Domestic and stock	166,752	5%	166,630	6%
Urban and commercial	662,211	18%	803,630	29%
Power generation	86,989	2%	89,770	3%
Total	**3,662,154**	**100%**	**2,822,590**	**100%**

Figure 3-3 Total surface water diversions for consumptive purposes in Victoria, 2011–12



3.2 Groundwater entitlements and use

The consumption of groundwater from Victoria's aquifers is managed according to geographical area. The principal management unit for groundwater in Victoria is the groundwater management unit (GMU), the boundaries of which often fall across more than one river basin. There are three types of GMU:

- **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 2011–12 are presented in Appendix B.

In 2011–12, total groundwater licensed entitlement was approximately 983,839 ML across the state. The total groundwater use across the state, including domestic and stock use, was approximately 316,322 ML, which was significantly more than the volume used in 2010–11 (221,100 ML).

In 2011–12, the total volume of licensed groundwater extracted from GMAs and WSPAs (not UAs) was approximately 214,633 ML. This included metered use of 213,685 ML and estimated use of 948 ML, an increase of 47% compared to 2010–11 (146,000 ML).

Domestic and stock use (59,298 ML) was estimated to account for approximately 19% of total groundwater use (316,322 ML). This was a decrease from approximately 26% of total groundwater use in 2010–11.

In Victoria's GMAs, licensed groundwater entitlements totalled 252,335 ML, with total use of 96,873 ML consisting of 79,848 ML of metered extractions and an estimated 527 ML of unmetered extractions. Estimated domestic and stock use in these areas was 16,498 ML.

Licensed groundwater entitlements in WSPAs totalled 598,247 ML, with total use of 154,885 ML consisting of 133,837 ML of metered extractions and an estimated 421 ML of unmetered extractions. Estimated domestic and stock use in these areas was 20,627 ML.

Estimated groundwater entitlement in the unincorporated areas was approximately 133,257 ML, with approximately 64,564 ML extracted. This was significantly higher than 2010–11 when entitlement was approximately 121,470 ML and 42,086 ML was extracted.

The total volume of groundwater extracted for urban use in 2011–12 was 12,364 ML, which was approximately 4% of the total groundwater extracted.

Approximately 70 towns have a groundwater entitlement as either a supplementary or primary water supply. In 2011–12, only 50 of these towns recorded any extraction. The largest of these was Greater Geelong with extraction of 4,019 ML (Anglesea bulk entitlement). 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

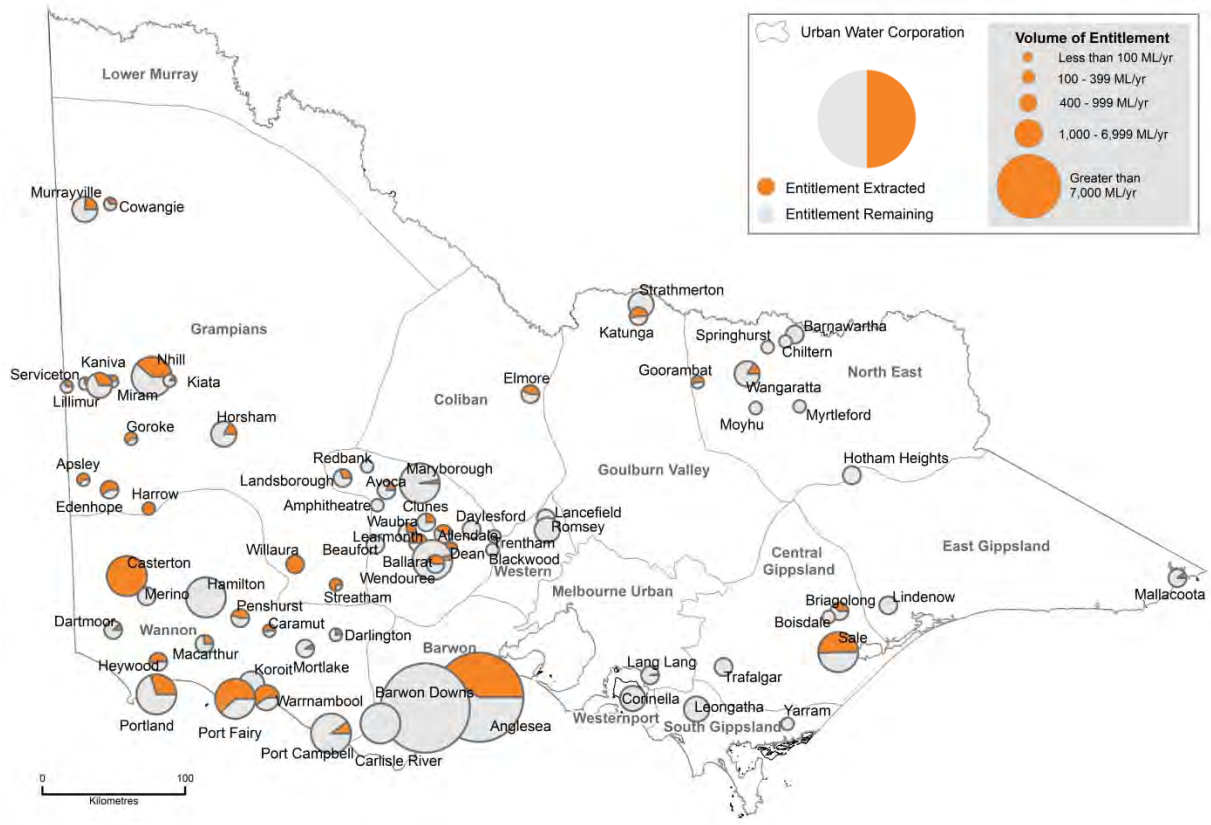
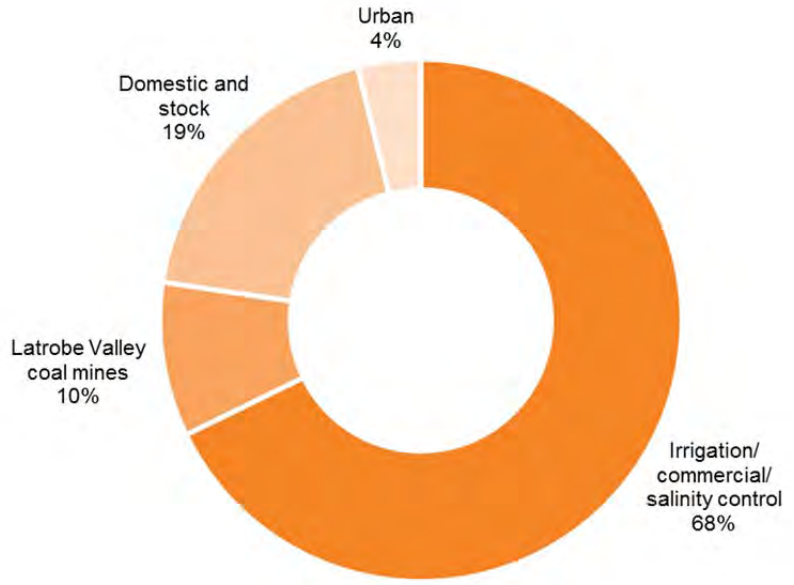


Table 3-5 and Figure 3-5 show the groundwater extraction by type of use in GMUs in 2011–12.

Table 3-5 Groundwater extraction by use in GMUs

Consumptive end use	Volume diverted (ML)	Proportion of total consumptive diversions (%)
Irrigation/commercial/salinity control	214,419	68
Domestic and stock	59,298	19
Urban	12,364	4
Power generation	30,242	10
Total consumptive diversions 2011–12	**316,322**	**100**
Total consumptive diversions 2010–11	221,096	100

Figure 3-5 Groundwater extraction by use in GMUs



3.3 Recycled water production

The total volume of 473,602 ML of wastewater produced in 2011–12 was lower than the 495,875 ML produced in 2010–11 (Table 3-6). The volume of water recycled by Victoria's water businesses for use external to treatment plants in 2011–12 increased compared to 2010–11. The recycled volume was 67,130 ML, which represents an increase of 12,432 ML compared to 2010–11. The volume recycled represents 14% of the total volume available for reuse at the end of the wastewater treatment process. An additional 19,804 ML was recycled for use within the wastewater treatment process, which when subtracted from the total increases the proportion to 18% 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 2011–12, the volume of water recycled by the Eastern Treatment Plant was 18,139 ML, which was an increase on the 16,741 ML recycled in 2010–11. 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 increased from 29,972 ML in 2010–11 to 30,617 ML in 2011–12. This increase is attributable largely to use of recycled water by agriculture rising from 9,261 ML in 2010–11 to 13,988 in 2011–12.

The volume of water recycled in Melbourne, including at treatment plants operated by the Melbourne metropolitan retailers, was 37,177 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 25%, or 29,953 ML, of the wastewater available for reuse. This was higher than in 2010–11, when it was 22,965 ML.

Table 3-6 Volume of wastewater recycled in 2011–12

Basin	Wastewater produced (ML)	Volume of wasterwater 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	10,364	3,980	38%	0	94	3,886	0	0	3,653	2,731
Kiewa	331	126	38%	0	0	126	0	0	205	0
Ovens	2,935	734	25%	0	70	664	0	0	2,201	0
Broken	318	318	100%	0	0	318	0	0	0	0
Goulburn	7,856	6,165	78%	0	184	5,981	0	0	1,691	0
Campaspe	2,554	1,942	76%	0	254	1,687	0	1	652	(40)
Loddon	8,244	2,815	34%	0	1,294	1,521	0	0	4,910	519
Avoca	159	155	98%	0	46	109	0	0	0	4
Mallee	-	-	-	-	-	-	-	-	-	-
Wimmera	1,507	1,724	114%	0	259	1,465	0	0	0	(217)
East Gippsland	159	147	93%	0	0	147	0	0	12	0
Snowy	321	209	65%	0	0	209	0	0	112	0
Tambo	668	668	100%	0	0	668	0	0	0	0
Mitchell	1,514	1,361	90%	0	0	123	1,238	0	153	0
Thomson	368	335	91%	0	3	332	0	0	33	0
Latrobe	25,643	777	3%	0	9	68	700	0	4,633	20,233
South Gippsland	5,949	216	3%	0	32	176	0	9	5,761	(27)
Bunyip	167,853	20,432	3%	3,808	1,224	87	0	15,313	10,357	137,064
Yarra	11,178	2,319	5%	0	297	262	0	1,761	8,243	616
Maribyrnong	3,198	1,378	21%	0	308	365	0	706	2,493	(673)
Werribee	179,182	35,238	20%	161	1,458	16,878	16,467	274	4,357	139,587
Moorabool	-	-	-	-	-	-	-	-	-	-
Barwon	29,291	3,978	8%	0	867	1,198	341	1,573	26,121	(808)
Corangamite	2,294	333	13%	0	13	276	0	44	2,116	(155)
Otway Coast	1,343	273	12%	0	0	155	0	117	1,084	(13)
Hopkins	6,065	647	11%	0	128	512	0	7	5,356	62
Portland Coast	3,016	113	4%	0	0	113	0	0	2,796	107
Glenelg	1,277	483	38%	0	192	291	0	0	623	171
Millicent Coast	14	67	469%	0	67	0	0	0	0	(53)
Total 2011–12	**473,602**	**86,934**	**14%**	**3,969**	**6,798**	**37,618**	**18,745**	**19,804**	**87,560**	**299,108**

Notes:

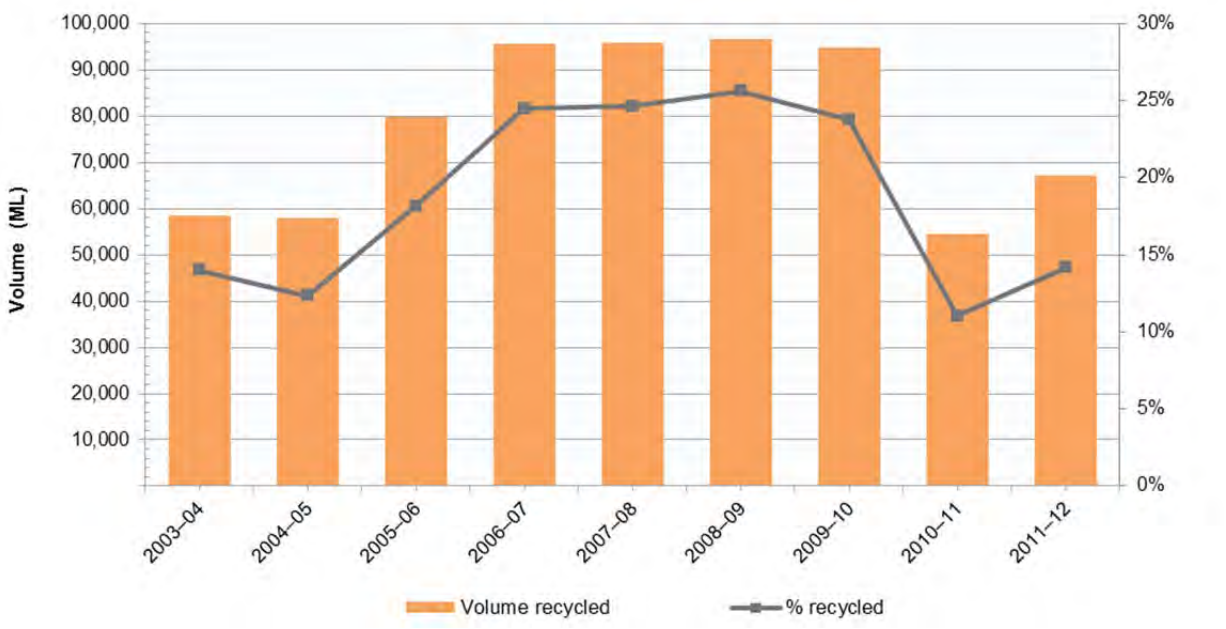
(1) Volume used to deliver specific environmental flow benefits.

(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 past eight years. 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 2010–11 and 2011–12 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 2011–12[(1)]



Note:

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

3.4 Urban and commercial consumptive use

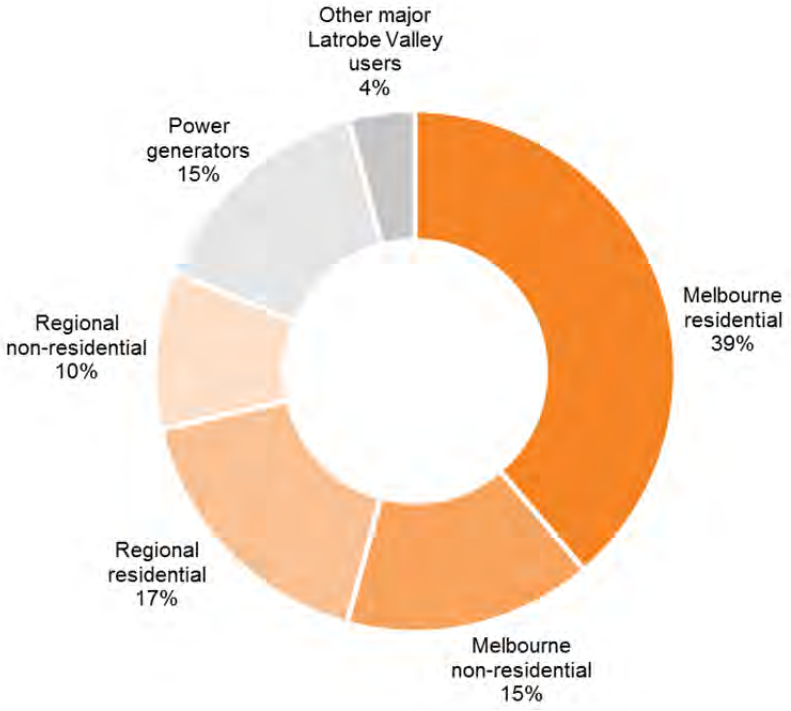
Consumption in urban areas is often measured by the metered volume of water delivered to customers. This figure differs from the bulk water diversion figures presented in Table 3-4 because water is lost in the distribution network through evaporation and leakage between the points of diversion and delivery. 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 7.

Metered urban water consumption in Victoria increased in 2011–12 compared to 2010–11. Total urban water consumption by residential users increased by 5% compared to 2010–11, and non-residential use increased by 3% in 2011–12 compared to 2010–11. The largest increases were in regional Victoria, with regional residential and non-residential customers increasing their water consumption by 13% and 8% respectively. The 2011–12 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	2011–12 (ML)	2010–11 (ML)	Change (%)
Melbourne – residential	229,386	217,720	5%
Melbourne – non-residential	91,529	89,170	3%
Regional – residential	101,832	90,140	13%
Regional – non-residential	57,904	53,380	8%
Power generators	86,989	89,770	-3%
Other major Latrobe Valley industrial users	24,265	24,229	0%
Total urban consumption	**591,905**	**564,409**	**5%**

Figure 3-7 Consumptive uses of urban and commercial metered water in Victoria, 2011–12



4 Water for the environment

The Environmental Water Reserve (EWR) is water set aside to meet 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 environment 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 limits on consumptive volumes.

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 4.1.

In unregulated rivers with no major storages on them, 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 4.2

4.1 Environmental water in regulated systems

Victorian environmental entitlements are held by the Victorian Environmental Water Holder (VEWH), an independent statutory body responsible for deciding the most efficient and effective use of environmental water entitlements across the state. As of 1 July 2011, environmental entitlements previously held by the Minister for Environment were transferred to the VEWH. Information on the VEWH's planning processes for the use of the environmental water holdings is 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.

In 2011–12, the VEWH oversaw the delivery of more than 516,000 ML of water to 35 river reaches and 10 wetlands, providing significant benefit to a wide range of water-dependent plants and animals. The average-to-wet seasonal conditions experienced across Victoria in 2011–12 resulted in many priority watering actions being met naturally, without the delivery of environmental water. The subsequent significant volume of carryover provides a good starting point for 2012-13.

The high availability of environmental water and limited demand due to high natural flows in waterways in 2011–12 also provided the opportunity for the VEWH to undertake its first water trades in the northern Victorian water market. When deciding whether to trade, the VEWH considered a number of factors; only water not required for any foreseeable priority watering actions was sold and only where trade was considered to be a better option than carrying water over. In January 2012, the VEWH sold about 200 ML of allocation from the River Murray Flora and Fauna Entitlement. A further 10,000 ML of allocation was sold in May 2012. Proceeds from the sale of water by the VEWH will be used for future watering priorities for Victoria's waterways and direct environmental outcomes in rivers and wetlands. This may include funding the delivery of environmental watering actions, purchasing water allocation at a different time or in a different system, or funding works and measures to improve water use efficiency.

More information on the outcomes of environmental watering undertaken by the VEWH in 2011–12 is available in the VEWH's annual report and annual watering booklet, available at **www.vewh.vic.gov.au**.

4.1.1 Environmental water holdings in southern Victoria

There are currently eight environmental entitlements within southern Victoria.

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, and 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 2011–12 (ML)

Basin	Entitlement type	Entitlement volume at 30 June 2011	Allocation carried over from 2010–11	Allocation 2011–12	Share of available water 2011–12	Total water available 2011–12	Water use 2011–12	Carried over to 2012–13
			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	2,795	10,000	-	12,795	12,046	749
	Macalister River Environmental Entitlement 2010(1)							
	High reliability	9,346	0	9,346	-	9,346	9,346	0
	Low reliability	4,672	0	4,672	-	4,672	4,672	0
Yarra	***Yarra River Environmental Entitlement 2006(2)***							
	High reliability	17,000	18,325	17,000	-	35,325	4,771	30,554
Bunyip	***Tarago and Bunyip Rivers Environmental Entitlement 2009***							
	Per cent share of inflows	10.9%	-	-	3,000	3,000	0	3,000
Werribee	***Werribee River Environmental Entitlement 2011***							
	Per cent share of inflows	10%	-	-	3,111	3,111	0	3,111
Barwon	***Barwon River Environmental Entitlement 2011***							
	Unregulated	-	-	-	-	-	-	-
Moorabool	***Moorabool River Environmental Entitlement 2010***							
	Per cent share of inflows	11.9%	-	-	7,402	7,402	2,173	5,229
Total			**21,120**	**41,018**	**13,513**	**75,651**	**33,008**	**42,643**

Notes:

(1) The Macalister River Environmental Entitlement was amended in January 2012 to allocate water savings achieved by the Macalister Channel Automation project. The volume of entitlement was increased to 9,346 ML (high reliability) and 4,672 ML (low reliability), all of which was made available in the 2011–12 water year. The entitlement was also amended in late June 2012 to allocate the final instalment of water savings achieved by the Macalister Channel Automation project. The volume of entitlement was increased to 12,460.9 ML (high reliability) and 6,229.5 ML (low reliability), however as the increased volume was not available in the 2011–12 water year it has not been included here.

(2) 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.

4.1.2 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 2011–12 (ML)

Basin	Entitlement type	Entitlement volume at 30 June 2011	Allocation carried over from 2010–11[1]	Allocation 2011–12	Share of available water 2011–12	Total water available 2011–12	Water use 2011–12	Carried over to 2012–13[1]
			A	B	C	D = A + B + C	E	D - E
Wimmera/ Glenelg	***Wimmera Glenelg Rivers Environmental Entitlement 2010***							
	High reliability	41,560	27,651	0	41,560	69,211	18,345	50,866
Total			**27,651**	**0**	**41,560**	**69,211**	**18,345**	**50,866**

Note:

(1) When spare capacity is available in certain storages, bulk and environmental entitlement holders in the Grampians headworks system are able to carry over more water than their entitlement volume. 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.

4.1.3 Environmental water holdings in northern Victoria

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

During 2011–12, the allocation of savings and mitigation water associated with Stage 1 of the Northern Victoria Irrigation Renewal Program (NVIRP) was made under supply agreements with Goulburn–Murray Water. Until the NVIRP program is complete, the actual volume available to the environment each year is determined and allocated after the audit of water savings in July. The water available and used under these supply agreements has been included in Table 4-3 below.

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. Allocation to water entitlements held in trust for the Snowy River is traded out of VEWH environmental accounts in order to supply consumptive users who would otherwise have been supplied through water diverted from the Snowy River. 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 River and the Murray River. More information on Snowy River increased flows is provided in section 4.1.4. The water available and used under these environmental entitlements and water shares are included in Table 4-3 below.

Table 4-3 Environmental entitlements in northern Victoria 2011–12 (ML)

Basin	Entitlement type	Entitlement volume at 30 June 2011	Allocation carried over from 2010–11	Carryover lost to spill[1]	Allocation 2011–12	Return flow re-credit[2]	Net transfers[3]	Net allocation trade VEWH[4]	Total water available 2011–12	Water use 2011–12	Carried over to 2012–13
			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***										
	High reliability	27,600	22,351	0	27,600	132,888	(142,888)	(10,203)	29,748	2,059	27,689
	Unregulated	40,000	0	0	10,519	0.0	0	0	10,519	10,519	0
	Murray environmental water account [5]										
	-	-	0	0	0	0	64,418	0.0	64,418	64,418	0
	River Murray Environmental Water Savings Supply Deed (NVIRP savings water)										
	-	0	88	0	188	0	0	0	276	88	188
	River Murray Environmental Water Savings Supply Deed (NVIRP mitigation water)										
	-	0	0	0	1,413	0	0	0	1,413	0	1,413

Basin	Entitlement type	Entitlement volume at 30 June 2011	Allocation carried over from 2010–11	Carryover lost to spill[1]	Allocation 2011–12	Return flow re-credit[2]	Net transfers[3]	Net allocation trade VEWH[4]	Total water available 2011–12	Water use 2011–12	Carried over to 2012–13
			A	B	C	D	E	F	G = A - B + C + D + E + F	H	I = G - H
Murray (continued)	***Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999* - Barmah-Millewa Environmental Water Allocation**										
	High reliability	50,000	0	0	50,000	0	0	0	0	0	0
	Low reliability	25,000	96,000	0	25,000	0	0	0	171,000	141,550	29,450
	***Bulk Entitlement (River Murray - Flora and Fauna) Conversion Order 1999* - Living Murray**										
	High reliability	5,710	5,710	0	5,710	61,577	(44,786)	0	28,211	26,701	1,510
	Low reliability	101,850	0	0	0	0	0	0	0	0	0
	Unregulated	34,300	0	0	34,300	0	(32,300)	0	2,000	2,000	0
	Bulk Entitlement (River Murray – Snowy Environmental Reserve) Conversion Order 2004										
	High reliability	29,794	0	0	29,794	0	(29,794)	0	0	-	0
	Water shares – Snowy River Environmental Reserve										
	High reliability	10,644	0	0	10,144	0	(10,144)	0	0	-	0
	Low reliability	6,415	0	0	0	0	0	0	0	-	0
Goulburn	***Goulburn River Environmental Entitlement 2010***										
	High reliability	1,432	272	8	1,432	0	0	0	1,696	647	1,049
	Goulburn Environmental Water Savings Supply Deed (NVIRP savings water)										
	-	-	3,116	919	8,638	0	135,022	0	145,857	136,219	9,638
	Goulburn Environmental Water Savings Supply Deed (NVIRP mitigation water)										
	-	-	0	0	149	0	0	0	149		149
	Environmental Entitlement (Goulburn System – Living Murray) 2007										
	High reliability	39,625	7,132	1,895	39,625	0	1,166	0	46,028	45,258	770
	Low reliability	156,980	65,370	15,568	0	0	0	0	49,802	15,780	34,022
	Bulk Entitlement (Snowy – Environment) Order 2005										
	High reliability	16,812	0	0	20,464	0	(20,464)	0	0	-	0
	Water shares – Snowy River Environmental Reserve										
	High reliability	6,121	0	0	4,950	0	(4,950)	0	0	-	0
	Low reliability	17,852	0	0	0	0	0	0	0	-	0
Campaspe	**Campaspe environmental water account [5]**										
	-	-	0	0	0	0	6,532	0	6,532	6,532	0
	Environmental Entitlement (Campaspe River – Living Murray Initiative) 2005										
	High reliability	126	126	77.9	126	0	0	0	174.1	174	0.1
	Low reliability	5,048	5,048	3,118	5,048	0	0	0	6,978	6,978	0
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	7,940	0	0	7,490	0	0	0	7,490	5,389	2,101
	Low reliability	2,024	0	0	0	0	1,564	0	1,564	1,564	0
	Water shares – Snowy River Environmental Reserve										
	High reliability	470	0	0	470	0	-470	0	0	-	0
Total			**207,212**	**23,586**	**285,060**	**194,465**	**(77,094)**	**(10,203)**	**575,854**	**465,876**	**109,978**

Notes:

(1) When spare capacity is available in certain storages in northern Victoria, entitlement holders are able to carry over more water than their entitlement volume. 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) Return flows allow environmental water to be delivered to achieve outcomes in multiple systems. Return flows enable environmental water to be delivered through one system, such as the Goulburn or Campaspe, and then be re-credited to the Murray system (subject to losses) to meet 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 Commonwealth Environmental Water 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. There is a negative net transfer out of VEWH accounts, representing the transfers of water from the Snowy River entitlements and transfers of water to South Australia to facilitate delivery through the Murray River.

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

(5) This is an allocation bank account which is not linked to an environmental entitlement; it allows water from other entitlements to be used in this system.

4.1.4 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 River and the Murray River.

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 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 2011–12 (ML)

Entitlement source	Entitlement volume at 1 March 2012 (ML)	Volume available for release in 2011–12 (ML)
Victoria(1)	87,652	71,847
New South Wales(2)	159,042	150,086
Total	**246,694**	**221,934**
Volume apportioned to Snowy River increased flows		*151,934*
Volume apportioned to River Murray increased flows		*70,000*

Notes:
(1) Primarily high reliability entitlements.
(2) Primarily high security entitlements.

4.2 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:

- **Streamflow 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 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 management plan that aims for equitable management and long-term sustainability of the resource. No surface water WSPAs were declared in 2011–12.

Streamflow management plans (SFMPs) determine how river water will be shared between consumptive uses and the environment in declared surface water WSPAs in unregulated systems.

In 2011–12, there were eight SFMPs in effect in Victoria, all within the Yarra basin. One integrated management plan in effect in the Upper Ovens River where there is a high degree of connectivity between groundwater and surface water.

Twenty-one priority systems were initially identified for development of a Streamflow Management Plan (SFMP). Since then, technical studies and resource appraisals have been completed, resulting in a reassessment of priorities across Victoria. These reassessments have occurred through the development of sustainable water strategies. Where SFMPs will no longer be 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. Local management rules have been prepared instead 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 2011–12 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 lists each basin where SFMPs are under development and reports the progress made towards finalising SFMPs within them.

Table 4-5 Status of streamflow management plans and conjunctive water management plans

Basin	Stream(s)	Work undertaken in 2011–12
Kiewa	Kiewa River	Local management rules in place as recommended under the Northern Region Sustainable Water Strategy.
Ovens	Ovens River above Myrtleford	Approved and operational.
Goulburn	King Parrot Creek, Yea River, Seven Creeks	Local management rules 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 was recommended.
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 and Stringybark Creek, Woori Yallock Creek and Little Yarra and Don Rivers	All approved and operational.
Maribyrnong	Maribyrnong River (upper)	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.

4.3 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 in 2011–12, however two minor failures to meet passing flow requirements occurred:

- Goulburn–Murray Water was unable to provide the minimum required passing flow in the Campaspe River below Lake Eppalock on a number of days between May and June 2012 while maintenance work was undertaken on the outlet valve of the dam. The volume of flow that was not able to be provided was recorded in Eppalock Passing Flow Account for later release for the environment on the advice of North Central Catchment Management Authority.
- Southern Rural Water failed to meet the passing flow requirement in the Maribyrnong River at the Sunbury gauging station over a three-day period in January 2012. The difficulties in complying with passing flow requirement were due to the highly variable system losses experienced during summer in the reach between the release point and the gauge site. To address this, Southern Rural Water has undertaken further upstream streamflow monitoring to better predict possible passing flow shortfalls, and is considering seeking an amendment to the *Bulk Entitlement (Maribyrnong – Southern Rural Water) Conversion Order 2000* to provide some flexibility in the passing flow at the Sunbury gauging site.

4.4 Proportion of total streamflow that reaches basin outlets

Figure 4-1 and Table 4-6 show 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 total volume of water leaving a basin is not a reliable indicator of river health or other environmental benefits. While this water may 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. The environmental health of Victoria's rivers should not be assessed solely on the total volume of water leaving a basin.

In 2011–12, the proportion of total flow leaving the basin as a percentage of total flow increased in most basins compared to 2010–11. The basins that experienced the lowest proportions of water leaving the basin as a percentage of total flow in 2010–11 were the Loddon (38%), Avoca (2%), Wimmera (33%), Werribee (41%) and Moorabool (53%). The proportion of annual flow leaving the basin was greater than 90% in 2011–12 in thirteen basins, same as in 2010–11. Of these basins, all except the Kiewa, Ovens and Broken were in the south of the state.

Across the state the proportion of total flow leaving the basins increased from 73% in 2010–11 to 83% in 2010–11. However, the volume of water leaving the basins decreased from 33,488 GL in 2010–11 to 26,668 GL in 2011–12, reflecting substantially lower basin inflows.

Figure 4-1 Volume leaving Victorian basins, as proportion of total flow, 2003–04 to 2011–12

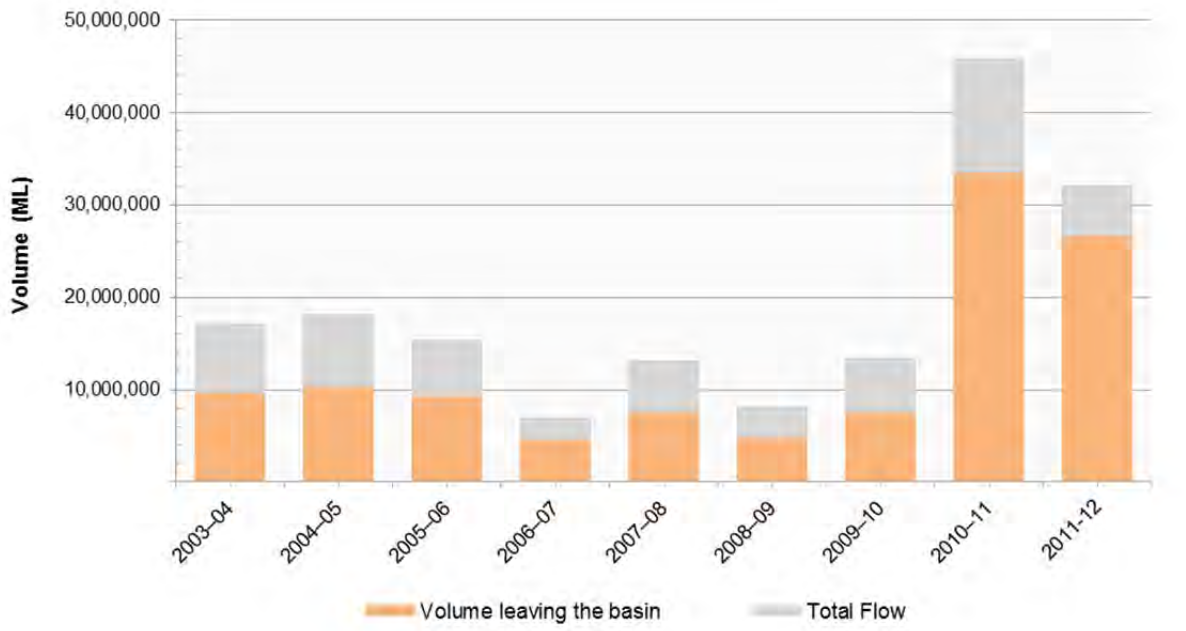


Table 4-6 Volume leaving the basin 2011–12

Basin	Outflow to	2011–12			2010–11	
		Total flow if no diversions (ML)	Volume leaving the basin (ML)	Proportion of total flow leaving the basin (%)	Volume leaving the basin (ML)	Proportion of total flow leaving the basin (%)
Murray[1]	South Australia	9,175,099	5,521,400	60%	8,975,500	57%
Kiewa[2]	Murray River	850,533	791,718	93%	1,082,000	93%
Ovens	Murray River	1,747,302	1,700,280	97%	3,428,800	99%
Broken	Murray River	469,470	421,384	90%	592,300	86%
Goulburn	Murray River	2,890,919	1,889,211	65%	3,193,100	55%
Campaspe	Murray River	155,699	91,165	59%	426,400	52%
Loddon	Murray River	195,230	73,607	38%	1,864,600	86%
Avoca[3]	Lake Bael Bael and the Marshes	26,975	586	2%	101,600	54%
Mallee[4]	Murray River	n/a	n/a	n/a	n/a	n/a
Wimmera[3]	Lakes Hindmarsh and Albacutya	145,567	47,355	33%	462,100	71%
East Gippsland	Bass Strait	1,647,803	1,646,426	100%	789,900	100%
Snowy (Vic. only)[5]	Bass Strait	2,796,999	3,735,696	134%	1,321,400	130%
Tambo	Gippsland Lakes	839,137	832,631	99%	178,500	96%
Mitchell	Gippsland Lakes	1,264,868	1,250,550	99%	954,200	98%
Thomson	Gippsland Lakes	1,788,987	1,390,741	78%	521,500	54%
Latrobe	Gippsland Lakes	1,338,357	1,237,780	92%	956,400	87%
South Gippsland	Bass Strait, Western Port	1,854,567	1,820,697	98%	1,529,000	98%
Bunyip	Bass Strait, Western Port, Port Phillip Bay	1,033,964	1,013,685	98%	1,158,200	98%
Yarra[6]	Port Phillip Bay	1,200,267	833,073	69%	943,700	65%
Maribyrnong	Port Phillip Bay	60,885	46,132	76%	222,200	89%
Werribee	Port Phillip Bay	64,557	26,670	41%	178,000	67%
Moorabool	Port Phillip Bay	109,037	57,763	53%	152,100	58%
Barwon	Port Phillip Bay, Bass Strait	191,647	155,376	81%	329,800	94%
Corangamite[3]	Corangamite lakes	164,247	147,277	90%	501,600	97%
Otway Coast	Bass Strait	780,800	749,379	96%	1,434,000	98%
Hopkins	Bass Strait	303,486	211,246	70%	982,100	92%
Portland Coast	Bass Strait	437,172	419,224	96%	504,200	97%
Glenelg	Bass Strait	648,620	557,131	86%	704,900	71%
Millicent Coast[4]	South Australia	n/a	n/a	n/a	n/a	n/a
Total		**32,182,195**	**26,668,183**	**83%**	**33,488,100**	**73%**

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 inflow is the flow entering from NSW and flows from Victorian tributaries of the Snowy River. Water extracted from the Snowy River within NSW is not included.

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

4.5 Overview of seasonal conditions and environmental water

The VEWH was established as an independent statutory body responsible for deciding the most efficient and effective use of environmental water entitlements across the state. In 2011–12, the VEWH oversaw the delivery of more than 516,000 ML of water to 35 river reaches and 10 wetlands, providing significant benefit to a wide range of water-dependent plants and animals. The average-to-wet seasonal conditions experienced across Victoria in 2011–12 resulted in many priority watering actions being met naturally, without the delivery of environmental water. The subsequent significant volume of carryover provides a good starting point for 2012-13.

As a result of the high rainfall and river flows across much of the state, basin outflows in 2011–12 were higher as a percentage of total inflows, however the outflow volume decreased in comparison to the previous year. In 2011–12, SFMPs were completed and commenced operation in the Woori Yallock Creek and the Little Yarra and Don Rivers' water supply protection areas, and six other SFMPs continued to be in operation. The Upper Ovens River Integrated Groundwater and Surface Water Management Plan was also completed and commenced operation in 2011–12.

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 2011–12 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 2011–12 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 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. There are three types of transfer for a take and use licence. 'Permanent volume transfer' and 'temporary volume transfer' transfer part or all of the volume from one licence to another and generally include a change in location. The third 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 2011–12

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 (GWMW).

Total allocation trade in northern Victoria amounted to 1,604 GL in 2011–12, up from 1,383 GL in the previous year. In southern Victoria, the wet conditions and high allocations led to relatively low levels of allocation trade. The total volume increased to around 7.5 GL in 2011–12, up from similarly low levels (5 GL) in the previous year.

There was also an increase in water share movement (i.e. transfers of ownership and variations) in 2011–12. In northern Victoria, total movement increased to 887 GL in 2011–12 compared with 420 GL in 2010–11. In southern Victoria, there was 17.2 GL of water share movement in 2011–12, compared to 24.3 GL in 2010–11.

In northern Victoria, the Commonwealth purchased about 174 GL of high reliability water shares in 2011–12, up from 113 GL in 2010–11.

For groundwater, change of ownership trades (i.e. where take and use licences are transferred with land transfers) were dominant in both northern and southern Victoria, with 20 GL and 10 GL respectively.

Further information about water trading in Victoria is provided in the *Victorian Annual Water Trading Report 2011–12*, available at **waterregister.vic.gov.au**.

5.3 Northern Victoria

5.3.1 Allocation trade

Total trade of allocation in northern Victoria amounted to 1,604 GL in 2011–12. The number of trades increased from 3,550 in 2010–11 to 5,189 in 2011–12. The large increase in trade likely resulted from a combination of factors, including high allocations and drIer conditions. Increased activity by environmental and institutional water owners transferring water allocation between their accounts, and trade to parties with the ability to store water for future seasons through carryover also may have been factors.

Victoria changed from being a net importer of 176 GL of allocation from interstate in 2010–11 to exporting 232 GL to South Australia and New South Wales in 2011–12. In 2011–12, the Victorian Environmental Water Holder used allocation trade as a mechanism for moving about 549.6 GL of environmental water, including 3.5 GL from New South Wales and about 226.8 GL to South Australia.

Table 5-1 shows the volume of allocation traded between each trading zone in northern Victoria in 2011–12. In summary:

- Intrazone trade was highest in *1A Greater Goulburn* and *7 Vic Murray – Barmah to SA*, with around 266 GL and 289 GL respectively.
- Only two Victorian trading zones had net purchases - *1A Greater Goulburn* and *6 Vic Murray – Dartmouth to Barmah* purchased about 36 GL and 32 GL respectively.
- South Australia was the largest net purchasing area of allocation, with a net of 180 GL. This, however, included environmental trade to South Australia of about 227 GL.
- Victoria sold a net volume of around 51 GL to New South Wales.

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

Trading zone		Buyer																		
		Victoria														NSW	SA			
Seller		1A Greater Goulburn	1B Boort	2A Broken – Nillacootie 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	266,097	17,117	0	0	5,521	4,551	0	509	0	9,161	1,083	31,929	0	0	22,062	5,765	1,396	**365,190**	**1,916**	**-35,742**
	1B Boort	20,916	6,349	0	0	0	0	0	0	0	4,393	0	4,642	0	0	328	300	0	**36,928**	**104**	**3,182**
	2A Broken – Nillacootie to Caseys Weir	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**	**0**
	2B Broken – Caseys Weir to Goulburn River	0	0	0	23	0	0	0	0	0	0	0	0	0	0	0	0	0	**23**	**1**	**0**
	3 Lower Goulburn	10,898	0	0	0	695	0	0	0	0	100	0	600	0	0	3,025	0	100	**15,418**	**52**	**8,072**
	4A Campaspe	5,734	0	0	0	0	14,227	100	0	0	167	0	2,970	0	0	0	0	0	**23,198**	**74**	**3,317**
	4C Lower Campaspe	33	0	0	0	0	603	0	0	0	0	0	0	0	0	0	0	0	**636**	**5**	**536**
	5A Loddon	1,185	0	0	0	0	200	0	2,678	0	0	0	0	0	0	470	0	0	**4,533**	**37**	**1,255**
	5B Bullarook	0	0	0	0	0	0	0	0	27	0	0	0	0	0	0	0	0	**27**	**2**	**0**
	6 Vic Murray – Dartmouth to Barmah	19,870	1,155	0	0	0	200	0	0	0	52,269	869	30,290	0	0	30,809	1,316	1,324	**138,102**	**580**	**-31,570**
	6B Lower Broken Creek	1,067	0	0	0	0	0	0	0	0	3,964	1,831	1,309	0	0	0	189	0	**8,360**	**66**	**3,326**
	7 Vic Murray – Barmah to SA	65,525	8,926	0	0	1,130	100	0	91	0	92,195	1,252	289,018	0	0	9,129	52,655	329,944	**849,964**	**2,183**	**345,128**
	9A Ovens	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	**33**	**2**	**0**
	9B King	0	0	0	0	0	0	0	0	0	0	0	0	0	60	0	0	0	**60**	**1**	**0**
	20 Snowy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**	**-65,822**
NSW	NSW	530	0	0	0	0	0	0	0	0	3,300	0	5,138	0	0	0	0	0	**8,968**	**41**	**-51,257**
SA	12 South Australian Murray	9,077	200	0	0	0	0	0	0	0	4,123	0	138,941	0	0	0	0	0	**152,341**	**125**	**-180,423**
Total purchased		**400,932**	**33,746**	**0**	**23**	**7,346**	**19,881**	**100**	**3,278**	**27**	**169,672**	**5,035**	**504,836**	**33**	**60**	**65,822**	**60,225**	**332,764**	**1,603,781**		**0**
Number of trades		**2,004**	**139**	**0**	**1**	**33**	**86**	**1**	**31**	**2**	**597**	**55**	**2,011**	**2**	**1**	**19**	**94**	**113**		**5,189**	

5.3.2 Water share transfers

Table 5-2 and Table 5-3 summarise the transfer and variations of high reliability and low reliability water shares in northern Victoria during 2011–12 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 887 GL of high reliability and low reliability water shares were transferred or varied.
- 4,546 transfers or variations of high reliability water shares occurred, totalling 617 GL.

2,043 transfers or variations of low reliability water shares occurred, totalling 270 GL.

Table 5-2 and Table 5-3 show that the trend to disassociate water shares from land continued in 2011–12. During the year, the net movement of high reliability water shares to the non-water user group (NWU) increased to 174 GL after having dropped to 129 GL in 2010–11. The majority of this movement of high reliability and low reliability water shares was from the irrigation areas and districts.

In 2011–12, the Commonwealth continued to be a significant purchaser of water shares as part of its environmental water buyback program. The Commonwealth purchased about 174 GL of high reliability water shares, representing 28% of high reliability water share transfers.

Table 5-2 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	Murray River	Murray Valley Irrigation Area	Nyah, Tresco and Woorinen	Ovens River	Loddon Valley Irrigation Area	Rochester Irrigation Area	Shepparton Irrigation Area	Torrumbarry Irrigation Area	Robinvale, Red Cliffs, Merbein, FMID	Non-water user	**Total trades (ML)**	**Number of trades**	**Net out (ML)**
Source	Broken River	423	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70	**493**	**14**	**47**
	Bullarook	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**24**	**3**	**0**
	Campaspe Irrigation Area	0	0	104	0	0	0	0	0	0	0	0	0	0	0	0	0	90	**195**	**4**	**90**
	Campaspe River	0	0	0	602	0	0	0	0	0	0	0	0	0	0	0	0	864	**1,465**	**22**	**790**
	Central Goulburn Irrigation Area	0	0	0	0	55,157	166	0	0	0	0	0	8	0	0	0	0	39,593	**94,924**	**836**	**39,486**
	Goulburn River	0	0	0	0	74	3,182	0	0	0	0	0	2	0	0	0	0	1,506	**4,764**	**80**	**1,414**
	Loddon River	0	0	0	0	10	0	216	0	0	0	0	0	0	0	74	0	1,182	**1,482**	**42**	**1,266**
	Murray River	0	0	0	0	0	0	0	18,001	205	0	0	0	0	0	480	10	38,892	**57,588**	**348**	**37,892**
	Murray Valley Irrigation Area	0	0	0	0	15	0	0	2	50,034	0	0	0	0	0	0	0	21,373	**71,424**	**516**	**20,646**
	Nyah, Tresco and Woorinen	0	0	0	0	0	0	0	10	0	5,752	0	0	0	0	158	0	599	**6,519**	**102**	**757**
	Ovens River	0	0	0	0	0	0	0	0	0	0	632	0	0	0	0	0	190	**822**	**20**	**190**
	Loddon Valley Irrigation Area	0	0	0	0	0	2	0	0	0	0	0	63,194	0	0	1	0	17,046	**80,243**	**341**	**17,038**
	Rochester Irrigation Area	0	0	0	0	25	0	0	0	0	0	0	0	36,844	0	0	0	18,194	**55,062**	**348**	**10,735**
	Shepparton Irrigation Area	15	0	0	0	78	0	0	0	2	0	0	0	0	17,907	0	0	12,140	**30,143**	**374**	**11,877**
	Torrumbarry Irrigation Area	0	0	0	0	0	0	0	447	0	10	0	0	0	0	95,449	0	25,854	**121,759**	**700**	**24,996**
	Robinvale, Red Cliffs, Merbein, FMID	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	9,534	6,968	**16,504**	**497**	**6,919**
	Non-water user	8	0	0	74	79	0	0	1,236	537	0	0	1	7,483	359	600	41	62,848	**73,265**	**299**	**-174,143**
	Total trades (ML)	**446**	**24**	**104**	**676**	**55,438**	**3,350**	**216**	**19,696**	**50,778**	**5,762**	**632**	**63,205**	**44,327**	**18,266**	**96,763**	**9,585**	**247,408**	**616,675**		**0**
	Number of trades	**16**	**3**	**1**	**12**	**539**	**55**	**26**	**215**	**373**	**77**	**19**	**259**	**272**	**254**	**528**	**377**	**1,520**		**4,546**	

Table 5-3 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	Murray River	Murray Valley Irrigation Area	Nyah, Tresco and Woorinen	Ovens River	Loddon Valley Irrigation Area	Rochester Irrigation Area	Shepparton Irrigation Area	Torrumbarry Irrigation Area	Robinvale, Red Cliffs, Merbein, FMID	Non-water user	**Total trades (ML)**	**Number of trades**	**Net out (ML)**
Source	Broken River	85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**85**	**8**	**-3**
	Bullarook	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**12**	**2**	**0**
	Campaspe Irrigation Area	0	0	55	0	0	0	0	0	0	0	0	0	0	0	0	0	119	**174**	**3**	**119**
	Campaspe River	0	0	0	339	0	0	0	0	0	0	0	0	0	0	0	0	1,028	**1,366**	**16**	**1,028**
	Central Goulburn Irrigation Area	0	0	0	0	37,379	41	0	0	54	0	0	284	430	69	118	0	1,804	**40,179**	**444**	**2,160**
	Goulburn River	0	0	0	0	49	849	0	0	0	0	0	0	31	0	0	0	7	**936**	**25**	**42**
	Loddon River	0	0	0	0	0	0	143	0	0	0	0	0	0	0	0	0	12	**155**	**8**	**12**
	Murray	0	0	0	0	0	0	0	746	54	0	0	0	0	0	0	0	811	**1,611**	**37**	**217**
	Murray Valley Irrigation Area	0	0	0	0	0	0	0	123	25,670	0	0	0	0	0	10	0	2,441	**28,243**	**304**	**1,631**
	Nyah, Tresco and Woorinen	0	0	0	0	0	0	0	0	0	1,169	0	0	0	0	0	0	0	**1,169**	**22**	**0**
	Ovens River	0	0	0	0	0	0	0	0	0	0	227	0	0	0	0	0	95	**322**	**12**	**95**
	Loddon Valley Irrigation Area	0	0	0	0	91	0	0	0	52	0	0	59,165	125	64	97	0	2,144	**61,738**	**267**	**1,992**
	Rochester Irrigation Area	0	0	0	0	11	0	0	0	0	0	0	0	20,355	88	292	0	829	**21,574**	**187**	**-505**
	Shepparton Irrigation Area	3	0	0	0	179	4	0	0	1	0	0	98	100	11,179	0	0	736	**12,299**	**191**	**828**
	Torrumbarry Irrigation Area	0	0	0	0	0	0	0	525	132	0	0	0	0	0	67,336	154	1,478	**69,624**	**429**	**1,085**
	Robinvale, Red Cliffs, Merbein, FMID	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**	**-154**
	Non-water user	0	0	0	0	311	0	0	1	649	0	0	199	1,039	71	686	0	28,149	**31,105**	**88**	**-8,547**
	Total trades (ML)	**89**	**12**	**55**	**339**	**38,019**	**894**	**143**	**1,394**	**26,612**	**1,169**	**227**	**59,746**	**22,079**	**11,471**	**68,539**	**154**	**39,652**	**270,591**		**0**
	Number of trades	**9**	**2**	**1**	**5**	**407**	**23**	**7**	**34**	**283**	**22**	**11**	**253**	**185**	**174**	**411**	**1**	**215**		**2,043**	

5.3.3 Unregulated surface water

As shown in Table 5-4, trade in surface water take and use licences is much lower than the trade in groundwater take and use licences (Table 5-5). 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 5-4 Trade of surface water take and use licences in northern Victoria

Water supply source	Permanent trade		Temporary trade		Trade as part of land transfer	
	Number	Volume (ML)	Number	Volume (ML)	Number	Volume (ML)
Broken	-	-	-	-	3	6.0
Campaspe	184	932.5	7	112.2	80	583.8
Goulburn	5	53.0	2	4.5	57	682.1
Kiewa	1	50.0	1	40.0	12	758.3
Loddon	-	-	-	-	9	419.5
Murray	1	2.0	2	73.0	19	689.0
Ovens	-	-	4	222.0	23	409.2
Total	**191**	**1,037.5**	**16**	**451.7**	**203**	**3,547.9**

5.3.4 Groundwater

Table 5-5 shows that in 2011–12, trades of groundwater take and use licences were dominated by trades as part of land transfer (take and use licence change of ownership) with 136 trades amounting to about 20 GL. Temporary and permanent entitlement volume trades had 53 transfers (about 5 GL) and 13 transfers (about 2 GL) respectively.

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

Water system source (GMU)	Permanent trade		Temporary trade		Trade as part of land transfer	
	Number	Volume (ML)	Number	Volume (ML)	Number	Volume (ML)
Katunga	1	40.0	11	682.0	12	2,103.0
Kinglake	1	5.0	1	10.0	2	57.6
Loddon Highlands	-	-	14	1,229.8	10	1,743.4
Lower Campaspe Valley	4	1,405.0	16	2,406.0	4	1,225.0
Lower Ovens	4	23.0	4	55.0	3	289.0
Mid-Goulburn	-	-	2	124.0	1	102.0
Mid-Loddon	3	280.0	2	175.0	5	1,697.0
Mullindolingong	-	-	-	-	1	3.7
Shepparton Irrigation	-	-	-	-	68	11,384.1
Unincorporated	-	-	-	-	28	1,295.1
Upper Ovens	-	-	3	70.0	2	12.0
Total	**13**	**1,753.0**	**53**	**4,751.8**	**136**	**19,911.9**

5.4 Southern Victoria

5.4.1 Allocation trade

In southern Victoria, the wet conditions and high allocations led to low levels of allocation trade in 2011–12 (7.5 GL in 152 trades). Although allocation trade was relatively low, it was more than 2010–11 when 5.5 GL of allocations were traded in 103 trades.

Table 5-6 shows the number and volume of allocation trades by trading zone in southern water systems during 2011–12. In summary:

- 5,812 ML of allocation trade in southern Victoria was within the Thomson–Macalister system (77% of total allocation trade in the area).
- Only a small volume of allocation (1,735 ML) was traded within the Werribee and Bacchus Marsh trading zones.
- Allocation trades largely occurred within trading zones (97%), with only 218 ML of interzone trade.

Table 5-6 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	65	0	30	52	0	0	**147**	**8**	**82**
	31AR Upper Werribee Diverters	0	0	0	0	0	0	**0**	**0**	**0**
	31BD Werribee District	0	0	1,430	36	0	0	**1,466**	**81**	**-94**
	31BR Lower Werribee Diverters	0	0	100	22	0	0	**122**	**5**	**12**
	41 Macalister	0	0	0	0	5,121	0	**5,121**	**56**	**0**
	42B Mid-Thomson	0	0	0	0	0	691	**691**	**2**	**0**
	Total purchased	**65**	**0**	**1,560**	**110**	**5,121**	**691**	**7,547**		**0**
	Number of trades	**5**	**0**	**81**	**8**	**56**	**2**		**152**	

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 5-7 and Table 5-8. Whilst 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:

- 11,665 ML of high reliability water share transfers resulted from 142 transfers
- the largest volume of transfers was within the Macalister Irrigation District (about 9.9 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 to the NWU category decreased from 103 ML in 2010–11 to 1 ML in 2011–12.

Table 5-7 Transfer and variation of high reliability water shares in southern Victoria (ML)

Delivery system		Destination									
		Bacchus Marsh Irrigation District	Macalister River	Macalister Irrigation District	Thomson River	Werribee River	Werribee Irrigation District	Non-water user	Total trades (ML)	Number of trades	Net out (ML)
Source	Bacchus Marsh Irrigation District	163	0	0	0	0	0	0	**163**	**5**	**0**
	Macalister River	0	269	0	0	0	0	0	**269**	**4**	**0**
	Macalister Irrigation District	0	0	9,838	0	0	0	51	**9,889**	**105**	**11**
	Thomson River	0	0	0	928	0	0	0	**928**	**8**	**-10**
	Werribee River	0	0	0	0	12	0	0	**12**	**2**	**0**
	Werribee Irrigation District	0	0	0	0	0	344	0	**344**	**15**	**0**
	Non-water user	0	0	40	10	0	0	0	**50**	**3**	**-1**
	Total trades (ML)	**163**	**269**	**9,878**	**938**	**12**	**344**	**51**	**11,655**		**0**
	Number of trades	**5**	**4**	**103**	**10**	**2**	**15**	**3**		**142**	

Table 5-8 Transfer and variation of low reliability water shares in southern Victoria (ML)

Delivery system		Destination									
		Bacchus Marsh Irrigation District	Macalister River	Macalister Irrigation District	Thomson River	Werribee River	Werribee Irrigation District	Non-water user	**Total trades (ML)**	**Number of trades**	**Net out (ML)**
Source	Bacchus Marsh Irrigation District	76	0	0	0	0	0	0	**76**	**5**	**0**
	Macalister River	0	126	0	0	0	0	0	**126**	**3**	**0**
	Macalister Irrigation District	0	0	4,631	0	0	0	19	**4,650**	**86**	**0**
	Thomson River	0	0	0	463	0	0	0	**463**	**7**	**-2**
	Werribee River	0	0	0	0	5	0	0	**5**	**1**	**0**
	Werribee Irrigation District	0	0	0	0	0	162	0	**162**	**15**	**0**
	Non-water user	0	0	19	2	0	0	0	**21**	**2**	**2**
	Total trades (ML)	**76**	**126**	**4,650**	**465**	**5**	**162**	**19**	**5,503**		**0**
	Number of trades	5	3	86	8	1	15	1	0	**119**	

5.4.3 Unregulated surface water

As shown in Table 5-9, trade in surface water take and use licences is much lower than the trade in groundwater take and use licences (see Table 5-10) . However, like groundwater trades, trades as part of land transfers (take and use licence change of ownership) are the dominant trade type (by volume and number of trades) in surface water trades.

Table 5-9 Trade of surface water take and use licences in southern Victoria (ML)

Water system source	Permanent trade		Temporary trade		Trade as part of land transfer	
	Number	Volume (ML)	Number	Volume (ML)	Number	Volume (ML)
Barwon	-	-	7	136.3	9	127.3
Bunyip	2	46.0	6	97.4	18	378.1
East Gippsland	-	-	-	-	1	12.0
Glenelg	1	5.0	1	2.5	3	8.8
Hopkins	2	76.0	4	251.5	1	48.0
Latrobe	4	132.7	6	229.0	28	1,319.6
Maribyrnong	-	-	-	-	5	77.1
Mitchell	2	30.0	2	50.0	10	489.9
Moorabool	1	7.0	-	-	10	509.4
Otway Coast	-	-	1	20.0	5	217.2
Portland Coast	-	-	-	-	3	122.2
Snowy	-	-	2	59.0	1	2.2
South Gippsland	2	8.5	-	-	24	299.0
Tambo	-	-	-	-	2	32.2
Thomson–Macalister	-	-	5	154.5	11	580.1
Werribee	-	-	-	-	1	2.2
Yarra	6	51.0	11	144.0	41	954
Total	**20**	**356.2**	**45**	**1,144.2**	**173**	**5,179.3**

5.4.4 Groundwater

Table 5-10 shows that in 2011–12, trades of groundwater 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 10 GL. Temporary and permanent entitlement volume trades had 42 transfers (about 2 GL) and 38 transfers (about 3 GL) respectively.

Table 5-10 Trade of groundwater take and use licences in southern Victorian GMUs

Water system source (GMU)	Permanent trade		Temporary trade		Trade as part of land transfer	
	Number	Volume (ML)	Number	Volume (ML)	Number	Volume (ML)
Bungaree	-	-	3	39.0	3	226.5
Cardigan	1	8.5	1	3.0	-	-
Colongulac	-	-	-	-	1	12.0
Condah	-	-	-	-	3	343.0
Cut Paw Paw	-	-	-	-	1	0.5
Denison	-	-	1	176.0	9	942.9
Deutgam	1	7.8	3	187.5	4	113.0
Giffard	1	900.0	1	50.0	1	720.0
Glenelg	-	-	1	50.0	2	35.0
Glenormiston	-	-	-	-	1	62.0
Hawkesdale	2	40.0	4	530.0	2	245.9
Heywood	-	-	-	-	6	422.8
Koo Wee Rup	9	209.3	4	79.5	12	475.3
Merrimu	1	65.0	1	18.0	1	61.0
Moe	-	-	2	6.0	1	164.6
Moorabbin	1	2.0	-	-	-	-
Nepean	2	95.0	7	452.3	3	36.9
Nullawarre	3	29.5	3	254.0	4	350.2
Rosedale	3	70.0	1	40.0	2	222.0
Sale	8	1,208.8	3	54.5	6	1,814.9
Unincorporated	2	67.0	1	25.0	26	1,775.6
Wa De Lock	1	30.0	-	-	7	636.7
Wandin Yallock	-	-	2	10.0	3	58.0
Warrion	3	63.0	-	-	4	574.4
Wy Yung	-	-	-	-	2	154.2
Yangery	-	-	2	19.0	6	689.1
Yarram	-	-	2	258.0	4	38.1
Total	**38**	**2,795.9**	**42**	**2,251.8**	**114**	**10,174.6**

5.5 Western Victoria

5.5.1 Allocation trade

In 2011–12, there were two allocation trades in western Victoria within the 21A Wimmera–Mallee trading zone amounting to 7 GL.

5.5.2 Unregulated surface water

Table 5-11 and Table 5-12 show that trade in surface water take and use licences was much lower than the trade in groundwater take and use licences. However, unlike groundwater trades, trades as part of land transfers (take and use licence change of ownership) were the dominant trade type (by volume and number of trades) in surface water trades.

Table 5-11 Trade of surface water take and use licences

Water system source	Permanent trade		Temporary trade		Trade as part of land transfer	
	Number	Volume (ML)	Number	Volume (ML)	Number	Volume (ML)
Avoca	2	83.3	-	-	9	232.4
Wimmera–Avon			-	-	8	65.5
Total	**2**	**83.3**	**-**	**-**	**17**	**297.9**

5.5.3 Groundwater

In 2011–12 the volume of trade in groundwater take and use licences was dominated by a combination of temporary and permanent trades (i.e. trades independent of land sales) (Table 5-12). Temporary and permanent entitlement volume trades amounted to 770 ML compared to 440 ML for trades as part of land transfers (take and use licence change of ownership).

Table 5-12 Trade of groundwater take and use licences

Water system source	Permanent trade		Temporary trade		Trade as part of land transfer	
	Number	Volume (ML)	Number	Volume (ML)	Number	Volume (ML)
Apsley (GMU)	-	-	-	-	1	240.0
Murrayville (GMU)	-	-	-	-	1	200.0
Neuarpur 2 (GMU)	-	-	1	400.0	-	-
Northern (GMU)	-	-	1	120.0	-	-
Yanipy (GMU)	1	250.0	-	-	-	-
Total	**1**	**250.0**	**2**	**520.0**	**2**	**440.0**

Part 2:
Water accounts 2011–12

Part 2 of the *Victorian Water Accounts 2011–12* presents an account of surface water, groundwater and distribution systems in Victoria for 2011–12.

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

- a map of each basin
- a basin overview, including summaries of information presented in each basin, management responsibilities in the basinand, where applicable, information about the environmental water reserve
- the total water resources in each basin
- detailed information about surface water, groundwater 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 adds 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 some other destination.

Such accounting is very important because distribution systems are part of the water cycle that people control, and because, with these systems, delivery efficiency improvements can most readily be made. These accounts have the potential, over time, to throw light on questions such as:

- how do the many urban systems compare? 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 Victorian 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
- hydrogeologic information from selected groundwater 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, groundwater and recycled water in 2011–12 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. River basins have been chosen as the basis of reporting water resource information in the Victorian Water Accounts because the majority of data is easily collected and aggregated into this reporting unit. However, some data sets are not aligned with basin boundaries and this data has been treated as follows.

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 utilised 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 Groundwater data

The presentation of groundwater by river basin presents a number of reporting difficulties. Groundwater Management Units (GMUs) often fall across more than one river basin. Where this is the case, the proportion of a GMU's surface area within a given basin has been used as a proxy for the proportion of the GMU's total entitlement and use that is located within the basin. For example, Colongulac GMA spans the Corangamite basin, the Otway Coast basin, and the Hopkins basin. In the Corangamite basin, volumes for the Colongulac GMA are determined by multiplying the total volumes being reported by the proportion of the Colongulac GMA's surface area within the basin.

6.1.4 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 2011 to 30 June 2012. Responsibilities for water management are reported in the accounts as they were during 2011–12. Any changes to responsibilities since the end of June 2012 will be reported in future water accounts.

This is the ninth year that the water accounts have been compiled. In preceding years Victorian Water Accounts water balance information was presented alongside the values reported in the previous water year. This information has not been included in this year's account as revisions have been made to the way the volume of diversions are determined in the water balances. The previous year's data is not considered to be comparable and hence a column has not been provided comparing 2011–12 values to 2010–11 published data.

6.1.5 Total water resources in the basin section

A summary of total water resources is presented for each basin. The summary represents an aggregate of the data presented in the basin chapter regarding surface water, groundwater and recycled water resources.

- **Surface water:** The total surface water resource available in a basin is considered to be the sum of all inflows to the basin. Total usage is represented as the sum of all diversions in the basin.
- **Groundwater:** The total groundwater resource in a basin is considered to be the sum of all entitlement limits (or the permissible consumptive volume where one has been set) and estimated domestic and stock use. The total use is represented as all licensed use plus the estimated use from unlicensed domestic and stock bores.
- **Recycled water:** The total recycled water resource in a basin is considered to be the total volume of water that is produced by wastewater treatment plants and available to be recycled for further use. Total recycled water use is represented as the total volume of treated water that is reused (including uses within the recycling process), excluding the total volume that is discharged to waterways or the ocean.

The total surface water resource (the sum of all inflows to a basin) includes water discharged from treatment plants into waterways, and this volume is also a component of the total recycled water resource.

6.1.6 Surface water resources section

Information on surface water in 2011–12 is presented in this section for each of the 29 river basins. There are three sub-sections: water balance, storages and flows and volume of diversions.

6.1.7 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.

6.1.7.1 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. On-stream storages included in the 2011–12 surface water balances are listed in Appendix A.

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.

6.1.7.2 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 NSW's share of storage:** This item only applies in the Murray basin. When NSW's share of storage capacity is full, NSW's share of incoming inflows are credited to Victoria's share of capacity. This is referred to as an 'internal spill'.
- **Ceding from NSW'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 6.1.11 for more information.

6.1.7.3 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 6.1.9.

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 6.1.9.
- **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 5-1. 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:** there are several rivers in Western Victoria that 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 are 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 2011–12

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

6.1.8 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 seven years. Where a basin does not have any major on-stream storages, only inflow information is presented in this section.

6.1.9 Volume diverted sub-section

This section presents information on diversions used in the surface water balance. It provides an overview of 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.

6.1.9.1 Bulk entitlement volumes and diversions

Details of all bulk entitlements held by water corporations and power generators for diversions from waterways within a basin are presented in a table. Bulk entitlements specify a maximum volume of water that may be diverted over a given period (one or more years). The number of years in the period is provided in the column titled 'Bulk entitlement period'. The 'Bulk entitlement volume' column provides the maximum volume that may be diverted over the period, divided by the number of years in the period. The net trade of water to or from a bulk entitlement is provided in the column titled 'Net assignment of allocation'. The volume of water diverted under a bulk entitlement is provided in the final column 'Volume diverted'.

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 Victorian Environmental Water Holder.

- **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' and 'Volume diverted' reported 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, the delivery bulk entitlements have been excluded from the totals for these two columns to avoid the volumes being double-counted.

This is a different approach to previously published versions of the Victorian Water Accounts. The 2010–11 totals that are presented in the table for comparison purposes have been re-calculated using this approach and will not be consistent with those published in the 2010–11 edition of the Victorian Water Accounts.

6.1.9.2 Volume of licensed diversions from 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.

The total licensed volume and volume of diversions from regulated streams is accounted for under source bulk entitlements held by rural water corporations that operate the regulating infrastructure in the system. Diversions under bulk entitlements are provided in the preceding section.

The total licensed volume and volume of diversions from unregulated streams is provided by rural water corporations responsible for licensing in each basin.

6.1.9.3 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 2011–12 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.

6.1.10 Groundwater resources section

As noted earlier in these accounts, management of groundwater in Victoria is based on allocating resources within groundwater management units (GMUs) which can be classified as either:

- groundwater management areas (GMAs) or
- water supply protection areas (WSPAs).

Groundwater in areas outside of GMUs are reported as unincorporated areas (UAs).

Groundwater is managed not only across areas, but also at different aquifer depths. For example, in Gippsland groundwater is drawn from different aquifers that lie at different depths. Aquifers are nominally attributed to different GMUs and each GMU is reported individually in the accounts.

The Minister for Water declares, by order published in the government gazette, the total volume of groundwater that may be taken from a GMU, which is the permissible consumptive volume (PCV). The entitlement limit included in the groundwater compliance table is set at the PCV for the management unit or, where there is no gazetted PCV, it equates to the sum of all licensed entitlements for the area. This volume is also used as a proxy for the total groundwater resource in the second table presented in each basin. The total groundwater use in these tables includes both licensed usage and usage from domestic and stock bores.

As groundwater resources in UAs are largely undeveloped, resource information is not currently readily available in these areas and is not reported in each basin. An exception to this approach is where urban groundwater use is sourced from a UA. For instance, in the Avoca basin, Avoca, Redbank, Amphitheatre and Daylesford are all supplied by groundwater from a UA and the related entitlement volume and use is reported in the basin account. In these

instances, the ‘Summary of total water resources and water use’ table is amended to show that there is groundwater available and used in the basin, although there is no groundwater compliance table.

Monitoring and measurement of groundwater resources is constantly improving. These improvements (for example, through better metering) have sometimes resulted in variances between the numbers of bores and entitlement/usage volumes in previous reports.

The concentration of bores and groundwater use varies considerably across GMUs, which often fall across more than one river basin. It is not possible to accurately apportion groundwater entitlements and use to specific river basins.

The proportion of a GMU’s surface area within a given basin has been used as a proxy for the proportion of the GMU’s total entitlement and use that is located within the basin. The number of domestic and stock bores in a basin are also based on this percentage. A GMU will not be reported at all in a basin if it does not have at least 5% of its surface area within the basin. The entire entitlement volume and extraction amount per GMU is reported in Appendix B. A limitation of this approach is that it does not perfectly reflect where the entitlement and use is actually located. It is likely that groundwater bores are not evenly distributed across a GMU and therefore more or fewer bores could be located in a basin than calculated. Furthermore, some bores are licensed to extract more water than others, which will also result in inaccuracies in the volumes reported.

The number of domestic and stock bores recorded for each GMU include 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 to the appropriate GMUs where management units 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.

Stock and domestic use for 2010–11 was estimated to be 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).

6.1.11 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.

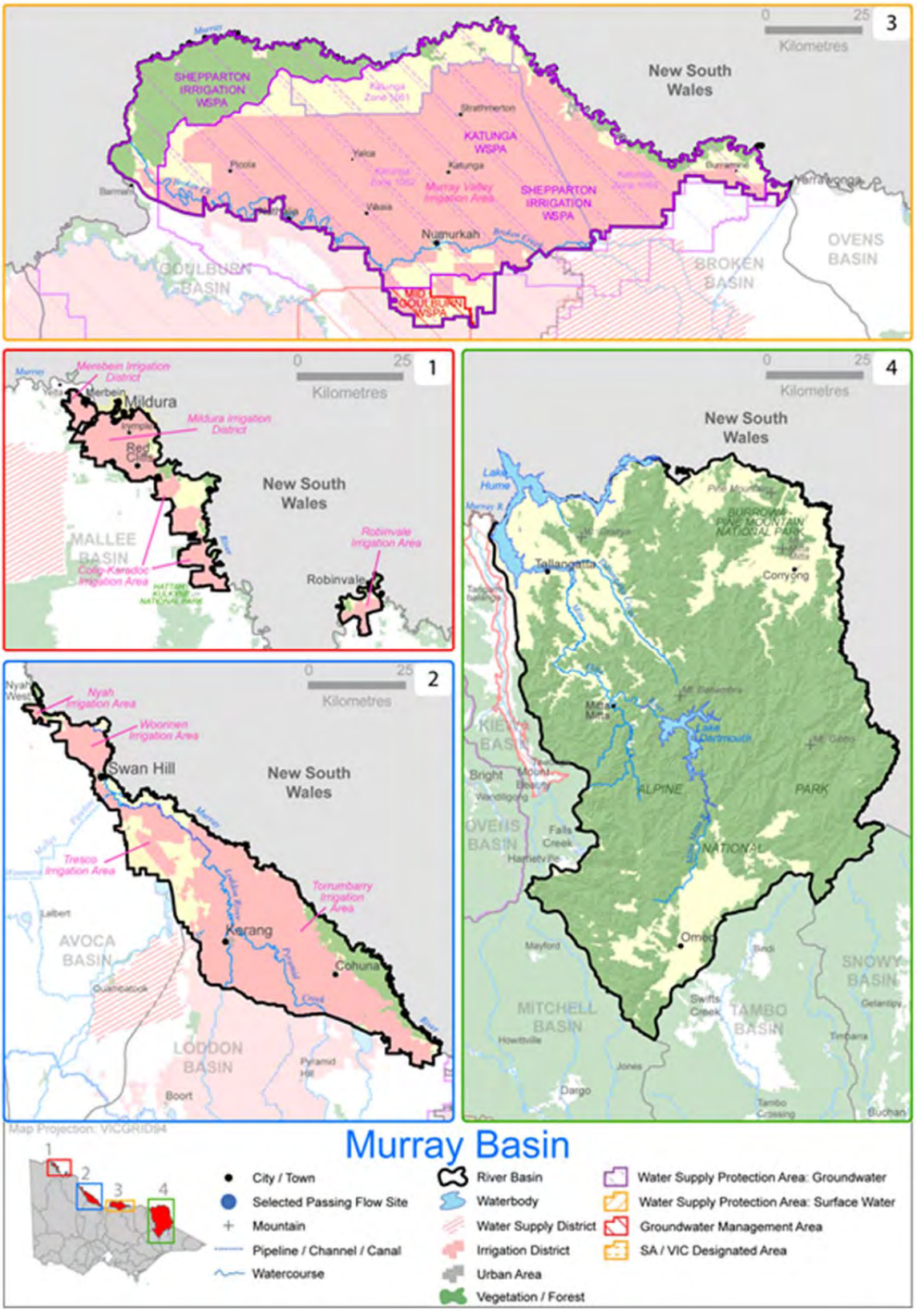
A table in each basin chapter provides the following information:

- 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 2011–12 was between 80% and 150% of the long-term average. While catchment inflows to the Murray basin in 2011–12 were 120% of the long-term average, they were much lower compared to 2010–11 when inflows were more than double the long-term average.

The volume held in Victoria's share of the major Murray system storages started at 81% of capacity at the beginning of July and were 90% of capacity at the end of June 2012.

After five consecutive years of opening the year at 0%, allocations in the regulated Murray system began the year at 50%. The allocation for high reliability water shares reached 100% on 15 November 2011. This was the third consecutive year that the allocation for high reliability entitlements reached 100%.

Lower Murray Water imposed Stage 3 restrictions at Robinvale while treatment works were in progress during August and September 2011, and then returned to permanent water saving rules once the works were complete. No other towns in the Murray basin were subject to restrictions during 2011–12.

Licensed surface water users in the Murray basin were unrestricted throughout the year. Groundwater users in the Katunga WSPA were restricted to 70% of allocation in 2011–12.

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 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 2011–12.

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 groundwater and surface water 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 groundwater and surface water 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	
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 2011–12 the Murray basin (Victoria) EWR comprised the following components:

- the *Bulk Entitlement (River Murray – Flora and Fauna) Order 1999* comprised 27,600 ML of high reliability and 40,000 ML unregulated entitlements held by the Victorian Environmental Water Holder (VEWH)
- the Living Murray Environmental Entitlement comprised 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 Barmah-Millewa Forest Environmental Water Allocation – a significant operational rule embedded in consumptive entitlements
- the allocation of savings and mitigation water associated with Stage 1 of the Northern Victoria Irrigation Renewal Program (NVIRP) under supply agreements with Goulburn–Murray Water
- 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 Total water resources in the basin

Victoria's share of the total volumes of water available and supplied from water resources in the Murray basin is shown in Table 6.2-2. 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 3,653 ML portion of the recycled water resource presented in Table 6.2-2 was discharged from the Wodonga, Nathalia and Numurkah treatment plants back into the Murray waterways (see section 6.2.5). This amount is also reported as 'treated wastewater discharged back to river' in Table 6.2-3, therefore it is included as both a surface water resource and recycled water resource in Table 6.2-2.

Table 6.2-2 Summary of total water resources and water use in the Murray basin (Victoria)

Water source	Total water resource (ML)	Total use (ML)
Surface water	9,613,822	1,339,729
Groundwater	114,164	25,190
Recycled water	10,364	3,980

6.2.3 Surface water resources

6.2.3.1 Water balance

A surface water balance for the Murray basin (Victoria) is shown in Table 6.2-3.

Table 6.2-3 Balance of surface water in the Murray basin (Victoria)

Water account component	2011–12 (ML)[1][2]
Water in storage	
Volume in major on-stream storages at start of year	3,679,480
Volume in major on-stream storages at end of year	4,090,380
Change in storage	**410,900**
Inflows	
Catchment inflow[3]	9,175,099
Rainfall on major storages	337,892
Internal spills from NSW share of storage	5,620
Ceding from NSW share of storage	1,150
Return flow from irrigation	90,408
Treated wastewater discharged back to river	3,653
Total inflows	**9,613,822**
Outflows	
Diversions	
Urban diversions	31,625
Irrigation district diversions	932,861
Licensed diversions from regulated streams	321,433
Licensed diversions from unregulated streams	6,989
Environmental water diversions	40,377
Small catchment dams	6,445
Total diversions	***1,339,729***
Losses	
Evaporation losses from major storages	767,237
Evaporation from small catchment dams	1,164
In-stream infiltration to groundwater, flows to floodplain and evaporation[4]	1,171,582
Total losses	***1,939,983***
Water passed at outlet of basin	
Murray River flow to South Australia from Victoria's allocation	5,521,400
Internal spills to NSW share of storages	281,260
Ceding to NSW storages per Murray–Darling Basin Agreement	120,550
Total water passed at outlet of basin	***5,923,210***
Total outflows	**9,202,922**

Notes:

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

(2) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts.*

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

(4) 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.

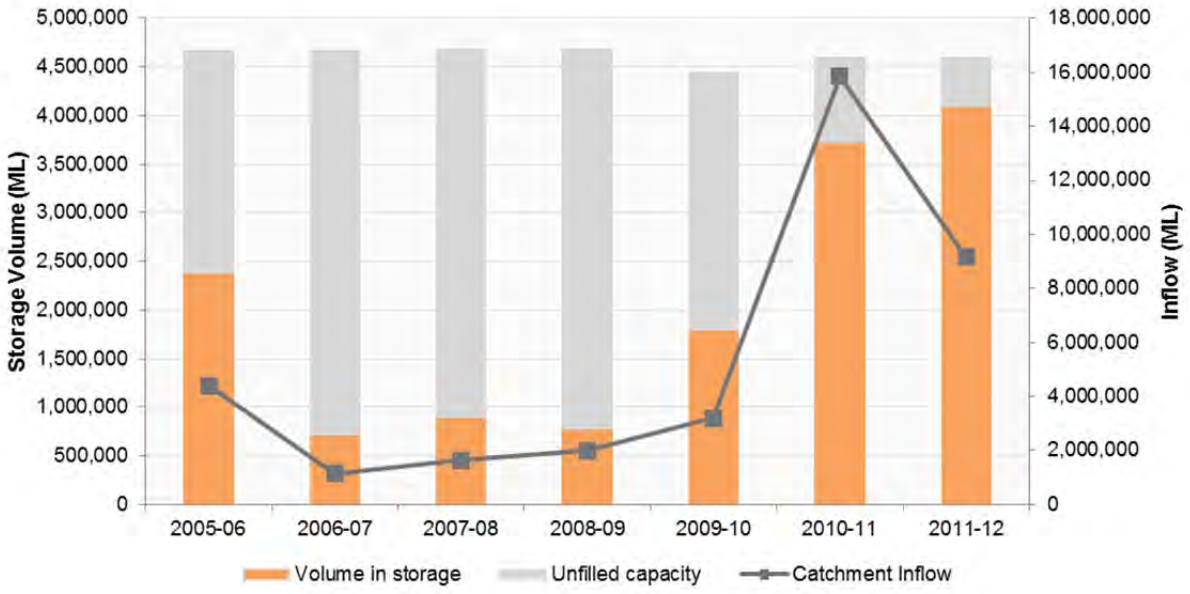
6.2.3.2 Storages and flows

The volume held in major storages in the Murray basin began 2011–12 at 3,679,480 ML (81% of capacity) and ended the year at 4,090,380 ML (90% of capacity) (Figure 6.2-2). This includes Victoria's share of Lake Hume, Lake Dartmouth, Lake Cullulleraine, Lake Victoria and the Menindee Lakes.

Victoria's share of catchment inflows were 20% higher than the long-term average (of 7,618,000ML) significantly lower compared to 2010–11 where inflows were more than double the long-term average (Figure 6.2-2).

The Victorian component of water flowing from the Murray basin to South Australia was 5,521,400 ML in 2011–12. This represented 60% of the total inflows into the basin, compared to 57% in 2010–11.

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



6.2.3.3 Volume diverted

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.

Water corporations diversions under bulk entitlements for 2011–12 are presented in Table 6.2-4 below. 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.*

Table 6.2-4 Bulk entitlement volumes and diversions

Bulk entitlement[1]	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
East Gippsland Water				
Omeo	1	77	0	46
Coliban Water				
River Murray	1	6,285	0	3,551
Goulburn Valley Water				
River Murray	1	5,593	(1,140)	4,288
North East Water				
Bundalong	1	51	0	24
Corryong	1	680	0	220
Cudgewa	1	29	0	0
Dartmouth	1	60	0	21
Walwa	1	61	0	16
River Murray	1	12,794	0	6,688
GWMWater				
River Murray [2]	1	3,492	0	3,533
Goulburn–Murray Water				
River Murray	1	1,516,023	0	830,915
Lower Murray Water				
River Murray – Urban	1	31,958	0	16,771
River Murray – Irrigation	1	422,022	0	387,133
River Murray – First Mildura Irrigation Trust	1	69,216	0	32,712
2011–12 Total		**2,068,341**	**(1,140)**	**1,285,918**
2010–11 Total		2,071,937	0	621,242

Notes:

(1) This table does not include bulk entitlements and environmental entitlements held by the VEWH. Any diversions out of the waterway under VEWH entitlements are discussed below.

(2) The volume diverted is higher than the bulk entitlement volume due to unused allocation from 2010–11 being carried-over in to 2011–12.

The VEWH diverted 40,377 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.

The total volume of water diverted from unregulated streams by licence holders in the Murray basin increased considerably in 2011–12 compared to 2010–11 (Table 6.2-5).

Table 6.2-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**84,910**	**6,989**
2010–11	83,753	2,400

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

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

6.2.4 Groundwater resources

Murray basin groundwater includes a proportion of the Katunga and Shepparton WSPAs. Groundwater supplies licences, domestic and stock use and the three townships in the area.

Licensed groundwater entitlements and use within the Murray basin for 2011–12 is presented in Table 6.2-7. The volumes include domestic and stock usage only where it is part of an existing licence. Groundwater use in the Murray basin increased significantly in 2011–12 compared to 2010–11. Although groundwater levels in the Shepparton WSPA saw some recovery in response to recharge provided by wetter conditions and reduced usage, overall groundwater levels were still lower than five years prior. As one of the management aims for this WSPA is to control salinity resulting from rising water levels, the fact that groundwater levels have not fully recovered can be considered a positive outcome. Extractions from Katunga WSPA were restricted to 70% allocation in 2011–12 and groundwater levels are increasing within the WSPA.

Table 6.2-7 Licensed groundwater volumes, Murray basin (Victoria)

WSPA/GMA[1]	GMA/WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Katunga WSPA (80%)[3]	>25	33,924	48,463	15,047	0	15,047	9,323
Shepparton WSPA (31%)	≤25	63,322	63,322	7,764	0	7,764	5,169
Total		**97,246**	**111,785**	**22,811**	**0**	**22,811**	**14,492**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit. The entitlement limit in the Katunga WSPA is represented by 70% PCV due to restrictions in 2011–12.

(3) PCV exceeded due to the issue of entitlement under the Dairy Shed Water Licence Transition Program. PCV to be amended.

An estimate of domestic and stock groundwater use is provided in Table 6.2-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.2-9.

Table 6.2-8 Number of domestic and stock bores and estimated use

WSPA/GMA	Number of domestic and stock bores	Estimated domestic and stock use (assuming 2 ML per bore) (ML)
Katunga WSPA (80%)	610	1,221
Shepparton WSPA (31%)	579	1,158
Total	**1,189**	**2,379**

Groundwater is used to provide urban water supply to some towns in the Murray basin. The licensed entitlements and metered use for these supplies is presented in Table 6.2-9. Groundwater use for Katunga increased slightly in 2011–12 compared to 2010–11, while groundwater use for Dinner Plain reduced slightly.

Table 6.2-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Dinner Plain	120	0	45
Katunga	110	58	39
Strathmerton	730	0	0
Total	**960**	**58**	**84**

6.2.5 Recycled water

Around 38% of the volume of wastewater passing through treatment plants in the basin was recycled for consumptive use (Table 6.2-10), mostly for agricultural purposes. This is higher than the proportion recycled in 2010–11 even though water consumption rates were similar.

Table 6.2-10 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]		
Bellbridge	51	51	100%	0	51	0	0	0	0
Bundalong	0	0	0%	0	0	0	0	0	0
Cobram	313	313	100%	0	313	0	0	0	0
Cohuna	0	0	0%	0	0	0	0	0	0
Corryong	84	84	100%	0	84	0	0	0	0
Dartmouth	5	0	0%	0	0	0	0	5	0
Gunbower / Leitchville	0	0	0%	0	0	0	0	0	0
Koondrook	67	0	0%	0	0	0	0	0	67
Koorlong	1,846	1,732	94%	0	1,732	0	0	0	114
Lake Boga	43	0	0%	0	0	0	0	0	43
Merbein	142	0	0%	0	0	0	0	0	142
Mildura	1,469	598	41%	0	598	0	0	0	871
Murrabit	8	0	0%	0	0	0	0	0	8
Nathalia	160	90	56%	0	90	0	0	70	0
Numurkah	323	256	79%	0	256	0	0	67	0
Nyah/Nyah West	69	0	0%	0	0	0	0	0	69
Omeo	20	18	88%	0	18	0	0	2	0
Robinvale	229	126	55%	0	126	0	0	0	103
Strathmerton	0	0	0%	0	0	0	0	0	0
Swan Hill	1,254	0	0%	0	0	0	0	0	1,254
Tallangatta	114	114	100%	0	114	0	0	0	0
Wodonga	3,664	94	3%	94	0	0	0	3,508	62
Yarrawonga	505	505	100%	0	505	0	0	0	0
Total 2011–12	**10,364**	**3,980**	**38%**	**94**	**3,886**	**0**	**0**	**3,653**	**2,731**
Total 2010–11	9,972	3,479	35%	75	3,404	0	0	4,014	2,479

Notes:

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

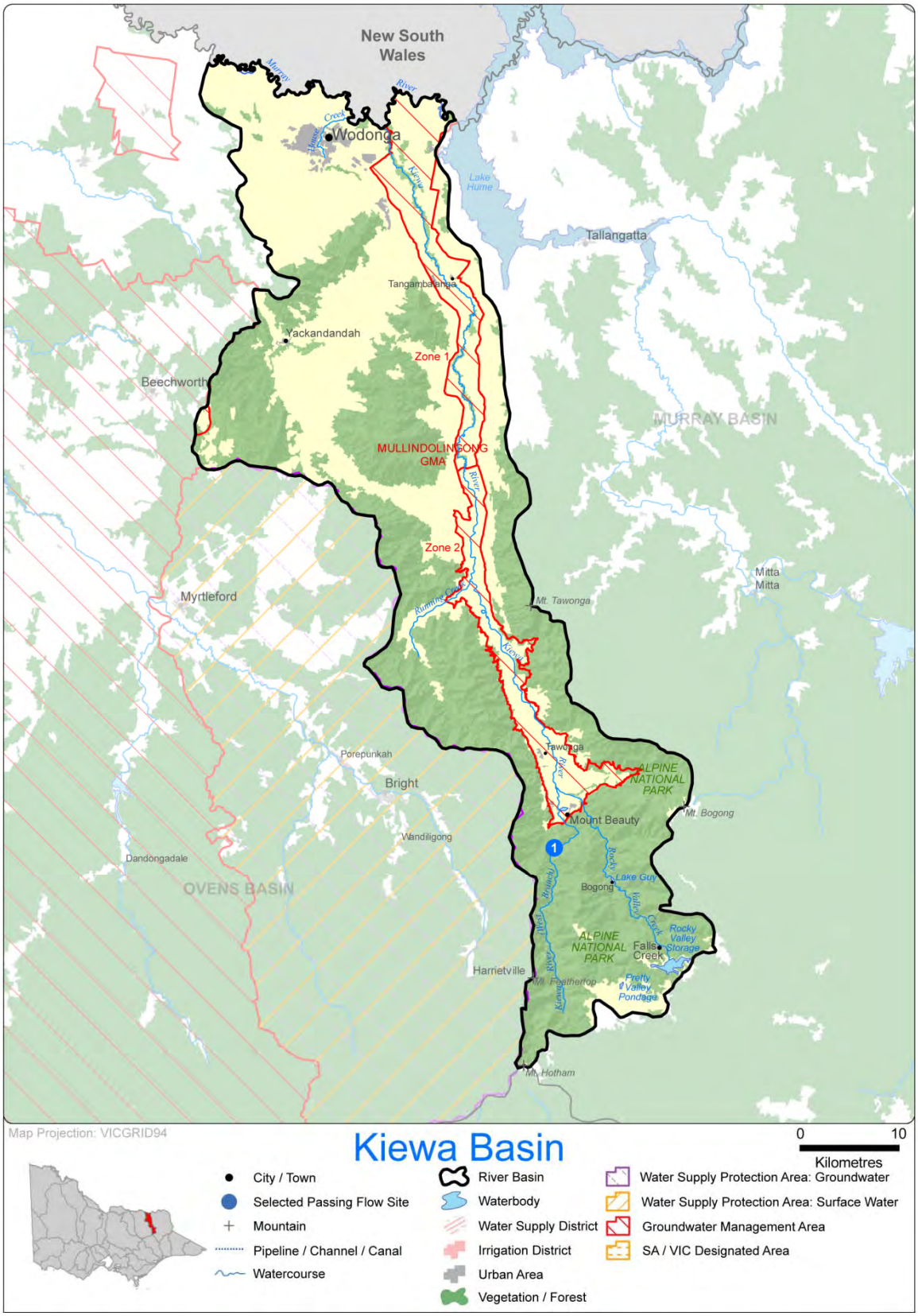
(2) 'Within process' refers to water reused in wastewater treatment processes, for example to maintain biological processes. This value is not included in the total percent recycled, consistent with its treatment in the ESC's performance report.

(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 northward to the Murray River.

Figure 6.3-1 Map of the Kiewa basin



6.3.1 Water resources overview

In 2011–12, rainfall in the Kiewa basin ranged from 100% of the long-term average in the upper catchment to 150% in the lower catchment. Catchment inflows were 123% of the long-term average, compared to 169% in 2010–11. The volume of water flowing out of the Kiewa River into the Murray basin represented 93% of the Kiewa basin's total inflows.

The volume of water in major storages in the Kiewa basin finished the year at 68% of capacity, compared with 64% of capacity at the start of the year.

The volume of water taken under licensed diversions in 2011–12 was three times that taken in the previous year.

Diversions from several unregulated streams in the Kiewa basin were subject to restrictions during the summer months, with diversions being unrestricted throughout the remainder of the year. There were no restrictions on urban water use during 2011–12.

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

Table 6.3-1 Responsibilities for water resources management

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Goulburn–Murray Water	Manages groundwater and surface water 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 2011–12, 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 Total water resources in the basin

In 2011–12 the total volumes of water available and supplied from water resources in the Kiewa basin are shown in Table 6.3-2. Only a small proportion of the surface water resources in the Kiewa basin (0.8%) were extracted for consumptive use. A 205 ML portion of the recycled water resource presented in Table 6.3-2 was discharged from Mount Beauty treatment plant back into the Kiewa waterways (see section 6.3.5). This amount is also included in the volume reported as 'treated wastewater discharged back to river' in Table 6.3-3, therefore this volume is included as both a surface water resource and recycled water resource in Table 6.3-3.

Table 6.3-2Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	855,779	6,699
Groundwater	1,842	127
Recycled water	331	126

6.3.3 Surface water resources

6.3.3.1 Water balance

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 slightly lower in 2011–12 (Table 6.3-3) than those reported in the 2010–11 Victorian Water Accounts.

Table 6.3-3 Balance of surface water in the Kiewa basin

Water account component	2011–12 (ML)[1]
Major on-stream storage	
Volume in storage at start of year	18,920
Volume in storage at end of year	20,213
Change in storage	**1,293**
Inflows	
Catchment inflow[2]	850,533
Rainfall on major storages	4,918
Treated wastewater discharged back to river	328
Total inflows	**855,779**
Outflows	
Diversions	
Urban diversions	481
Licensed diversions from unregulated streams	2,290
Small catchment dams	3,927
Total diversions	***6,699***
Losses	
Evaporation losses from major storages	2,432
Evaporation from small catchment dams	1,099
In-stream infiltration to groundwater, flows to floodplain and evaporation	52,538
Total losses	***56,069***
Water passed at outlet of basin	
Kiewa basin outflow to Murray River – Victoria share	395,859
Kiewa basin outflow to Murray River – NSW share	395,859
Total water passed at outlet of basin	***791,718***
Total outflows	**854,486**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

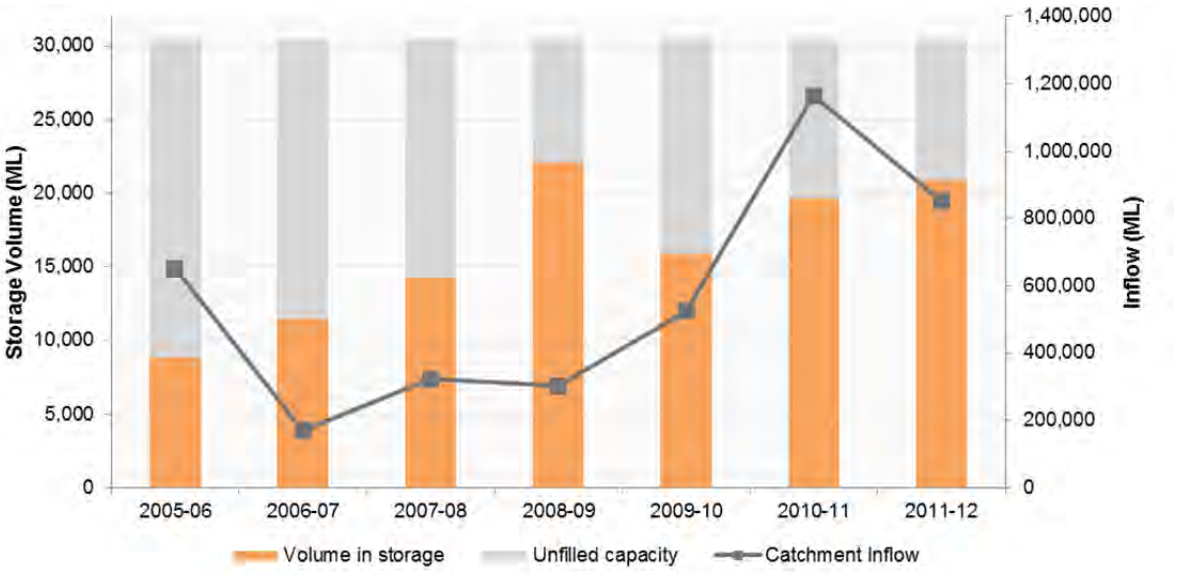
(2) Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, and the known inflows and net change in storage volume.

6.3.3.2 Storages and flows

Storage levels for all major on-stream and off-stream storages in the basin were 20,849 ML (68% of capacity) by the end of June 2012 compared to 19,636 ML (64% of capacity) at the start of July 2011 (Table 6.3-3).

Catchment inflows were 123% of the long-term average (689,000 ML). Figure 6.3-2 illustrates the greater magnitude of inflows to the basin in the last two years, compared to the five years prior. The volume of water flowing from the Kiewa basin into the Murray River decreased to 791,718 ML in 2011–12 (including the New South Wales share of Kiewa River flows under the Murray–Darling Basin Agreement). This volume was approximately 290,000 ML less than the 2010–11 outflow volume of 1,082,000 ML. The volume of water flowing from the Kiewa basin into the Murray River in 2011–12 represented 93% of the total inflows into the Kiewa basin, which is the same percentage of inflows as the previous year.

Figure 6.3-2 All major storages and catchment inflows



6.3.3.3 Volume diverted

North East Water and AGL Hydro Ltd hold bulk entitlements to divert surface water in the Kiewa basin. Surface water is diverted by licence holders and surface water is also harvested in small catchment dams.

North East Water and AGL Hydro Ltd's diversions for 2011–12 under these bulk entitlements are presented in Table 6.3-4. 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 6.3-4 Bulk entitlements volumes and diversions

Bulk entitlement	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
North East Water				
Kiewa – Tangambalanga	1	179	0	0
Mount Beauty – Tawonga	1	719	0	318
Yackandandah	1	178	0	163
AGL Hydro Ltd				
Kiewa – Southern Hydro Ltd(1)	1	-	-	-
2011–12 Total	**-**	**1,076**	**-**	**481**
2010–11 Total	-	1,126	-	504

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.

Licence holders diverted a greater volume of water from unregulated streams in 2011–12 compared to 2010–11 (Table 6.3-5). Diversions were considerably lower than the total licence volume.

Table 6.3-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**20,673**	**2,290**
2010–11	20,676	700

The estimated volume of water harvested from small catchment dams represents the largest diversion of surface water in the Kiewa basin (Table 6.3-6).

Table 6.3-6 Estimated small catchment dam information

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**

6.3.4 Groundwater resources

The Kiewa basin contains the Mullindolingong GMA. Groundwater supplies licences and domestic and stock use in the area. Groundwater levels in the Mullindolingong GMA remained stable through 2011–12. Groundwater is not used to supplement surface water supplies to urban customers in the Kiewa basin.

A summary of the groundwater entitlement volume and use within the Kiewa basin is presented in Table 6.3-7. These volumes may include domestic and stock usage where it is part of an existing licence.

Table 6.3-7 Licensed groundwater volumes

WSPA/GMA[1]	GMA/WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Mullindolingong GMA (100%)	All depths	6,980	1730	15	0	15	13
Total		**6,980**	**1,730**	**15**	**0**	**15**	**13**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit.

An estimate of domestic and stock groundwater use is provided in Table 6.3-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.3-7.

Table 6.3-8 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 (100%)	56	112
Total	**56**	**112**

6.3.5 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 6.3-9. In addition to the recycled water reported in below, 123 ML was returned from the Falls Creek Alpine Resort to Rocky Valley Creek during the water year.

Table 6.3-9 shows the volumes of water recycled in the Kiewa basin in 2011–12.

Table 6.3-9 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]		
Baranduda	0	0	0%	0	0	0	0	0	0
Dinner Plain	66	66	100%	0	66	0	0	0	0
Mount Beauty	205	0	0%	0	0	0	0	205	0
Yackandandah	60	60	100%	0	60	0	0	0	0
Total 2011–12	**331**	**126**	**38%**	**0**	**126**	**0**	**0**	**205**	**0**
Total 2010–11	424	181	43%	0	181	0	0	0	242

Notes:

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

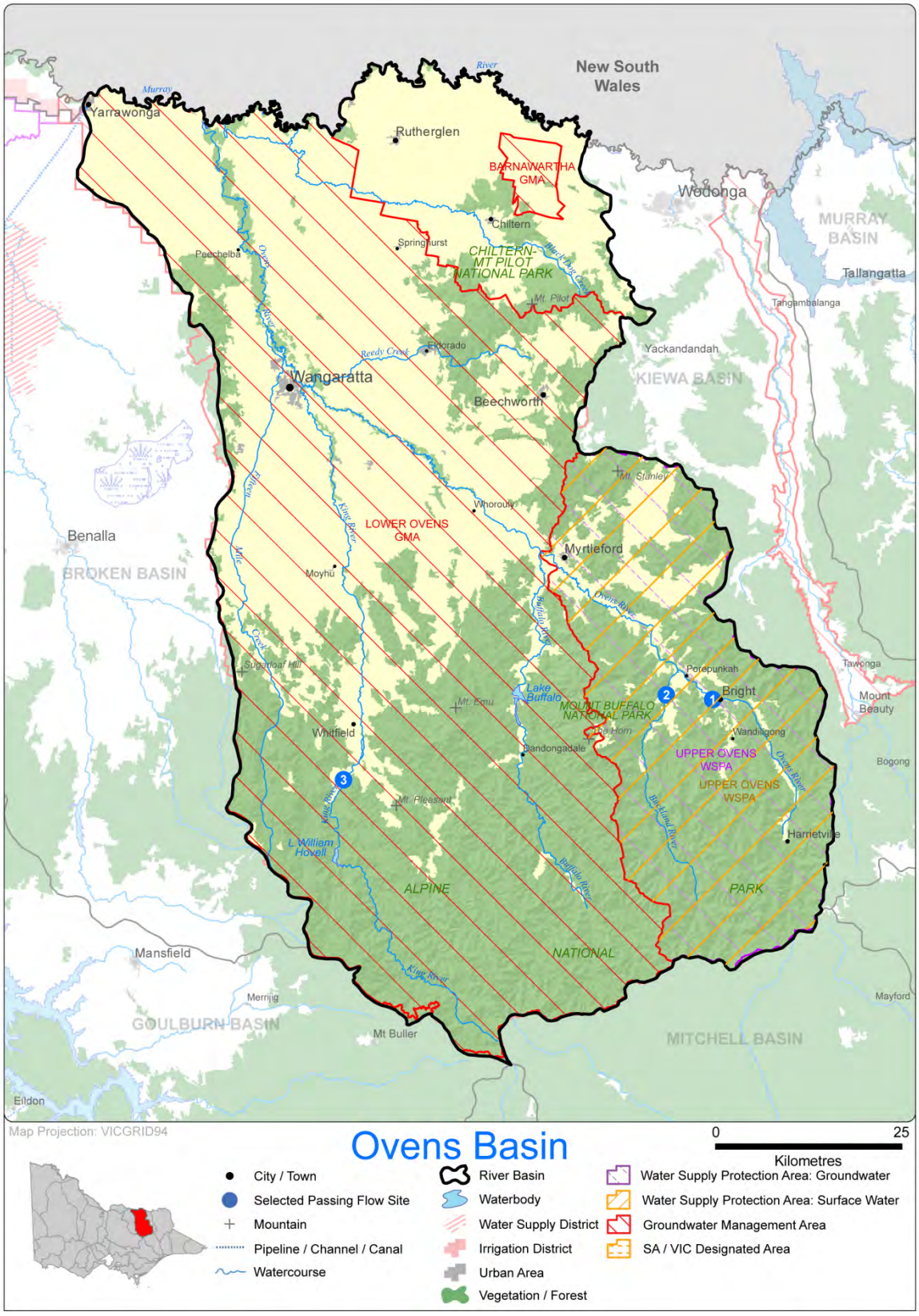
(2) 'Within process' refers to water reused in sewage treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(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. The 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 2011–12, rainfall across the Ovens basin was generally between 80% and 100% of the long-term average, with up to 150% falling in the lower catchment. Catchment inflows in 2011–12 were close to the long-term average annual volume, after being almost double the average in 2010–11. The volume of water flowing out of the Ovens basin into the Murray River represented 97% of the Ovens basin's total inflows.

The total volume of water held in major storages in the Ovens basin finished the year at 76% capacity, marginally higher than the 74% at the start of the year.

Only one town was subject to water restrictions in 2011–12. North East Water implemented Stage 4 restrictions in Bundalong for the month of July when water carting was required in response to water quality issues.

Licensed diversions on unregulated streams were largely unrestricted during 2011–12, with only Hurdle Creek having Stage 3 restrictions in place in February, which were lifted during March. The total volume of licensed diversions on unregulated streams showed a marked increase in comparison with the previous year, with almost six times the 2010–11 volume diverted by licence holders.

Licensed groundwater use in the basin also increased compared to 2010–11, primarily as a result of increased extractions from the Lower Ovens GMA.

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 groundwater and surface water 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 2011–12 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 Total water resources in the basin

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 2011–12 decreased to 1,754,256 ML, compared to 3,479,500 ML in 2010–11. Total water use increased slightly from the previous year, with total use of 34,635 ML in 2011–12 compared with 31,810 ML in 2010–11. A large portion, or 2,201 ML, of the recycled water resource presented in Table 6.4-2 was discharged from treatment plants in the Ovens basin back into the Ovens waterways (see section 6.4.5). This amount is also reported as 'treated wastewater discharged back to river' in Table 6.4-3, therefore this volume is included as both a surface water resource and recycled water resource in Table 6.4-2.

Table 6.4-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	1,754,256	26,233
Groundwater	29,154	7,668
Recycled water	2,935	734

6.4.3 Surface water resources

6.4.3.1 Water balance

A surface water balance for the Ovens basin is shown in Table 6.4-3.

Table 6.4-3 Balance of surface water in the Ovens basin

Water account component	2011–12 (ML)[1]
Major on-stream storage	
Volume in storage at start of year	27,646
Volume in storage at end of year	28,475
Change in storage	**829**
Inflows	
Catchment inflow[2]	1,747,302
Rainfall on major storages	4,753
Treated effluent discharged back to river	2,201
Total inflows	**1,754,256**
Outflows	
Diversions	
Urban diversions	5,183
Licensed diversions from regulated streams	2,812
Licensed diversions from unregulated streams	2,350
Small catchment dams	15,888
Total diversions	***26,233***
Losses	
Evaporation losses from major storages	3,184
Evaporation from small catchment dams	4,514
In-stream infiltration to groundwater, flows to floodplain and evaporation	19,216
Total losses	***26,914***
Water passed at outlet of basin	
Ovens basin outflow to Murray River	1,700,280
Total water passed at outlet of basin	***1,700,280***
Total outflows	**1,753,427**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

6.4.3.2 Storages and flows

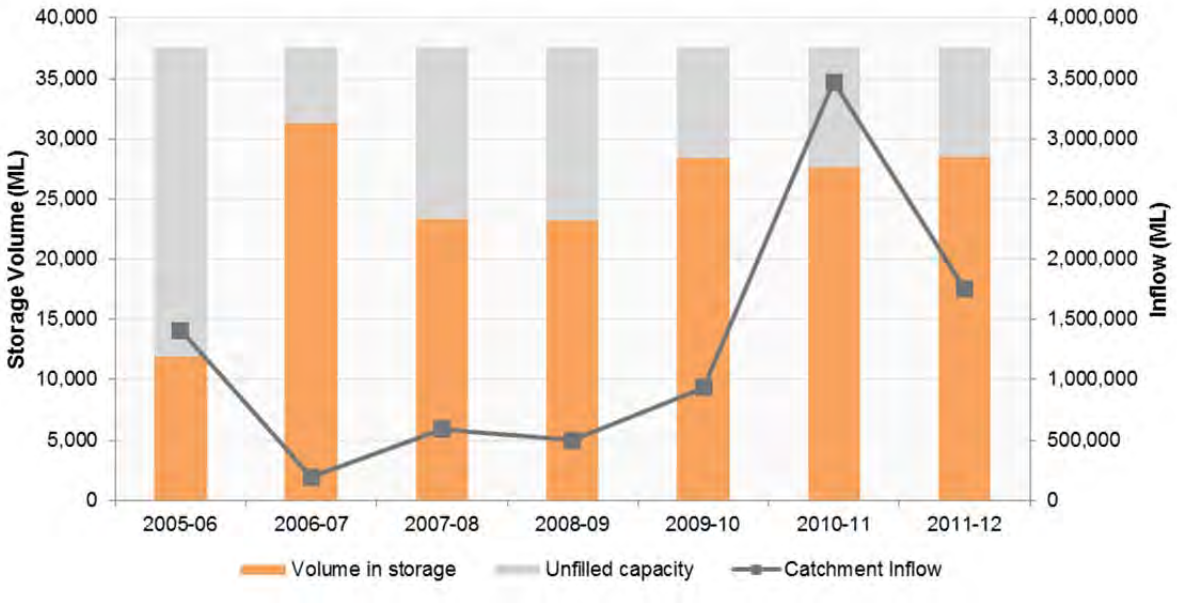
The total volume of water held in major storages in the Ovens basin was 27,646 ML at 1 July 2011 and 28,475 ML or 76% of capacity by end June 2012. Major on-stream storages are Lake Buffalo and Lake William Hovell.

Catchment inflows in 2011–12 were 99% of the long-term annual average (1,758,000 ML), compared to 197% in 2010–11.

The volume of water flowing from the Ovens basin into the Murray River was 1,700,280 ML in 2011–12. This represented 97% of the total inflows into the basin, compared to 99% in 2010–11.

Figure 6.4-2 shows the storage levels and inflow volumes in the Ovens basin from 2005–06 to 2011–12.

Figure 6.4-2 All major storages and catchment inflows



6.4.3.3 Volume diverted

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.

Goulburn–Murray Water and North East Water's diversions for 2011–12 under these bulk entitlements are presented in Table 6.4-4. 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.*

Table 6.4-4 Bulk entitlement volumes and diversions

Bulk entitlement	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
Goulburn–Murray Water				
Ovens River System[(1)]	1	46,632	0	6,380
North East Water				
Beechworth	1	1,100	0	412
Bright	1	704	0	592
Chiltern[(2)]	1	180	0	0
Glenrowan[(3)]	1	90	0	0
Harrietville	1	91	0	44
Myrtleford	2	1,212	0	615
Ovens System (Wangaratta, Oxley, Moyhu)[(4)]	1	7,932	0	3,499
Porepunkah[(5)]	1	166	0	0
Springhurst	1	36	0	8
Whitfield	1	34	0	13
2011–12 Total	**-**	**50,245**	**0**	**8,064**
2010–11 Total	-	50,196	0	5,862

Notes:

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

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

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

(4) North East Water's Ovens System bulk entitlement is omitted from the 2011–12 total as the entitlement volume and volume diverted are already accounted under Goulburn–Murray Water's Ovens River System bulk entitlement.

(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.

The volume of water diverted from unregulated streams by licence holders in the Ovens basin showed a marked increase from 2010–11 (Table 6.4-5).

Table 6.4-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**27,309**	**2,350**
2010–11	28,195	400

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**	**20,402**

6.4.4 Groundwater resources

The Ovens basin contains the Barnawartha GMA, Upper Ovens WSPA and Lower Ovens GMA. The Upper Ovens WSPA Management Plan, which was approved during 2011–12, manages groundwater in the unconsolidated sedimentary aquifer as a connected system with surface water. Groundwater resources supply licences, domestic and stock usage and six towns in the area.

Licensed groundwater entitlements and use for the GMUs in the Ovens basin are shown in Table 6.4-7. These volumes may include domestic and stock usage where it is part of an existing licence. There were no metered groundwater extractions from the Barnawartha GMA for 2011–12. Metered groundwater use from the Upper Ovens WSPA and Lower Ovens GMA for 2011–12 was 2,958 ML. Groundwater levels in the area are generally stable to increasing.

Table 6.4-7 Licensed groundwater volumes

WSPA/GMA(1)	GMA/WSPA aquifer depth limits (m)	Entitlement limit(2) (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Barnawartha GMA (100%)	All depths	2,100	645	0	0	0	0
Lower Ovens GMA (100%)	All depths	25,200	20,156	2,681	0	2,681	86
Upper Ovens WSPA (100%)	All depths	4,010	3,643	277	0	277	1,344
Total		**31,310**	**24,444**	**2,958**	**0**	**2,958**	**1,429**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit.

An estimate of domestic and stock groundwater use is provided in Table 6.4-8. A number of licensed groundwater allocations also incorporate domestic and stock use, and the estimated use for these bores is included in the licensed volume in Table 6.4-7.

Table 6.4-8 Number of domestic and stock bores and estimated use

WSPA/GMA	Number of domestic and stock bores	Estimated domestic and stock use (assuming 2 ML per bore) (ML)
Barnawartha GMA (100%)	29	58
Lower Ovens GMA (100%)	2,011	4,022
Upper Ovens WSPA (100%)	315	630
Total	**2,355**	**4,710**

Groundwater within the Ovens basin 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. A new bore was constructed at Bright in 2010 for emergency town water supply. The bore was commissioned and was

issued with a licence for zero volume in March 2012 to enable trade to the bore. The volume of licensed entitlements and metered use for these groundwater supplies are provided in Table 6.4-9.

In 2011–12, no groundwater was supplied to the towns of Barnawartha, Chiltern, Moyhu, Myrtleford and Springhurst. Urban groundwater supply to Wangaratta was significantly increased in 2011–12 compared to 2010–11.

Table 6.4-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Barnawartha	293	0	3
Bright	0	0	-
Chiltern	25	0	0
Moyhu	15	0	0
Myrtleford	75	0	0
Springhurst	20	0	2
Wangaratta	675	108	50
Total	**1,103**	**108**	**54**

6.4.5 Recycled water

North East Water operates all wastewater treatment plants in the Ovens basin. Approximately 25% of the wastewater passing through treatment plants in the basin in 2011–12 was recycled, more than the estimated 17% in 2010–11.

Table 6.4-10 shows the volumes of water recycled in the Ovens basin in 2011–12.

Table 6.4-10 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	13	13	100%	-	13	-	-	-	-
Beechworth	340	72	21%	-	72	-	-	269	-
Bright / Porepunkah	269	20	7%	20	-	-	-	249	-
Chiltern	72	72	100%	-	72	-	-	-	-
Myrtleford	347	-	0%	-	-	-	-	347	0
Rutherglen / Wahgunyah	189	189	100%	47	142	-	-	-	0
Wangaratta	1,705	369	22%	4	366	-	-	1,336	-
Total 2011–12	**2,935**	**734**	**25%**	**70**	**664**	**-**	**-**	**2,201**	**-**
Total 2010–11	3,521	606	17%	52	554	-	-	2,915	-

Notes:

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

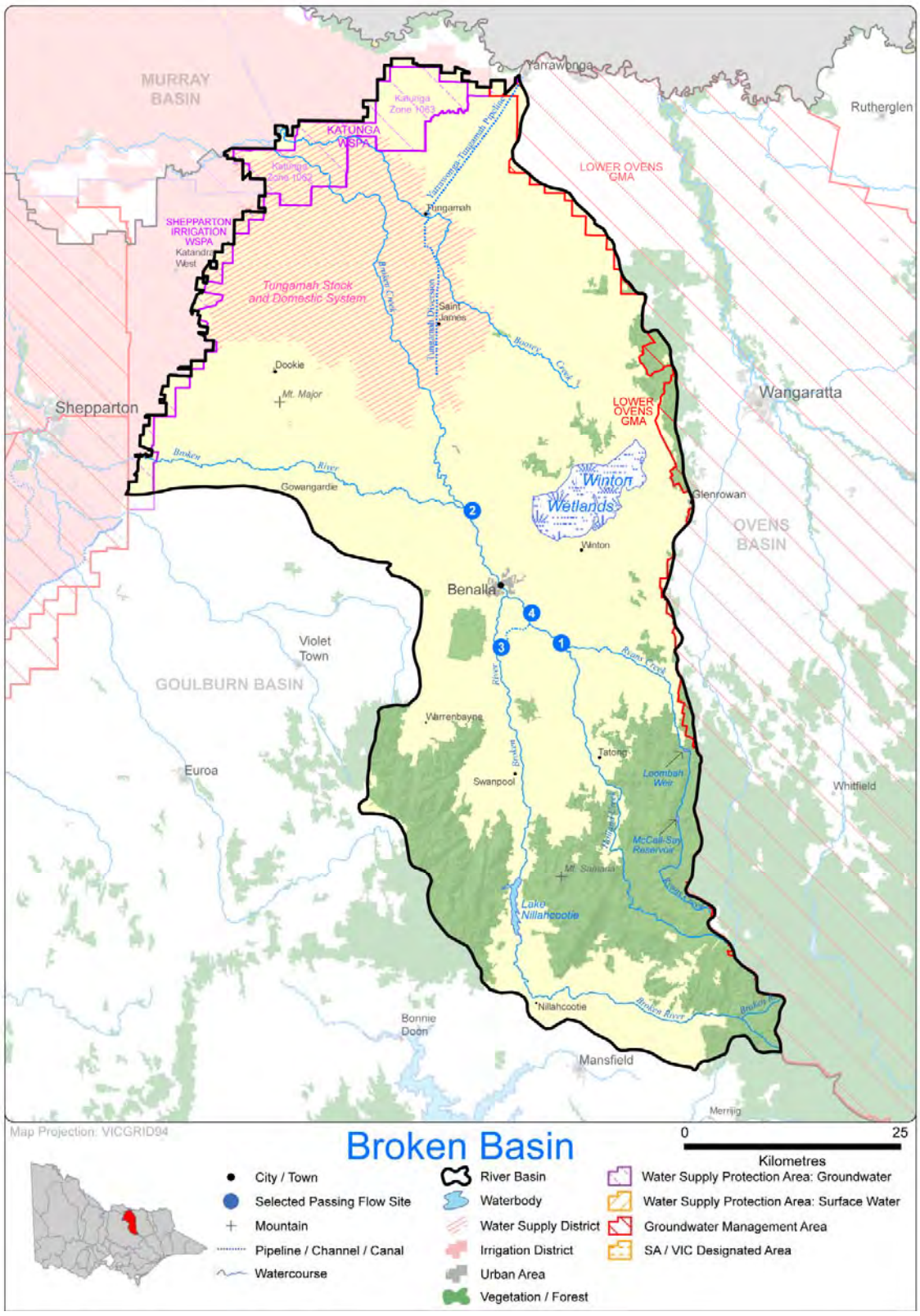
(2) 'Within process' refers to water reused in sewage treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(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 2011–12, rainfall across the Broken basin ranged from 80% of the long-term average in the upper catchment to 150% in the lower catchment. Total catchment inflows were 152% of the long-term average, making it the second consecutive year of above-average inflows. The amount of water flowing from the Broken basin into the Murray River represented 90% of the total inflows into the basin in 2011–12.

Storage levels at Lake Nillahcootie remained high throughout 2011–12. The year began with an 18% allocation for high reliability water shares for Broken system irrigators. By mid-September, high reliability water shares had increased to 100%, with 10% for low reliability water shares. Low reliability shares also reached 100% by December.

A ban was in place for private diverters on Boosey Creek during July 2011 and also throughout the summer months, however diversions from all other streams in the Broken basin were unrestricted. The total volume of licensed diversions from unregulated streams was more than three times the volume diverted in 2010–11. There were no restrictions on urban water use in the Broken basin during 2011–12.

Groundwater use in the Katunga WSPA was limited to 70% of the licensed entitlement volume in 2011–12. Goorambat's bore level improved to its highest level in three years after local flooding in the region.

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

Table 6.5-1 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 the Tungamah domestic and stock supply system	Manages groundwater and surface water 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). So too do 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 2011–12, 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 2011–12. A total of 10,386 ML was delivered to Broken Creek to provide elevated baseflows to support native fish habitat in the lower Broken Creek, and 51 ML was delivered to the Broken River to supplement natural fresh flows.

6.5.2 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Broken basin are shown in Table 6.5-2.

Table 6.5-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	475,070	20,204
Groundwater	5,291	1,733
Recycled water	318	318

6.5.3 Surface water resources

6.5.3.1 Water balance

A surface water balance for the Broken basin is shown in Table 6.5-3.

Table 6.5-3 Balance of surface water in the Broken basin

Water account component	2011–12 (ML)[1]
Major on-stream storage	
Volume in storage at start of year	42,423
Volume in storage at end of year	42,245
Change in storage	**(178)**
Inflows	
Catchment inflow[2]	469,470
Rainfall on major storages	5,600
Total inflows	**475,070**
Outflows	
Diversions	
Urban diversions	1,206
Licensed diversions from regulated streams	2,937
Licensed diversions from unregulated streams	323
Small catchment dams	15,738
Total diversions	***20,204***
Losses	
Evaporation losses from major storages	4,600
Evaporation from small catchment dams	7,227
In-stream infiltration to groundwater, flows to floodplain and evaporation	21,833
Total losses	***33,660***
Water passed at outlet of basin	
Broken River at Gowangardie to Goulburn basin	279,712
Boosey Creek at Tungamah to Murray basin	89,324
Broken Creek at Katamatite to Murray basin	52,348
Total water passed at outlet of basin	***421,384***
Total outflows	**475,248**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

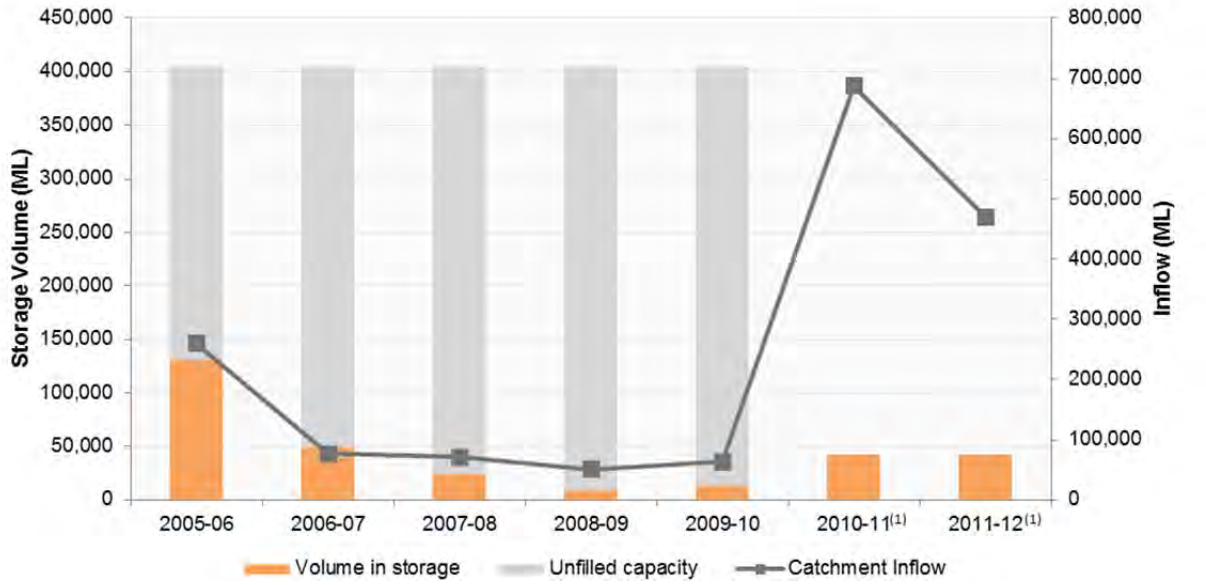
6.5.3.2 Storages and flows

The volume of water held in major storages in the Broken basin was 42,245 ML at the end of June 2012, very similar to the total storage volume at the start of the year (Figure 6.5-2). This total includes Lake Nillahcootie and Loombah-McCall Say Reservoir.

Catchment Inflows were 152% of the long-term average of 308,000 ML, representing a decrease compared to the volume of inflows in 2010–11 (Figure 6.5-2).

The amount of water flowing from the Broken basin into the Murray River increased to 421,420 ML in 2011–12. This represented 90% of the Broken basin's total inflows, compared to 86% in 2010–11.

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.

6.5.3.3 Volume diverted

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.

Goulburn–Murray Water and North East Water's diversions for 2011–12 under these bulk entitlements are presented in Table 6.5-4. 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 MDBA's Water Audit Monitoring Report.

Table 6.5-4 Bulk entitlement volumes and diversions

Bulk entitlement	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
Goulburn–Murray Water				
Broken River System[(1)]	1	22,955	0	2,937
North East Water				
Loombah-McCall Say (Benalla)	1	2,324	0	1,206
Tungamah, Devenish and St. James[(2)(3)]	1	135	0	0
2011–12 Total		**25,279**	**0**	**4,143**
2010–11 Total		25,469	0	1,648

Notes:

(1) Under this bulk entitlement, Goulburn–Murray Water operates Lake Nillahcootie to supply water share holders in the regulated part of the Broken system, and to supply water to North East Water's bulk entitlement for the townships of Tungamah, Devenish and St James.

(2) North East Water's Tungamah, Devenish, St James bulk entitlement is omitted from the the totals for Bulk Entitlement Volume and Volume Diverted as the entitlement volume and volume diverted are already accounted under Goulburn–Murray Water's Broken River System bulk entitlement.

(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 2011–12 these towns continued to be supplied water via a pipeline from Yarrawonga in the Murray system.

Licence holders diverted a greater volume of water from unregulated streams in 2011–12 compared to 2010–11 (Table 6.5-5). Diversions were considerably lower than the total licence volume.

Table 6.5-5 Volume of licensed diversions from regulated and unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**12,357**	**323**
2010–11	12,085	100

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).

Table 6.5-6 Estimated small catchment dam information

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**

6.5.4 Groundwater resources

The Broken basin contains a small part of the Katunga WSPA, representing 9% of the WSPA by surface area. Groundwater resources supply licences, domestic and stock use and also the town of Goorambat.

Licensed groundwater entitlements and use for the GMUs in the Broken basin are shown in Table 6.5-7. These volumes may include domestic and stock usage where it is part of an existing licence. The Katunga WSPA Management Plan sets the allocation as a percentage of the licensed entitlement based on the average annual use over the preceding five years. For 2011–12 the allocation was set to the maximum value of 70% of licensed entitlement.

It should be noted that the licensed entitlement volume exceeded the limit set in the management plan; the PCV for Katunga allowed additional licensed entitlements to be issued under the Dairy Shed Water Licence Transition Program. The volume extracted from the Katunga WSPA in 2011–12 was significantly greater than that extracted in 2010–11.

Table 6.5-7 Licensed groundwater volumes

WSPA/GMA[1]	GMA/ WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Katunga WSPA (9%)	>25	3,613	5,161	1,603	0	1,603	993
Total		**3,613**	**5,161**	**1,603**	**0**	**1,603**	**993**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water in this table represents the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit.

An estimate of domestic and stock groundwater use is provided in Table 6.5-8. A number of licensed groundwater allocations also incorporate domestic and stock use, and the estimated use for these bores is included in the licensed volume in Table 6.5-7.

Table 6.5-8 Number of domestic and stock bores and estimated use

WSPA/GMA	Number of domestic and stock bores	Estimated domestic and stock use (assuming 2 ML per bore) (ML)
Katunga WSPA (9%)	65	130
Total	**65**	**130**

Groundwater is available as an urban water supply for Goorambat in the Broken basin. The licensed entitlements and metered use for this supply are provided in Table 6.5-9.

Table 6.5-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Goorambat	24	13	14
Total	**24**	**13**	**14**

6.5.5 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 198 ML in 2010–11 to 318 ML in 2011–12. As in 2010–11, 100% of the wastewater produced in 2011–12 was recycled. Table 6.5-10 below details the recycling undertaken at Benalla in 2011–12.

Table 6.5-10 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]		
Benalla	318	318	100%	0	318	0	0	0	0
Total 2011–12	**318**	**318**	**100%**	**0**	**318**	**0**	**0**	**0**	**0**
Total 2010–11	198	198	100%	0	198	0	0	0	0

Notes:

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

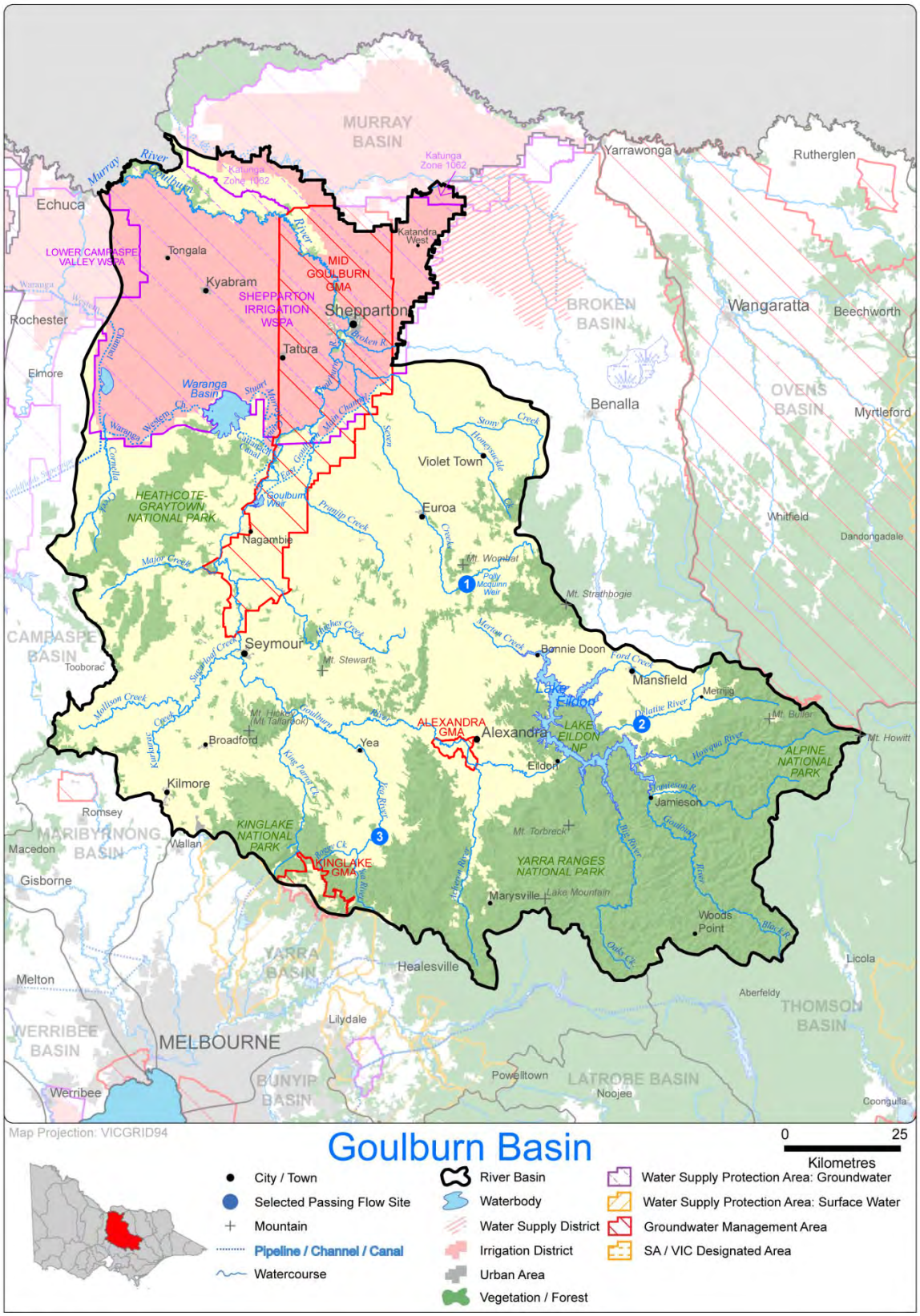
(2) 'Within process' refers to water reused in sewage treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(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 2011–12, rainfall across the Goulburn basin ranged between 100% and 125% of the long-term average. Catchment inflows were 86% of the long-term average, significantly lower than 2010–11 when inflows were 172% of the average. The amount of water flowing from the Goulburn basin into the Murray River represented 64% of the total inflows into the basin.

The volume of water in major storages in the Goulburn basin started the year at 87% of capacity and ended the year slightly higher, at 90% of capacity.

The seasonal allocation for high reliability water shares started at 48%, and reached 100% in October. The was no allocation for low reliability water shares in 2011–12.

Towns in the Goulburn basin were not subject to urban water restrictions during the year.

The volume of surface water diversions in 2011–12 was significantly higher than the previous year. The volume of groundwater extractions also increased.

Extractions from the Katunga WSPA were limited to 70% of licensed entitlement volume in 2011–12.

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

Table 6.6-1 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 Central Goulburn Irrigation District, Rochester Irrigation Area, Shepparton Irrigation Area	Manages private groundwater pumping and 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 2011–12, the Goulburn basin EWR comprised:

- the Goulburn River – Living Murray Environmental Entitlement 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 system – Snowy Environmental Reserve bulk entitlement of 16,812 ML held by the VEWH
- the Goulburn River Environmental Entitlement 2010 of 1,432 ML
- the Goulburn River – Environmental Water Reserve 2010
- the Goulburn Environmental Water Savings Supply Deed, which is the instrument to which Northern Victoria Irrigation Renewal Project (NVIRP) Stage 1 savings and mitigation water are allocated before the completion of the program
- 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, 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 2011–12. A total of 133,939 ML was delivered to complement natural flows and provide refuge to aquatic animals in the Murray River that were at risk from blackwater entering from the Murrumbidgee River.

6.6.2 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Goulburn basin are shown in Table 6.6-2. A 1,691 ML portion of the recycled water resource presented in Table 6.6-2 was discharged from treatment plants in the Goulburn basin back into the Goulburn waterways (see section 6.6.5). This amount is also included in the volume reported as 'treated wastewater discharged back to river' in Table 6.6-3, therefore it is included as both a surface water resource and recycled water resource in Table 6.6-2.

Table 6.6-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	3,303,818	1,062,275
Groundwater	142,825	22,053
Recycled water	7,856	6,165

6.6.3 Surface water resources

6.6.3.1 Water balance

A surface water balance for the Goulburn basin is shown in Table 6.6-3.

Table 6.6-3 Balance of surface water in the Goulburn basin

Water account component	2011–12 (ML)[1]
Major on-stream storage	
Volume in storage at start of year	2,938,806
Volume in storage at end of year	3,024,175
Change in storage	85,369
Inflows	
Catchment inflow[2]	2,890,919
Rainfall on major storages	130,180
Inflow from Broken River at Gowangardie	279,712
Return flow from irrigation	0
Goulburn River to Campaspe River via Waranga Western Channel	1,101
Treated wastewater discharged back to river	1,905
Total inflows	3,303,818
Outflows	
Diversions	
Urban diversions	22,495
Irrigation district diversions	965,842

Water account component	2011–12 (ML)[1]
Licensed diversions from regulated streams	15,507
Licensed diversions from unregulated streams	9,818
Silver and Wallaby creeks to Yarra basin	1,100
Transfers to Melbourne via North-South pipeline[3]	0
Environmental water diversions	0
small catchment dams	47,513
Total diversions	***1,062,275***
Losses	
Evaporation losses from major storages	109,178
Losses from small catchment dams	10,065
In-stream infiltration to groundwater, flows to floodplain and evaporation	147,720
Total losses	***266,963***
Water passed at outlet of basin	
Goulburn River to Campaspe River via Waranga Western Channel	945
Goulburn River outflow to Murray River	1,876,930
Goulburn River outflow to Murray River via Broken Creek	11,336
Total water passed at outlet of basin	***1,889,211***
Total outflows	3,218,449

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

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

6.6.3.2 Storages and flows

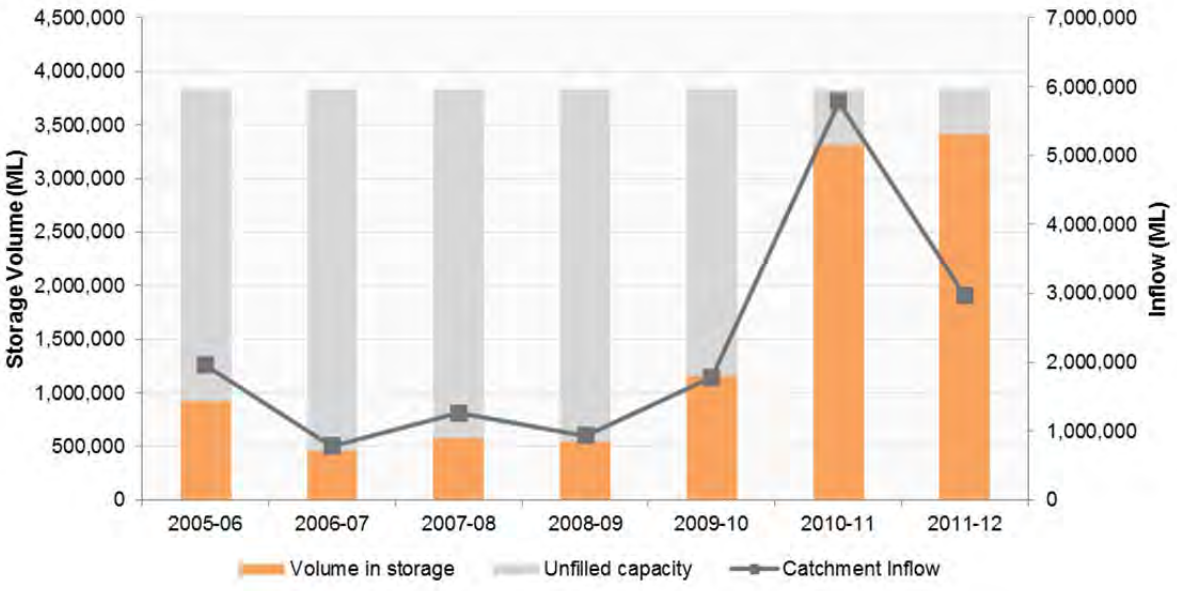
Levels for all major storages in the basin were 3,024,175 ML at the end June 2012, or 90% of the total storage capacity, compared to 2,938,806 ML at the start of July 2011 (Figure 6.6-2).

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.

Inflows to the Goulburn basin in 2011–12 were 86% of the long-term average, significantly lower compared to 2010–11, which were 172% of the long-term average (Figure 6.6-2).

The amount of water flowing from the Goulburn basin into the Murray River decreased to 1,888,266 ML in 2011–12. This represented 64% of the total inflows into the Goulburn basin, an increase from 60% in 2010–11.

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



6.6.3.3 Volume diverted

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.

The VEWH holds several environmental entitlements in the Goulburn basin. The water available is used to support streamflows and is not diverted out of the waterway.

Diversions under bulk entitlements for 2011–12 are presented in Table 6.6-4. 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 MDBA's *Water Audit Monitoring Report*.

Table 6.6-4 Bulk entitlement volumes and diversions

Bulk entitlement[1]	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
Goulburn–Murray Water				
Eildon–Goulburn Weir[2]	10	1,919,000	0	1,001,873
Coliban Water[3]				
Boort	1	425	0	158
Dingee	1	50	0	12
Lockington	1	130	0	78
Macorna	1	40	0	4
Mitiamo	1	60	0	26
Mysia	1	15	0	1
Pyramid Hill	1	300	0	97
Rochester	1	1,400	0	1,138
Goulburn Valley Water				
Alexandra[3]	1	931	(350)	511
Bonnie Doon[3]	1	112	(50)	56
Broadford, Kilmore and Wallan	10	2,238	0	620
Buxton	1	110	0	0
Colbinabbin[3]	1	89	(50)	20
Corop[3]	1	44	(50)	8
Dookie[3]	1	160	0	85
Eildon[3]	1	471	(386)	20
Euroa System	1	1,990	0	572
Girgarre[3]	1	100	(50)	41
Katandra West[3]	1	64	(50)	35
Kyabram[3]	1	2,000	(600)	1,334
Longwood	1	120	0	44
Mansfield	2	1,300	0	295
Marysville	1	462	0	155
Mooroopna[3]	1	300	(100)	115
Murchison[3]	1	350	(100)	176
Nagambie[3]	1	825	(200)	534
Pyalong	1	75	0	31
Rushworth[3]	1	530	(200)	250
Seymour[3]	1	5,340	(3,300)	1,888
Shepparton[3]	1	17,970	(6,900)	11,054
Stanhope[3]	1	200	(100)	79
Strathbogie[4]	1	23	0	9
Tatura[3]	1	2,600	(100)	2,146
Thornton	1	120	0	0
Tongala[3]	1	1,404	(700)	591
Upper Delatite	1	235	0	52
Violet Town	1	20	0	-
Woods Point	1	30	0	10

Bulk entitlement[1]	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
Yea	1	438	0	177
GWMWater				
Quambatook[3]	1	100	0	73
Melbourne metropolitan retailers				
Silver and Wallaby Creek	3	22,000	0	1,100
AGL Hydro Ltd				
Rubicon – Southern Hydro Ltd[5]	1	0	0	0
2011–12 Total		**1,948,161**	**(13,286)**	**1,004,938**
2010–11 Total		1,948,138	(16,121)	522,429

Notes:

(1) This table does not include bulk entitlements and environmental entitlements held by the VEWH. Water available under VEWH entitlements in the Goulburn basin is used to support streamflows and is not diverted out of the waterway.

(2) 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.

(3) These bulk entitlements are not included in the totals for Bulk Entitlement Volume and Volume Diverted as the entitlement volume and volume diverted is already accounted under G-MW's Eildon-Goulburn Weir bulk entitlement.

(4) Goulburn Valley Water was granted a bulk entitlement conversion Order in May 2012 for supply from Seven Creeks to the township of Strathbogie.

(5) 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.

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.

Table 6.6-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**47,096**	**9,818**
2010–11	47,369	3,000

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

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

6.6.4 Groundwater resources

The Goulburn basin contains the Alexandra GMA and Mid-Goulburn GMA, as well as parts of the Shepparton WSPA, Katunga WSPA and Kinglake GMA. Groundwater levels in this basin are generally categorised as stable to declining. Groundwater resources supply licences and domestic and stock use in the area. Groundwater is not used to supplement surface water supplies to urban customers in the Goulburn basin.

A summary of the licensed entitlements and use from GMUs within the Goulburn basin is presented in Table 6.6-7. These volumes may include domestic and stock usage where it is part of an existing licence. Extractions from the Katunga WSPA were limited to 70% of licensed entitlement volume in 2011–12.

Reported groundwater usage in the Goulburn basin increased significantly in 2011–12 compared to 2010–11, largely due to increased extraction in the Mid-Goulburn GMA, Katunga GMA and Shepparton WSPA.

Table 6.6-7 Licensed groundwater volumes

WSPA/GMA[1]	GMA/WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Alexandra GMA (100%)	All depths	1,937	1,714	127	0	127	138
Kinglake GMA (78%)	All depths	1,569	1,441	117	0	117	110
Mid-Goulburn GMA (100%)	Zone 1070: >25 Zone 1071: All depths	14,900	12,506	2,180	0	2,180	895
Katunga WSPA (12%)[3]	>25	4,868	6,954	2,159	0	2,159	1,338
Shepparton WSPA (57%)	≤25	117,097	117,097	14,358	0	14,358	9,557
Total		**140,371**	**139,713**	**18,941**	**0**	**18,941**	**12,037**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit. The entitlement limit in the Katunga WSPA is represented by 70% PCV due to restrictions in place in 2011–12.

(3) PCV exceeded due to the issue of entitlement under the Dairy Shed Water Licence Transition Program. PCV to be amended.

An estimate of domestic and stock groundwater use is provided in Table 6.6-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.6-7.

Table 6.6-8 Number of domestic and stock bores and estimated use

WSPA/GMA	Number of domestic and stock bores	Estimated domestic and stock use (assuming 2 ML per bore) (ML)
Alexandra GMA (100%)	18	36
Kinglake GMA (78%)	199	397
Mid Goulburn GMA (100%)	181	362
Katunga WSPA (12%)	88	175
Shepparton WSPA (57%)	1,071	2,141
Total	**1,556**	**3,111**

6.6.5 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, an increase of 40% compared to 2010–11. The percentage of wastewater that was recycled varied at each treatment plant. In addition to the recycled water reported below, 214 ML was returned from the Mount Bulla Resort to Black Dog Creek and other waterways during the water year.

Table 6.6-9 shows the volumes of water recycled in the Goulburn basin in 2011–12.

Table 6.6-9 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	244	55	23%	0	55	0	0	189	0
Avenel	22	22	100%	0	22	0	0	0	0
Bonnie Doon	31	31	100%	0	31	0	0	0	0
Broadford	109	109	100%	0	109	0	0	0	0
Eildon	170	0	0%	0	0	0	0	170	0
Euroa	179	179	100%	40	138	0	0	0	0
Girgarre	3	3	100%	0	3	0	0	0	0
Kilmore	359	275	77%	0	275	0	0	84	0
Kyabram/Merrigum	360	360	100%	0	360	0	0	0	0
Mansfield	231	114	49%	44	70	0	0	117	0
Marysville	94	94	100%	29	65	0	0	0	0
Mooroopna	499	499	100%	0	499	0	0	0	0
Murchison	0	0	0%	0	0	0	0	0	0
Nagambie	61	61	100%	0	61	0	0	0	0
Seymour	558	558	100%	44	514	0	0	0	0
Shepparton	3,335	2,566	77%	0	2,566	0	0	769	0
Stanhope/Rushworth	43	43	100%	0	43	0	0	0	0
Tatura	1,213	851	70%	0	851	0	0	362	0
Tongala	196	196	100%	0	196	0	0	0	0
Upper Delatite	17	17	100%	0	17	0	0	0	0
Violet Town	30	30	100%	0	30	0	0	0	0
Yea	103	103	100%	26	76	0	0	0	0
Total 2011–12	**7,856**	**6,165**	**78%**	**184**	**5,981**	**0**	**0**	**1,691**	**0**
Total 2010–11	9,745	3,746	38%	100	3,646	0	0	6,000	0

Notes:

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

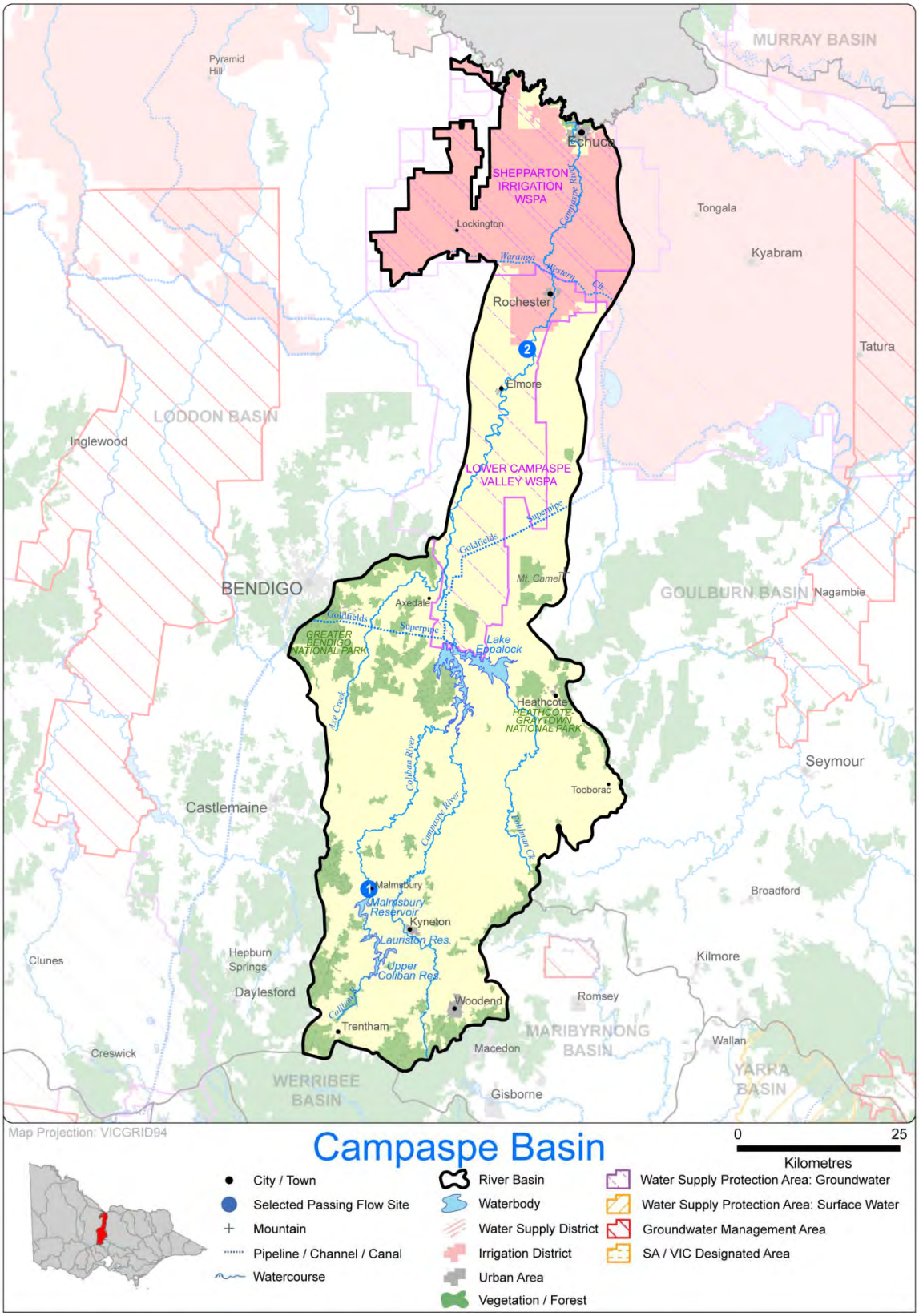
(2) 'Within process' refers to the water reused in sewage treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(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 2011–12 generally ranged from 100% to 125% of the long-term average, in contrast to the previous year when rainfall was up to 300% of the average. In line with the lower rainfall, the catchment inflow volume also decreased to 44% of the long-term average, compared to double the average volume in 2010–11.

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 97% of capacity at the start of the year and 88% at the end of June 2012.

Woodend, which is supplied from the Melbourne supply system, was the only town in the Campaspe basin that was subject to urban restrictions during 2011–12. Restrictions were eased from Stage 2 to Stage 1 in December, in line with the Melbourne supply system.

Allocations for high reliability water shares in the Campaspe system started the year at 100%, and low reliability water shares reached 100% allocation by October 2011.

A number of streams in the basin were subject to restrictions on licensed diversions during the summer months, but were mostly unrestricted for the rest of the year.

Groundwater use increased sharply in 2011–12, with more than double the volume of groundwater used compared to the previous year. Extractions from the Lower Campaspe Valley WSPA were restricted to 75% of licensed entitlement volume.

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

Table 6.7-1 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 Rochester irrigation district and Campaspe irrigation district	Manages groundwater and surface water 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 2011–12, the Campaspe basin EWR comprised:

- the Environmental Entitlement (Campaspe River – Living Murray Initiative) 2007
- 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 2011–12. A total of 6,532 ML of water was delivered to provide connectivity for fish movement, promote river red gum recruitment and support aquatic habitat for macroinvertebrates.

6.7.2 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Campaspe basin are shown in Table 6.7-2. The volume of available surface water in 2011–12 was lower than in 2010–11 (189,689 ML compared to 853,300 ML). Total groundwater usage in the Campaspe basin increased in 2011–12 compared to 2010–11. A 652 ML portion of the recycled water resource presented in Table 6.7-2 was discharged from treatment plants in the Campaspe basin back into the Campaspe waterways (see section 6.7.5). This amount is also included in the volume reported as 'treated wastewater discharged back to river' in Table 6.7-3, therefore this volume is included as both a surface water resource and recycled water resource in Table 6.7-2.

Table 6.7-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	185,396	58,835
Groundwater	66,204	16,760
Recycled water	2,554	1,942

6.7.3 Surface water resources

6.7.3.1 Water balance

A surface water balance for the Campaspe basin is shown in Table 6.7-3.

Table 6.7-3 Balance of surface water in the Campaspe basin

Water account component	2011–12 (ML)[1]
Major on-stream storage	
Volume in storage at start of year	362,316
Volume in storage at end of year	330,507
Change in storage	**-31,809**
Inflows	
Catchment inflow[2]	155,699
Rainfall on major storages	26,439
Return flow from irrigation	0
Transfer from Waranga Western Channel to Lake Eppalock	1,661
Transfer to Campaspe basin from Waranga Western Channel	945
Treated wastewater discharged back to river	652
Total inflows	**185,396**
Outflows	
Diversions	
Urban diversions	12,617
Coliban Channel rural diversions	2,599
Campaspe irrigation district diversions	8,917
Licensed diversions from regulated streams	4,256
Licensed diversions from unregulated streams	460
Small catchment dams	28,776
Transfer from Campaspe basin to Western Waranga Channel	1,101
Transfer from Campaspe Basin to White Swan Reservoir	110
Total diversions	***58,835***
Losses	
Evaporation losses from major storages	45,905
Losses from small catchment dams	14,794
In-stream infiltration to groundwater, flows to floodplain and evaporation	6,505
Total losses	***67,204***
Water passed at outlet of basin	
Campaspe River outflow to Murray River	91,165
Total water passed at outlet of basin	***91,165***
Total outflows	**217,205**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

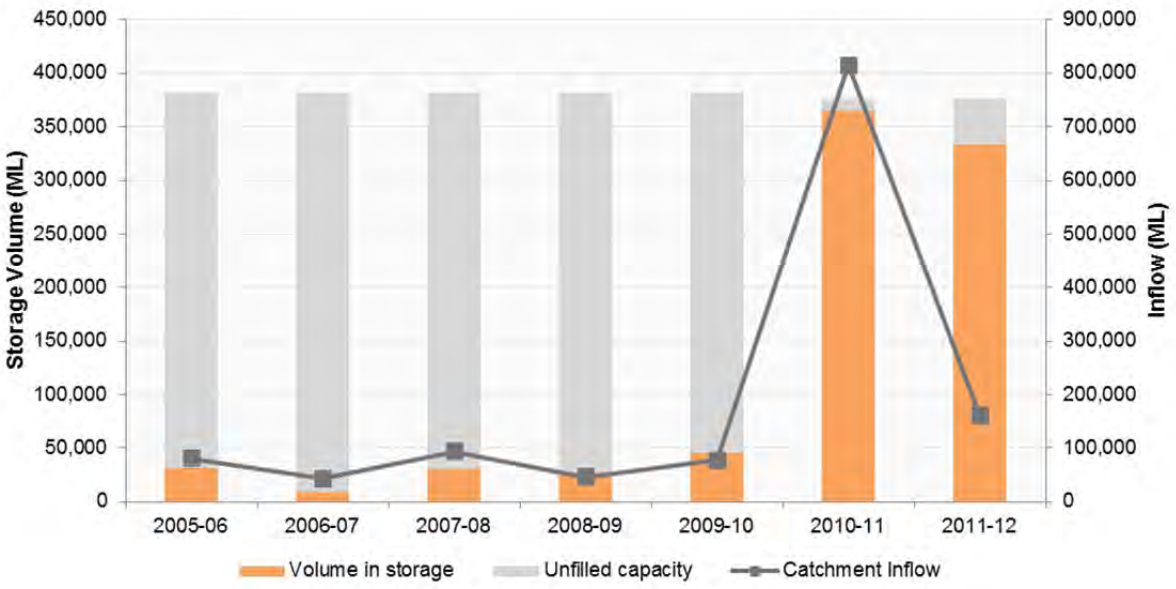
(2) Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, and the known inflows and net change in storage volume.

6.7.3.2 Storages and flows

Levels for all major storages in the basin totalled 333,162 ML (88% of capacity) by the end of June 2012 compared to 365,001 ML (97% of capacity) in July 2011 (Figure 6.7-2). In the Campaspe basin, major on-stream storages include the Upper Coliban, Lauriston and Malmsbury reservoirs and Lake Eppalock.

Inflows to the Campaspe basin amounted to 155,699 ML in 2011–12 which is 44% of the long-term average (352,000 ML). This is a significan decrease from 2010–11 when inflows were more than double the long-term average (Figure 6.7-2). The amount of water flowing from the Campaspe basin into the Murray River in 2011–12 was 91,165, representing 57% of the total inflows into the basin.

Figure 6.7-2 All major storages and catchment inflows



6.7.3.3 Volume diverted

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.

The Victorian Environmental Water Holder (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.

Diversions under bulk entitlements for 2011–12 are presented in Table 6.7-4. 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 MDBA's *Water Audit Monitoring Report.*

Table 6.7-4 Bulk entitlement volumes and diversions

Bulk entitlement[1]	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
Goulburn–Murray Water				
Campaspe System[2]	10	83,590	0	13,219
Coliban Water				
Axedale and Goornong[3]	1	215	0	46
Part Rochester[4]	10	134	0	0
Trentham[5]	3	120	0	88
Campaspe System – Coliban Water	3	50,260	0	14,193
Western Water				
Woodend	1	470	0	389
2011–12 Total		**134,574**	**0**	**27,889**
2010–11 Total		134,454	0	20,549

Notes:

(1) This table does not include bulk entitlements and environmental entitlements held by the VEWH. Water available under VEWH entitlements in the Campaspe basin is used to support streamflows and is not diverted out of the waterway.

(2) 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.

(3) Coliban Water's Axedale and Goornong bulk entitlement is omitted from the 2011–12 Total as the entitlement volume and volume diverted are already accounted under Goulburn–Murray Rural Water's Campaspe System bulk entitlement.

(4) Coliban Water also supplies Rochester under a bulk entitlement in the Goulburn system but did not take any water under this bulk entitlement in 2011–12.

(5) Coliban Water was granted a bulk entitlement conversion order in April 2012 for supply to Trentham.

The total volume of water diverted from unregulated streams by licence holders was greater in 2011–12 compared to 2010–11, and was significantly below the total licence volume in both years (Table 6.7-5).

Table 6.7-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**7,508**	**460**
2010–11	9,162	100

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

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.

6.7.4 Groundwater resources

The Campaspe basin contains part of the Lower Campaspe Valley WSPA and part of the Shepparton WSPA. Groundwater resources supply licences and domestic and stock use in the area and the towns of Elmore and Trentham. Goulburn–Murray Water is preparing the Central Victoria Mineral Springs Management Plan, expected to be completed in 2013, for the upper part of the Campaspe catchment upstream of Lake Eppalock, including the Coliban River.

A summary of the licensed entitlements and use from GMUs within the Campaspe basin, excluding domestic and stock use, is presented in Table 6.7-7. These volumes may include domestic and stock usage where it is part of an existing licence. Extractions from the Lower Campaspe Valley WSPA were restricted to 75% of allocation in 2011–12. Groundwater levels in Lower Campaspe Valley WSPA are increasing while levels in Shepparton WSPA are declining.

Table 6.7-7 Licensed groundwater volumes

WSPA/GMA[1]	GMA/WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Lower Campaspe Valley WSPA (72%)	All depths	32,188	40,603	12,602	0	12,602	6,171
Shepparton WSPA (12%)	≤25	24,440	24,440	2,997	0	2,997	1,995
Total		**56,628**	**65,043**	**15,599**	**0**	**15,599**	**8,167**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit. The entitlement limit in the Lower Campaspe Valley WSPA is represented by 75% PCV due to restrictions in place in 2011–12.

An estimate of domestic and stock groundwater use is provided in Table 6.7-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.7-7.

Table 6.7-8 Number of domestic and stock bores and estimated use

WSPA/GMA	Number of domestic and stock bores	Estimated domestic and stock use (assuming 2 ML per bore) (ML)
Lower Campaspe Valley WSPA (72%)	357	714
Shepparton WSPA (12%)	223	447
Total	**580**	**1,161**

In the Campaspe basin, groundwater is used as an urban water supply for the townships of Elmore and Trentham. The licensed entitlements and metered use for these groundwater supplies are provided in Table 6.7-9.

Table 6.7-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Elmore	284	123	104
Trentham	48	0	0
Total	**332**	**123**	**104**

6.7.5 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 76% of the wastewater discharged from treatment plants in the basin was recycled, mostly for agricultural use (Table 6.7-10).

Table 6.7-10 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]		
Axedale	7	7	100%	7	0	0	0	0	0
Echuca	1,382	1,382	100%	0	1,382	0	0	0	0
Elmore	0	0	0%	0	0	0	0	0	0
Heathcote	147	147	100%	147	0	0	0	0	0
Kyneton	688	321	47%	92	229	0	0	367	0
Lockington	0	0	0%	0	0	0	0	0	0
Rochester	42	42	100%	0	42	0	0	0	0
Woodend	288	43	15%	8	34	0	1	285	(40)
Total 2011–12	**2,554**	**1,942**	**76%**	**254**	**1,687**	**0**	**1**	**652**	**(40)**
Total 2010–11	2,165	582	27%	92	482	0	7	1,598	(15)

Notes:

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

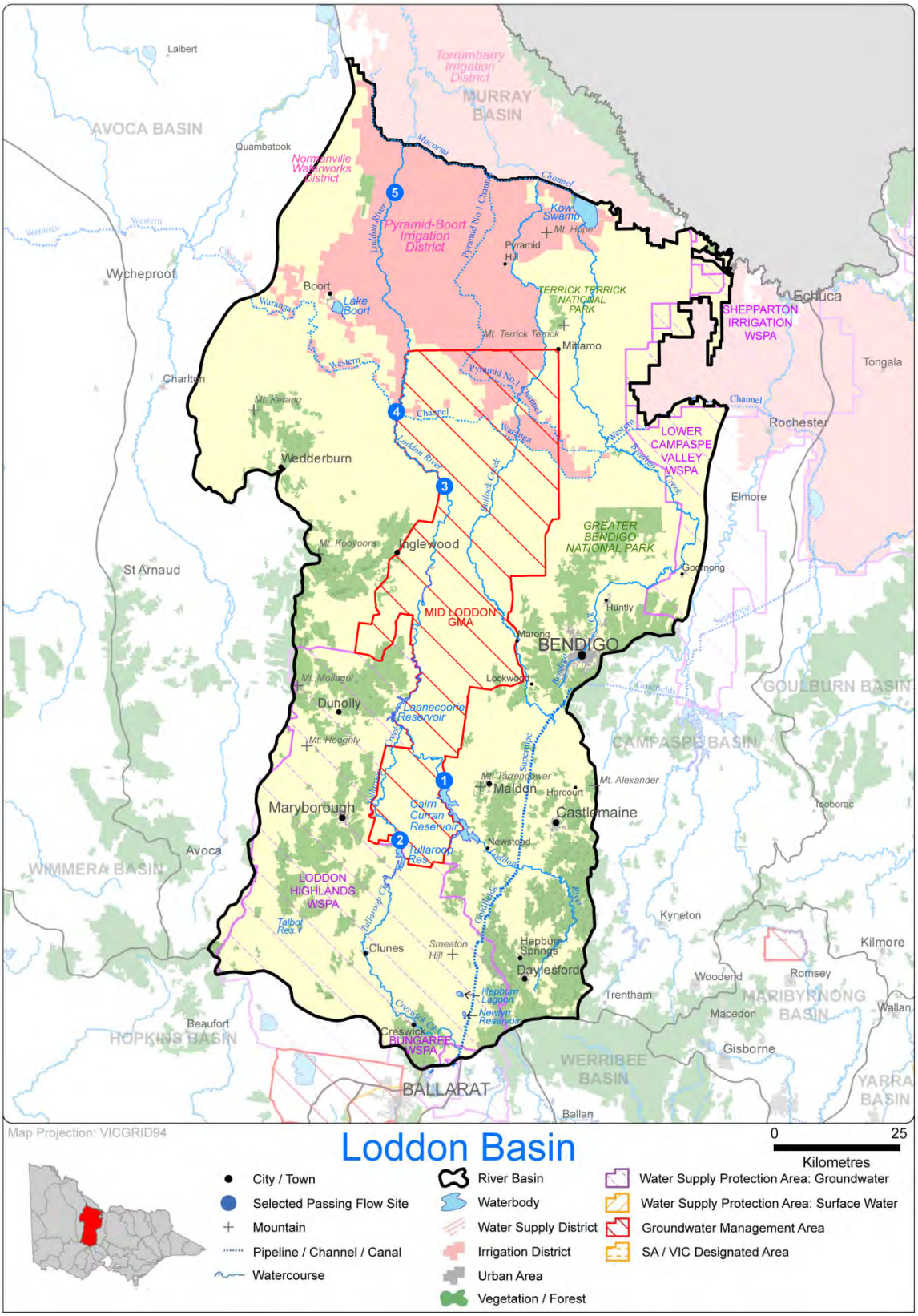
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(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 and various 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. 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 2011–12, rainfall across the Loddon basin ranged between 80% and 125% of the long-term average, in contrast to the previous year when rainfall was up to 300% of the average. In line with the lower rainfall, the catchment inflow volume also decreased to 52% of the long-term average, compared to more than five times the average in 2010–11.

The volume of water in major storages in the Loddon basin finished the year lower, with 91% of capacity at the start of the year and 85% by the end of June 2012.

Both the Loddon and Bullarook systems reached 100% allocations for high reliability water shares in 2011–12. The Bullarook system had a 100% allocation for low reliability entitlements, while the allocation for low reliability entitlements in the Loddon system remained at zero.

Bans on licensed diversions were in place for a number of streams during summer, with some continuing into autumn.

In 2011–12, the towns of Raywood and Sebastian were subject to Stage 3 restrictions while construction of a pipeline to connect the towns to the Bendigo water supply system continued. Towns supplied from the Forest Hill system had Stage 2 restrictions lifted at the end of September following the commissioning of new groundwater bores.

Groundwater usage in the basin increased significantly in 2011–12, with almost three times the volume of the previous year used. Groundwater accounted for approximately one-third of total water use in the basin. Extractions from the Lower Campaspe Valley WSPA were restricted to 75% of licensed entitlement volume.

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

Table 6.8-1 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 Pyramid-Boort irrigation district and domestic and stock supplies in Normanville area	Manages groundwater and surface water licensed diversions in the basin	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 2011–12, 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 1,564 ML of Commonwealth environmental water was traded into the Loddon basin in 2011–12 to support vegetation health and maintain water quality.

6.8.2 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Loddon basin are shown in Table 6.8-2.

Total surface water use in 2011–12 decreased slightly by 1,427 ML compared to 2010–11, while groundwater use increased by 13,391 ML. A 4,910 ML portion of the recycled water resource presented in Table 6.8-2 was discharged from the Bendigo and Castlemaine treatment plants back into the Loddon waterways (see section 6.8.5). This amount is also included in the volume reported as 'treated wastewater discharged back to river' in Table 6.8-3, therefore this volume is included as both a surface water resource and recycled water resource in Table 6.8-2.

Table 6.8-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	215,884	62,973
Groundwater	70,869	22,392
Recycled water	8,244	2,815

6.8.3 Surface water resources

6.8.3.1 Water balance

A surface water balance for the Loddon basin is shown in Table 6.8-3.

Table 6.8-3 Balance of surface water in the Loddon basin

Water account component	2011–12 (ML)[1]
Major on-stream storage	
Volume in storage at start of year	212,985
Volume in storage at end of year	200,771
Change in storage	**(12,214)**
Inflows	
Catchment inflow[2]	195,230
Rainfall on major storages	15,743
Treated wastewater discharged back to river	4,910
Total inflows	**215,884**
Outflows	
Diversions	
Urban diversions	3,387
Licensed diversions and irrigation diversions from regulated streams	5,344
Licensed diversions from unregulated streams	4,205
Small catchment dams	50,037
Total diversions	***62,973***
Losses	
Evaporation losses from major storages	34,959
Losses from small catchment dams	29,579
In-stream infiltration to groundwater, flows to floodplain and evaporation	26,979
Total losses	***91,517***
Water passed at outlet of basin	
Loddon River outflow to Murray River (Appin South)	44,789
Wandella Creek at Fairley	0
Mount Hope Creek at Mitiamo	23,869
Bullock Creek, Calivil and Nine Mile Creek	4,949
Total water passed at outlet of basin	***73,607***
Total outflows	**228,098**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

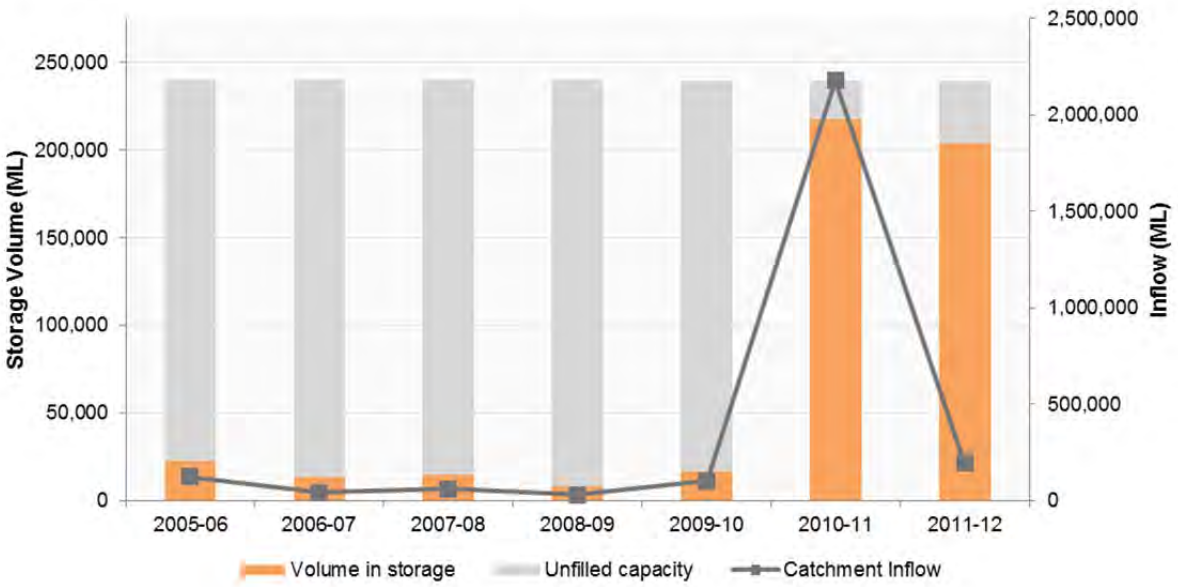
6.8.3.2 Storages and flows

The volume of water held in major storages was 203,564 ML (85% of capacity) at the end of June 2012 compared with 217,444 ML (91% of capacity) at the beginning of the year (Figure 6.8-2).

Only volumes for major on-stream storages have been included in the water balance; off-stream storages such as Spring Gully and Sandhurst Reservoir have not been included. The volume of water in the major on-stream storages in the basin (Newlyn, Tullaroop, Cairn Curran, Laanecoorie Reservoir and Hepburn Lagoon) was 200,771 ML at the end of the year, compared to 212,985 ML at the start. Cairn Curran Reservoir, which comprises nearly two-thirds of the storage capacity in the basin, finished the year with 131,391 ML in storage (89% of capacity).

Inflows were 52% of the long-term average (373,000 ML), which is significantly lower than 2010–11 when inflows were more than five times the long-term average (Figure 6.8-2). The amount of water flowing from the Loddon basin was 73,607 ML in 2011–12. This represents 38% of the total Loddon basin inflows.

Figure 6.8-2 All major storages and catchment inflows



6.8.3.3 Volume diverted

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

Diversions under bulk entitlements for 2011–12 are presented in Table 6.8-4. 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 MDBA's *Water Audit Monitoring Report.*

Table 6.8-4 Bulk entitlement volumes and diversions

Bulk entitlement[1]	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
Goulburn–Murray Water				
Bullarook System[2]	1	1,639	0	468
Loddon[3]	1	36,549	0	6,386
Central Highlands Water				
Bullarook System[4]	1	500	0	0
Creswick	1	500	0	3
Daylesford – Hepburn Springs	1	916	0	581
Lexton	1	45	0	21
Loddon System (part Maryborough)[4]	1	1,200	0	1,199
Evansford and Talbot System (part Maryborough)	1	3,000	0	1,221
Coliban Water				
Loddon system[4]	1	820	0	362
Total 2011–12		**42,649**	**0**	**8,681**
Total 2010–11		42,684	0	13,241

Notes:

(1) This table does not include bulk entitlements held by the VEWH. Any diversions out of the waterway under VEWH entitlements are discussed below.
(2) 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.
(3) 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.
(4) These bulk entitlements are omitted from the 2011–12 Total as the entitlement volume and volume diverted are already accounted for under Goulburn–Murray Water's Bullarook system bulk entitlement and Loddon system bulk entitlement.

The VEWH did not divert any water available under the Bulk Entitlement (Loddon River – Environmental Reserve) Order 2005 to off-stream wetlands in 2011–12. Water available under the entitlement was used to support streamflows in the Loddon River and Birch Creek.

The volume of water diverted from unregulated streams by licence holders in the Loddon basin showed a marked increase from 2010–11 to 2011–12 (Table 6.8-5) but was still significantly lower than the total licence volume.

Table 6.8-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**34,348**	**4,205**
2010–11	34,256	700

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

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	**72,379**	**50,037**	**79,616**

n/a: No information available.

6.8.4 Groundwater resources

The Loddon basin contains all of the Mid-Loddon GMA as well as part of Bungaree WSPA, Loddon Highlands WSPA and Lower Campaspe Valley WSPA. Goulburn–Murray Water is developing the Central Victoria Mineral Springs Management Plan, expected to be completed in 2013, for the Loddon River upstream of Cairn Curren reservoir, including the Coliban and highlands part of the Campaspe Rivers.

A summary of the licensed entitlements and use from GMUs within the Loddon basin are shown in Table 6.8-7. These volumes may include domestic and stock usage where it is part of an existing licence. Restrictions were imposed on management zone 1028 of the Lower Campaspe Valley WSPA in 2011–12. Allocation in the zone was set to the maximum value of 75% of licensed entitlement, extractions were therefore limited to 75% of licensed volume. Groundwater levels are generally increasing in GMUs in this area.

Table 6.8-7 Licensed groundwater volumes

WSPA/GMA[1]	GMA/ WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Bungaree WSPA (9%)[3]	All depths	485	484	180	0	180	67
Mid-Loddon GMA (100%)	All depths	37,200	34,036	11,128	0	11,128	2,738
Loddon Highlands WSPA (91%)	All depths	18,608	18,311	3,716	0	3,716	1,545
Lower Campaspe Valley WSPA (28%)	All depths	12,265	15,471	4,802	0	4,802	2,352
Total		**68,558**	**68,303**	**19,826**	**0**	**19,826**	**6,702**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.
(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit. The entitlement limit in the Lower Campaspe Valley WSPA is represented by 75% PCV due to restrictions in place in 2011–12.
(3) The licensed entitlement volume for Bungaree WSPA includes a 55 ML mineral water levy gazetted on 20 June 2009.

An estimate of domestic and stock groundwater use is provided in Table 6.8-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.8-7.

Table 6.8-8 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (ML)
Bungaree WSPA (9%)[1]	23	34
Mid-Loddon GMA (100%)[2]	382	764
Loddon Highlands WSPA (91%)[2]	748	1,496
Lower Campaspe Valley WSPA (28%)[2]	136	272
Total	**1,289**	**2,566**

Notes:
(1) Estimated domestic and stock use calculated using a factor of 1.5 ML per bore.
(2) Estimated domestic and stock use calculated using a factor of 2 ML per bore.

The licensed entitlements and metered use for urban groundwater supplies in the Loddon basin are provided in Table 6.8-9.

Table 6.8-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Clunes	698	175	155
Dean	30	15	21
Forest Hill	350	139	140
Learmonth	100	50	32
Maryborough	706	22	222
Smeaton	0	0	0
Waubra	100	28	23
Total	**1,984**	**429**	**592**

Notes:
(1) The town of Forest Hill is an amalgamation of the towns in the Forest Hill system (Forest Hill borefield), Allendale–Clunes and Spring Hill Supply System.
(2) Maryborough is supplied from two systems: the Moolort borefield and the Stoney Creek/Evansford borefield.

6.8.5 Recycled water

Coliban Water and Central Highlands Water operate wastewater treatment plants in the Loddon basin. The total volume of wastewater produced in 2011–12 was less than in 2010–11. The proportion of wastewater recycled in 2011–12 increased to 34%, compared to 21% in 2010–11. This is presented in Table 6.8-10.

Table 6.8-10 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]		
Bendigo	5,618	1,841	33%	1,105	736	0	0	3,777	0
Boort	28	28	100%	0	28	0	0	0	0
Bridgewater/ Inglewood	0	0	0%	0	0	0	0	0	0
Castlemaine	1,166	66	6%	66	0	0	0	1,100	0
Clunes	30	30	100%	0	30	0	0	0	0
Daylesford	353	353	100%	23	330	0	0	0	0
Dunolly	15	15	100%	0	15	0	0	0	0
Kerang	519	0	0%	0	0	0	0	0	519
Maryborough	471	438	93%	100	338	0	0	33	0
Pyramid Hill	0	0	0%	0	0	0	0	0	0
Wedderburn	44	44	100%	0	44	0	0	0	0
Total 2011–12	**8,244**	**2,815**	**34%**	**1,294**	**1,521**	**0**	**0**	**4,910**	**519**
Total 2010–11	8,585	1,761	21%	1,167	594	0	0	6,245	579

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

Both rainfall and catchment inflows were above the long-term averages in the East Gippsland basin in 2011–12. Rainfall ranged between 100% and 150% of the long-term average. Catchment inflows were 231% of the long-term annual average, more than double the volume of inflow in 2010–11. Consumptive use in the basin is generally very low compared to water availability, with almost 100% of inflows passed to Bass Strait in 2011–12.

Licensed diversions from unregulated streams decreased considerably compared to 2010–11, with use estimated at 10% of 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 from groundwater and surface water sources		
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 2011–12, 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 Total water resources in the basin

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, and only limited groundwater is extracted. The groundwater resource in Table 6.9-2 is provided for the town of Mallacoota and is supplied from groundwater located in an unincorporated area. A 12 ML portion of the recycled water resource presented in Table 6.9-2 was discharged from the Cann River treatment plant back into the East Gippsland waterways (see section 6.9.5). This amount is also reported as 'treated wastewater discharged back to river' in Table 6.9-3, therefore this volume is included as both a surface water resource and recycled water resource in Table 6.9-2.

Table 6.9-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	1,647,815	1,322
Groundwater	220	25
Recycled water	159	147

6.9.3 Surface water resources

6.9.3.1 Water balance

The surface water balance for the East Gippsland basin for 2011–12 is presented in Table 6.9-3.

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 in small catchment dams.

Table 6.9-3 Balance of surface water in the East Gippsland basin

Water account component	2011–12 (ML)[1]
Major on-stream storage	
Volume in storage at start of year	-
Volume in storage at end of year	-
Change in storage	-
Inflows	
Catchment inflow[2]	1,647,803
Rainfall on major storages	-
Treated wastewater discharged back to river	12
Total inflows	**1,647,815**
Outflows	
Diversions	
Urban diversions	156
Licensed diversions from unregulated streams	66
Small catchment dams	1,100
Total diversions	***1,322***
Losses	
Evaporation losses from major storages	-
Evaporation from small catchment dams	67
In-stream infiltration to groundwater, flows to floodplain and evaporation[3]	n/a
Total losses	***67***
Water passed at outlet of basin	
River outflows	1,646,426
Total water passed at outlet of basin	***1,646,426***
Total outflows	**1,647,815**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

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

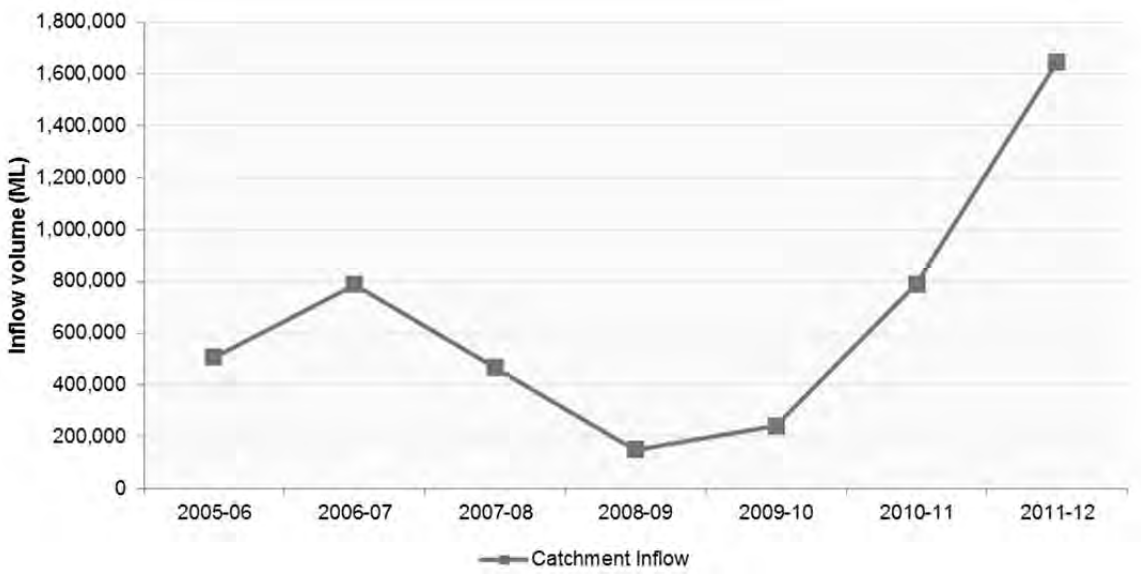
6.9.3.2 Storages and flows

Catchment inflows in 2011–12 were 231% of the long-term annual average of 714,000 ML. The year's inflows were more than two times the volume of 2010–11, which was 111% of the long-term average (Figure 6.9-2).

The amount of water flowing from the East Gippsland basin into Bass Strait was 1,646,426 ML in 2011–12, compared to 789,900 ML in 2010–11. 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



6.9.3.3 Volume diverted

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.

East Gippsland Water diverted a similar volume of surface water under its bulk entitlements in 2010–11 and 2011–12 (Table 6.9-4).

Table 6.9-4 Bulk entitlement volumes and diversions

Bulk entitlement	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
East Gippsland Water				
Bemm River	1	100	0	22
Cann River	1	192	0	32
Mallacoota	1	330	0	103
2011–12 Total	**-**	**622**	**0**	**156**
2010–11 Total	-	622	0	146

The volume of water diverted from unregulated streams by licence holders in the East Gippsland basin was considerably lower in 2011–12 compared to 2010–11 (Table 6.9-5).

Table 6.9-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**660**	**66**
2010–11	775	258

The estimated volume of water harvested from small catchment dams represents the largest diversion of water in the East Gippsland basin (Table 6.9-6).

Table 6.9-6 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**

6.9.4 Groundwater resources

There are no GMAs or WSPAs located within the East Gippsland basin. East Gippsland Water operates a groundwater bore in the East Gippsland basin for the town of Mallacoota with a licensed volume of 220 ML a year. In 2011–12, 25 ML was extracted from the bore, a significant decrease from the 46 ML extracted in 2010–11.

Table 6.9-7 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Mallacoota	220	25	46
Total	**220**	**25**	**46**

6.9.5 Recycled water

East Gippsland Water operates wastewater treatment plants at Mallacoota and Cann River. The volume of wastewater produced in 2011–12 increased, compared to 2010–11. All the wastewater was recycled for agricultural applications including pasture and tree plantations.

Table 6.9-8 shows the volumes of water recycled in the East Gippsland basin in 2011–12.

Table 6.9-8 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]		
Cann River	35	24	67%	0	24	0	0	12	0
Mallacoota	124	124	100%	0	124	0	0	0	0
Total 2011–12	**159**	**147**	**93%**	**0**	**147**	**0**	**0**	**12**	**0**
Total 2010–11	56	56	100%	0	56	0	0	0	0

Notes:

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

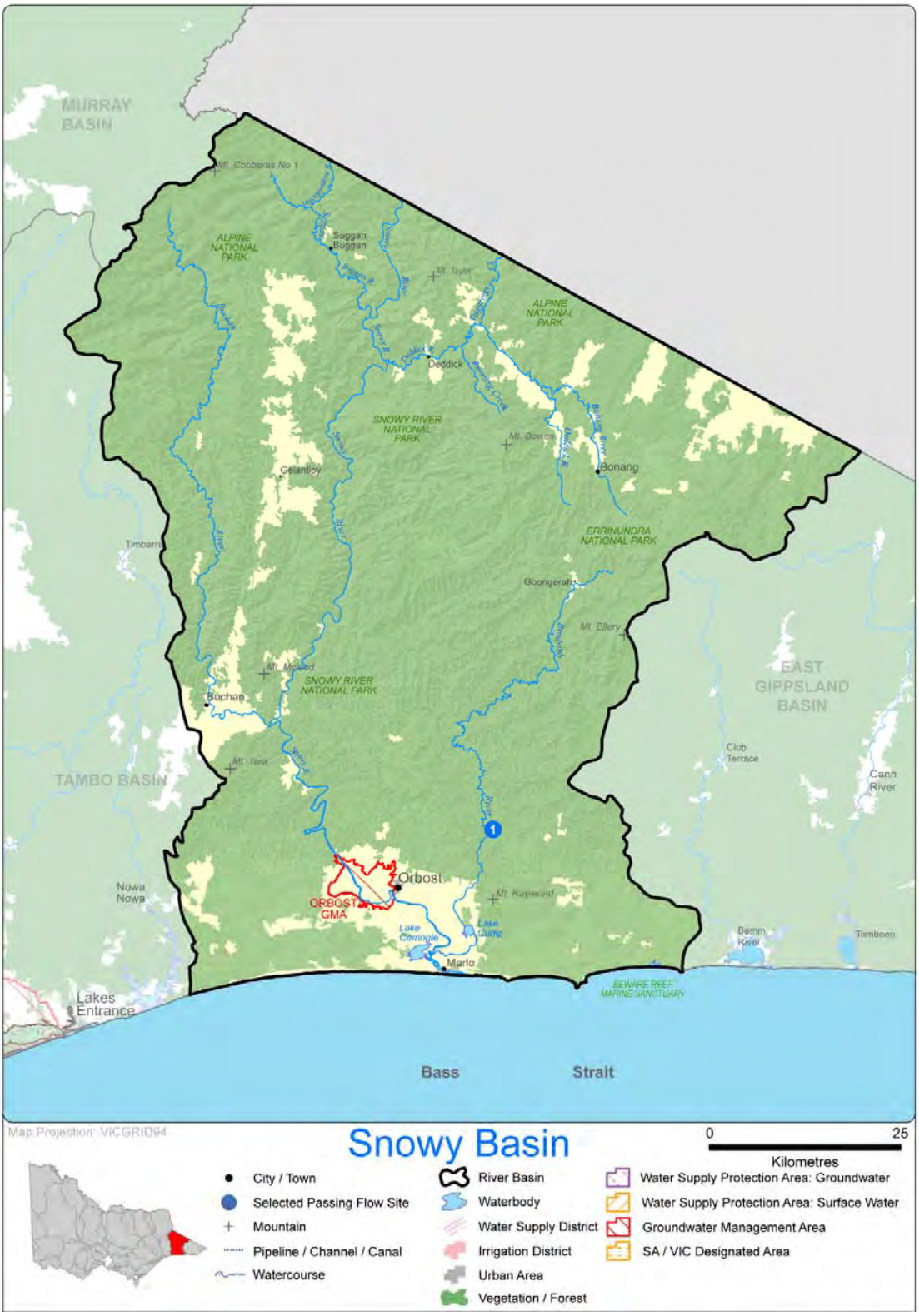
(2) 'Within process' refers to water reused in wastewater treatment processes, for example to maintain biological processes. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(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 near Orbost.

Figure 6.10-1 Map of the Snowy basin



6.10.1 Water resources overview

In 2011–12, both the rainfall and catchment inflows in the Snowy basin were above the long-term average. Rainfall ranged between 125% and 200% of the long-term average. Total inflows to the Victorian portion of the basin were 366% of the long-term average, compared to 130% 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 2011–12 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

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages groundwater and 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 2011–12 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 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Snowy basin are shown in Table 6.10-2. A 112 ML portion of the recycled water resource presented in the below table was discharged from the Orbost treatment plant back into Snowy waterways (see section 6.10.5). This amount is also reported as 'treated wastewater discharged back to river' in Table 6.10-3, therefore this volume is included as both a surface water resource and a recycled water resource in Table 6.10-2.

A very low proportion of surface water relative to the available resource was diverted for consumptive use in the Victorian portion of the basin. All treated wastewater is reused for productive purposes. Approximately 95% of the Snowy basin is an unincorporated area that contains a significant groundwater resource not represented in these totals.

Table 6.10-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	3,740,838	4,442
Groundwater	1,250	33
Recycled water	321	209

6.10.3 Surface water resources

6.10.3.1 Water balance

A surface water balance for the Snowy basin is shown in Table 6.10-3. 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 75% 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 6.10-3 Balance of surface water in the Snowy basin

Water account component	2011–12 (ML)[1]
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[2]	2,796,999
Catchment inflow from NSW[2]	943,727
Rainfall on major storages	-
Treated wastewater discharged back to river	112
Total inflows	**3,740,838**
Outflows	
Diversions	
Urban diversions	701
Licensed diversions from unregulated streams	385
Small catchment dams	3,356
Total diversions	***4,442***
Losses	
Evaporation losses from major storages	-
Evaporation from small catchment dams	700
In-stream infiltration to groundwater, flows to floodplain and evaporation[3]	n/a
Total losses	***700***
Water passed at outlet of basin	
River outflows to the ocean	3,735,696
Total water passed at outlet of basin	***3,735,696***
Total outflows	**3,740,838**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

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

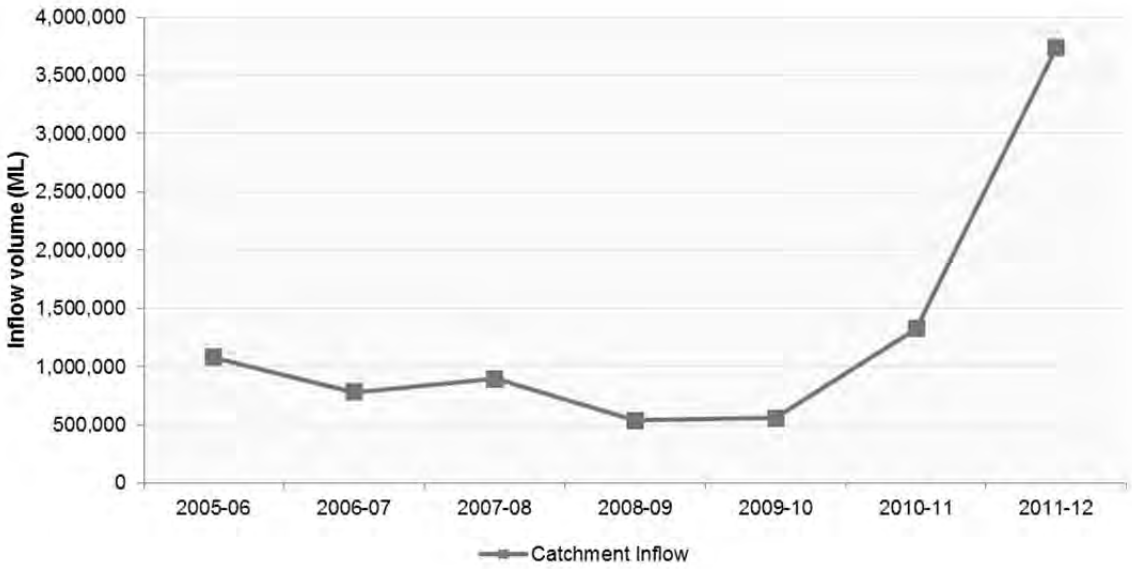
6.10.3.2 Storages and flows

Total inflows to the Victorian portion of the basin were 3,740,838 ML, or 366% of the long-term average (of 1,022,000 ML), compared to 1,326,800 ML, or 130% of the long-term average in 2010–11 (Figure 6.10-2). Inflows to the Victorian portion of the Snowy basin from New South Wales are regulated by the Snowy Mountains Hydro-Electric Scheme. This inflow was 943,727 ML in 2011–12, up from 312,600 ML in 2010–11.

The amount of water flowing from the Snowy basin into Bass Strait was 3,735,696 ML in 2011–12. This represents over 99% of total inflows to the basin.

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

Figure 6.10-2 Catchment inflows (including contribution from NSW)



6.10.3.3 Volume diverted

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

East Gippsland Water diverted less water under its bulk entitlements in 2011–12 compared to 2010–11 (Table 6.10-4).

Table 6.10-4 Bulk entitlement volumes and diversions

Bulk entitlement	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
East Gippsland Water				
Buchan	1	170	0	22
Orbost System	1	2,031	0	679
2011–12 Total		**2,201**	**0**	**701**
2010–11 Total		2,201	0	822

The volume of water diverted from unregulated streams by licence holders in the Snowy basin also decreased from 2010–11 to 2011–12 (Table 6.10-5).

Table 6.10-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**3,992**	**385**
2010–11	3,991	494

The estimated volume of water harvested from small catchment dams represents the largest diversion of water in the Snowy basin (Table 6.10-6).

Table 6.10-6 Estimated small catchment dam information

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**

6.10.4 Groundwater resources

The Orbost GMA is located in the Snowy basin. Groundwater supplies licences and domestic and stock use in the Snowy basin but does not supply any towns. Groundwater levels in Orbost GMA are increasing.

Licensed groundwater entitlements and use for the Orbost GMA in the Snowy basin are shown in Table 6.10-7. These volumes may include domestic and stock usage where it is part of an existing licence.

Table 6.10-7 Licensed groundwater volumes

WSPA/GMA[1]	GMA/WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Orbost GMA (100%)[3]	20-45	1,201	1,217	0	0	0	95
Total		**1,201**	**1,217**	**0**	**0**	**0**	**95**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit.

(3) PCV exceeded due to the issue of entitlement under the Dairy Shed Water Licence Transition Program. PCV to be amended.

An estimate of domestic and stock groundwater use in the Snowy basin is provided in Table 6.10-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.10-7.

Table 6.10-8 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 (100%)	22	33
Total	**22**	**33**

6.10.5 Recycled water

The Orbost wastewater treatment plant is the only treatment plant in the Snowy basin. In 2011–12, a total of 65% of wastewater was recycled for use in agricultural applications including pasture and tree plantations, compared to 100% in 2010–11 (Table 6.10-9).

Table 6.10-9 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]		
Orbost	321	209	65%	0	209	0	0	112	0
Total 2011–12	**321**	**209**	**65%**	**0**	**209**	**0**	**0**	**112**	**0**
Total 2010–11	359	359	100%	0	359	0	0	0	0

Notes:

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

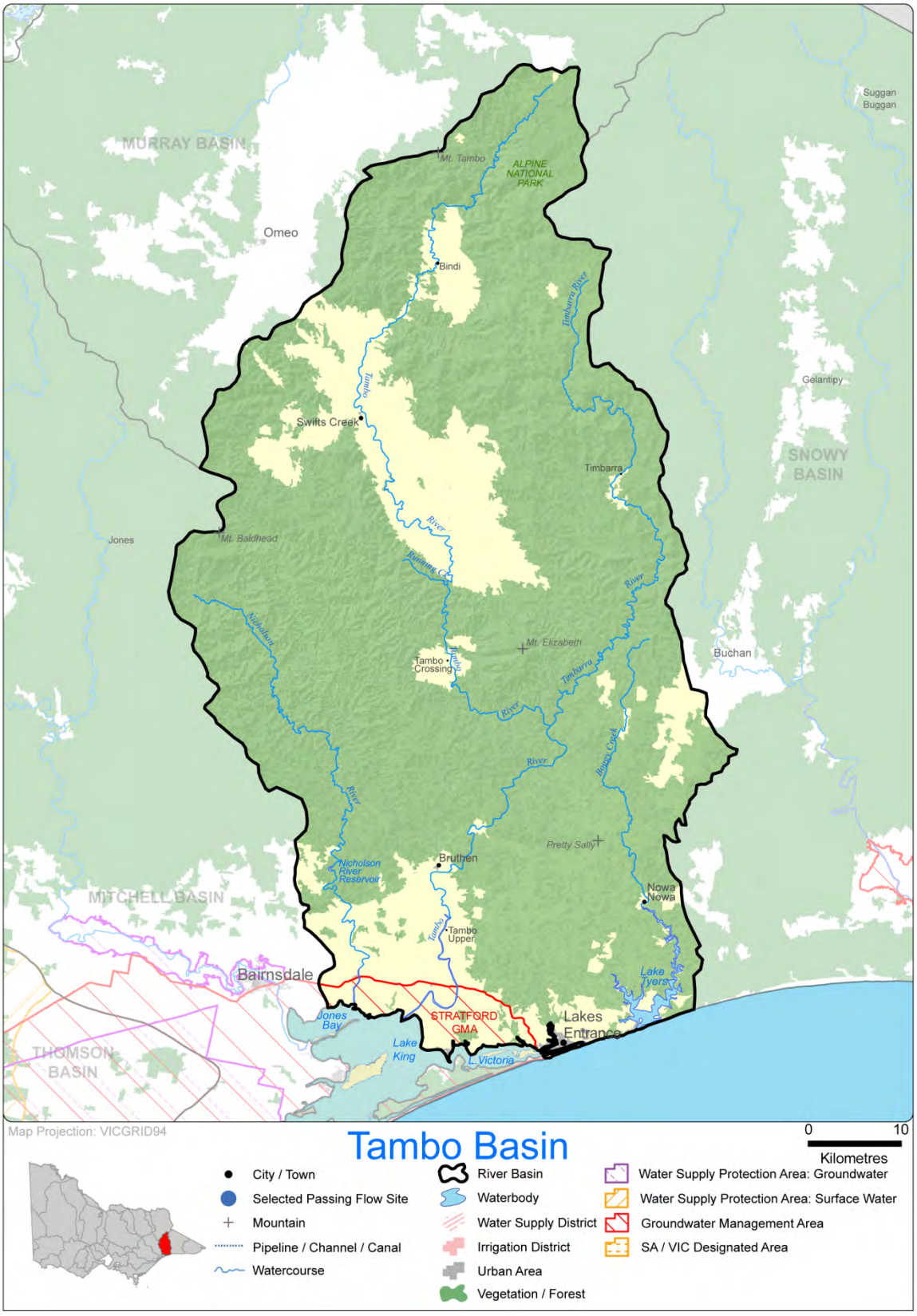
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(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.

6.11 Tambo basin

The Tambo basin 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 2011–12, both rainfall and catchment inflows in the Tambo basin were above average, and were higher compared to the previous year. Rainfall ranged between 125% and 200% of the long-term average, while total inflows were nearly three times the long-term average.

There are no large authorised diversions in the Tambo basin; its bigger towns, such as Lakes Entrance, are supplied by the Bairnsdale water system. As such, approximately 99% 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

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages groundwater and surface water licensed diversions		
East Gippsland Water		Supplies towns including Lakes Entrance, Bruthen and Swifts Creek	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 2011–12, 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 Total water resources in the basin

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.

Table 6.11-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	839,137	4,520
Groundwater	-	-
Recycled water	668	668

6.11.3 Surface water resources

6.11.3.1 Water balance

A surface water balance for the Tambo basin is shownin Table 6.11-3.

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

Table 6.11-3 Balance of surface water in the Tambo basin

Water account component	2011–12 (ML)[1]
Major on-stream storage	
Volume in storage at start of year	-
Volume in storage at end of year	-
Change in storage	-
Inflows	
Catchment inflow[2]	839,137
Rainfall on major storages	-
Treated wastewater discharged back to river	0
Total inflows	**839,137**
Outflows	
Diversions	
Urban diversions	21
Licensed diversions from unregulated streams	528
Small catchment dams	3,971
Total diversions	***4,520***
Losses	
Evaporation losses from major storages	-
Evaporation from small catchment dams	1,986
In-stream infiltration to groundwater, flows to floodplain and evaporation[3]	n/a
Total losses	***1,986***
Water passed at outlet of basin	
River outflows to the ocean	832,631
Total water passed at outlet of basin	**832,631**
Total outflows	**839,137**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML.

(2) 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.

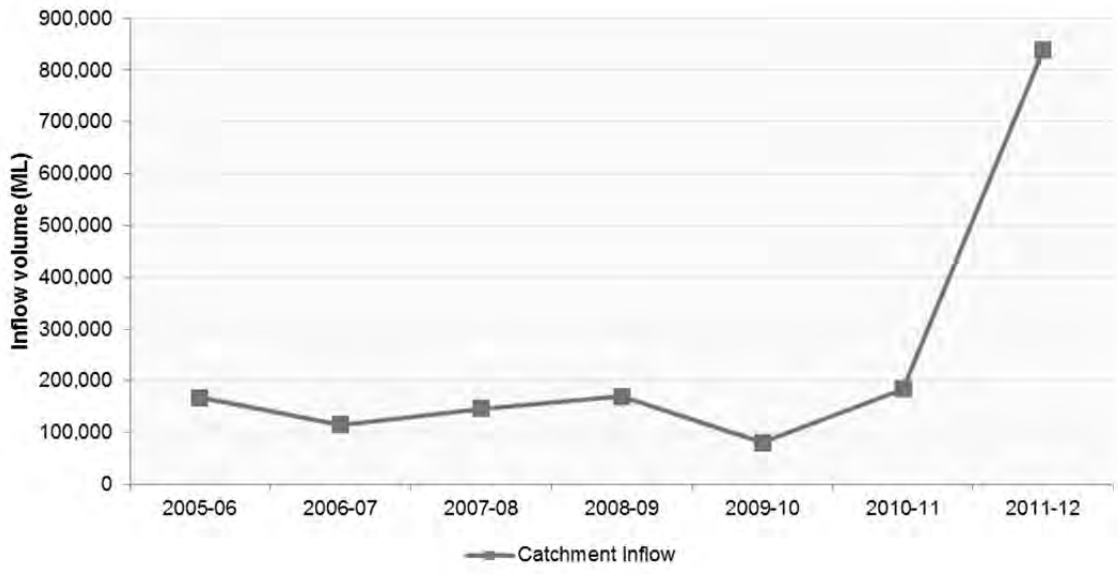
(3) No suitable model is available to make an estimate of in-stream losses.

6.11.3.2 Storages and flows

Total inflows to the basin were 839,137 ML, or 282% of the long-term average (of 297,800 ML), compared to 185,000 ML or 62% of the long-term average in 2010–11 (Figure 6.11-2). The amount of water flowing from the Tambo basin into the Gippsland Lakes was 832,631 ML in 2011–12, which was approximately 99% of total inflows to the basin.

There are no major on-stream storages located within the Tambo basin.

Figure 6.11-2 Catchment inflows



6.11.3.3 Volume diverted

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.

Under its bulk entitlements, East Gippsland Water diverted a similar volume of surface water in 2011–12 to 2010–11 (Table 6.11-4).

Table 6.11-4 Bulk entitlement volumes and diversions

Bulk entitlement	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
East Gippsland Water				
Nowa Nowa[(1)]	1	118	0	0
Swifts Creek	1	224	0	21
2011–12 Total		**342**	**0**	**21**
2010–11 Total		342	0	24

Note:

(1) No water was taken under the Nowa Nowa bulk entitlement in 2011–12. East Gippsland Water supplied this town under the Bairnsdale bulk entitlement, reported in Table 6.12-4 in the Mitchell Basin.

The volume of water diverted from unregulated streams by licence holders in the Tambo basin was also similar in 2011–12 and 2010–11 (Table 6.11-5).

Table 6.11-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**4,194**	**528**
2010–11	4,203	515

The estimated volume of water harvested from small catchment dams represents the largest diversion of water in the Tambo basin (Table 6.11-6).

Table 6.11-6 Estimated small catchment dam information

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.

6.11.4 Groundwater resources

There are no GMAs or WSPAs located within the Tambo basin and no towns are supplied with groundwater. Some groundwater use may have occurred in the basin in unincorporated areas. Details of unincorporated extractions are provided in Appendix A.

6.11.5 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 6.11-7 shows the volumes of water recycled in the Tambo basin in 2011–12.

Table 6.11-7 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]		
Lakes Entrance	564	564	100%	0	564	0	0	0	0
Metung	104	104	100%	0	104	0	0	0	0
Total 2011–12	**668**	**668**	**100%**	**0**	**668**	**0**	**0**	**0**	**0**
Total 2010–11	542	542	100%	0	542	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 2011–12, rainfall in the Mitchell basin ranged between 125% and 200% of the long-term average. Inflows in the Mitchell basin were 143% of the long-term average, compared to 110% in 2010–11. Consumptive use in the basin is generally low when compared to the total water resource. About 99% of the inflows were not diverted, and entered the Gippsland Lakes.

Towns supplied from the Bairnsdale water system were unrestricted during 2011–12. Licensed diversions from waterways were also unrestricted.

Groundwater extractions were not subject to any restrictions during the year, and licensed groundwater use in the basin in 2011–12 was similar to the volume used in 2010–11.

Table 6.12-2 shows the responsibilities of the authorities within the Mitchell basin.

Table 6.12-1 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		
East Gippsland Water		Supplies towns including Bairnsdale and Paynesville	Obliged to meet passing flow requirements
East Gippsland Catchment Management Authority			Manages waterways in the entire 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 2011–12, 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 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Mitchell basin are 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. Annual water use in the Mitchell basin is low, compared to the available resource. A 153 ML portion of the recycled water resource presented in Table 6.12-2 was discharged from the Paynesville treatment plant back into the Mitchell waterways (see section 6.12.5). This amount is also included in the volume reported as ‘treated wastewater discharged back to river’ in Table 6.12-3, therefore this volume is included as both a surface water resource and recycled water resource in Table 6.12-2.

Table 6.12-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	1,265,087	13,531
Groundwater	11,307	2,900
Recycled water	1,514	1,361

6.12.3 Surface water resources

6.12.3.1 Water balance

A surface water balance for the Mitchell basin is shown in Table 6.12-3. Diversions make up a relatively small proportion of total inflows, with approximately 1.1% 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 6.12-3 Balance of surface water in the Mitchell basin

Water account component	2011–12 (ML)[1]
Major on-stream storage	
Volume in storage at start of year	-
Volume in storage at end of year	-
Change in storage	**-**
Inflows	
Catchment inflow[2]	1,264,868
Rainfall on major storages	-
Treated wastewater discharged back to river	218
Total inflows	**1,265,087**
Outflows	
Diversions	
Urban diversions	3,887
Licensed diversions from unregulated streams	5,086
Small catchment dams	4,558
Total diversions	***13,531***
Losses	
Evaporation losses from major storages	-
Evaporation from small catchment dams	1,006
In-stream infiltration to groundwater, flows to floodplain and evaporation	0
Total losses	***1,006***
Water passed at outlet of basin	
River outflows to the ocean	1,250,550
Total water passed at outlet of basin	***1,250,550***
Total outflows	**1,265,087**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

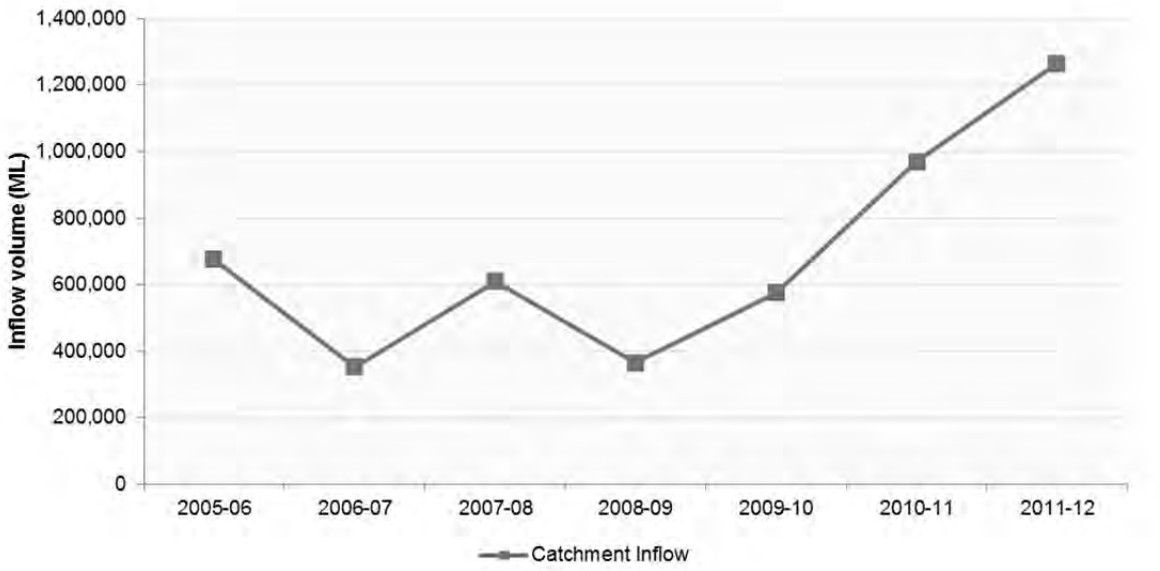
6.12.3.2 Storages and flows

Inflows to the basin were 143% of the long-term average (of 884,500 ML), compared to 110% in 2010–11 (Figure 6.12-2).

The amount of water flowing from the Mitchell basin into the Gippsland Lakes was 1,250,550 ML in 2011–12, a significant increase from 954,200 ML recorded in 2010–11. The 2011–12 outflows were 99% of the total inflows into the basin.

There are no major on-stream storages located within the Mitchell basin.

Figure 6.12-2 Catchment inflows



6.12.3.3 Volume diverted

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

East Gippsland Water holds only one bulk entitlement in the Mitchell basin, used to supply Bairnsdale. Under this bulk entitlement, East Gippsland Water diverted a similar volume in 2011–12 to 2010–11 (Table 6.12-4).

Table 6.12-4 Bulk entitlement volumes and diversions

Bulk entitlement	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
East Gippsland Water				
Bairnsdale	1	9,208	0	3,887
2011–12 Total		**9,208**	**0**	**3,887**
2010–11 Total		9,208	0	3,955

The volume of water diverted from unregulated streams by licence holders in the Mitchell basin was less in 2011–12 compared to 2010–11 (Table 6.12-5).

Table 6.12-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**16,391**	**5,086**
2010–11	16,910	5,929

Licence holders diverted a volume of water similar to the estimated volume harvested from small catchment dams in the Mitchell basin (Table 6.12-6).

Table 6.12-6 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.

6.12.4 Groundwater resources

The Mitchell basin contains the Wy Yung WSPA as well as part of the Sale WSPA and part of the Stratford GMA. Groundwater levels in the Wy Yung WSPA and Stratford GMA are stable, while levels in the Sale WSPA are declining.

A summary of the licensed entitlements and use from GMUs within the Mitchell basin are shown in Table 6.12-7. These volumes may include domestic and stock usage where it is part of an existing licence. Licensed groundwater use in 2011–12 was similar to the volume extracted in 2010–11.

Table 6.12-7 Licensed groundwater volumes

WSPA/GMA[1]	GMA/ WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Stratford GMA (7%)[3]	Zone 1 >150 Zone 2 >350	2,026	2,026	1,909	0	1,909	1,825
Sale WSPA (8%)	25-200	1,669	1,671	498	0	498	564
Wy Yung WSPA (100%)	≤25	7,463	7,462	347	0	347	309
Total		**11,159**	**11,160**	**2,754**	**0**	**2,754**	**2,698**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit.

(3) Use in Stratford GMA includes volumes of metered and estimated extractions from Latrobe Valley mines apportioned to the Mitchell river basin.

An estimate of domestic and stock groundwater use is provided in Table 6.12-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.12-7.

Table 6.12-8 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)
Stratford GMA (7%)	0	0
Sale WSPA (8%)	59	89
Wy Yung WSPA (100%)	39	59
Total	**98**	**147**

In the Mitchell basin, groundwater from the Lindenow Borefield is available as an urban water supply. The licensed entitlement and metered use for this groundwater supply is provided in Table 6.12-9. The Lindenow Borefield was not used for urban water supply in 2011–12.

Table 6.12-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Lindenow	120	0	0
Total	**120**	**0**	**0**

6.12.5 Recycled water

The wastewater treatment plants at Bairnsdale, Lindenow and Paynesville are operated by East Gippsland Water.

The wastewater passing through the Paynesville and Lindenow treatment plants was recycled and used for applications including pasture, tree plantations, racecourses and golf courses (Table 6.12-10). Lindenow recycled 100% of its wastewater and Paynesville 41%.

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 6.12-10, 65 ML was returned to the environment from the alpine resorts during the water year.

Table 6.12-10 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	1,225	1,225	100%	0	17	1,209	0	0	0
Lindenow	29	29	100%	0	0	29	0	0	0
Paynesville	259	106	41%	0	106	0	0	153	0
Total 2011–12	**1,514**	**1,361**	**90%**	**0**	**123**	**1,238**	**0**	**153**	**0**
Total 2010–11	1,431	1,412	99%	0	260	1,152	0	0	19

Notes:

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

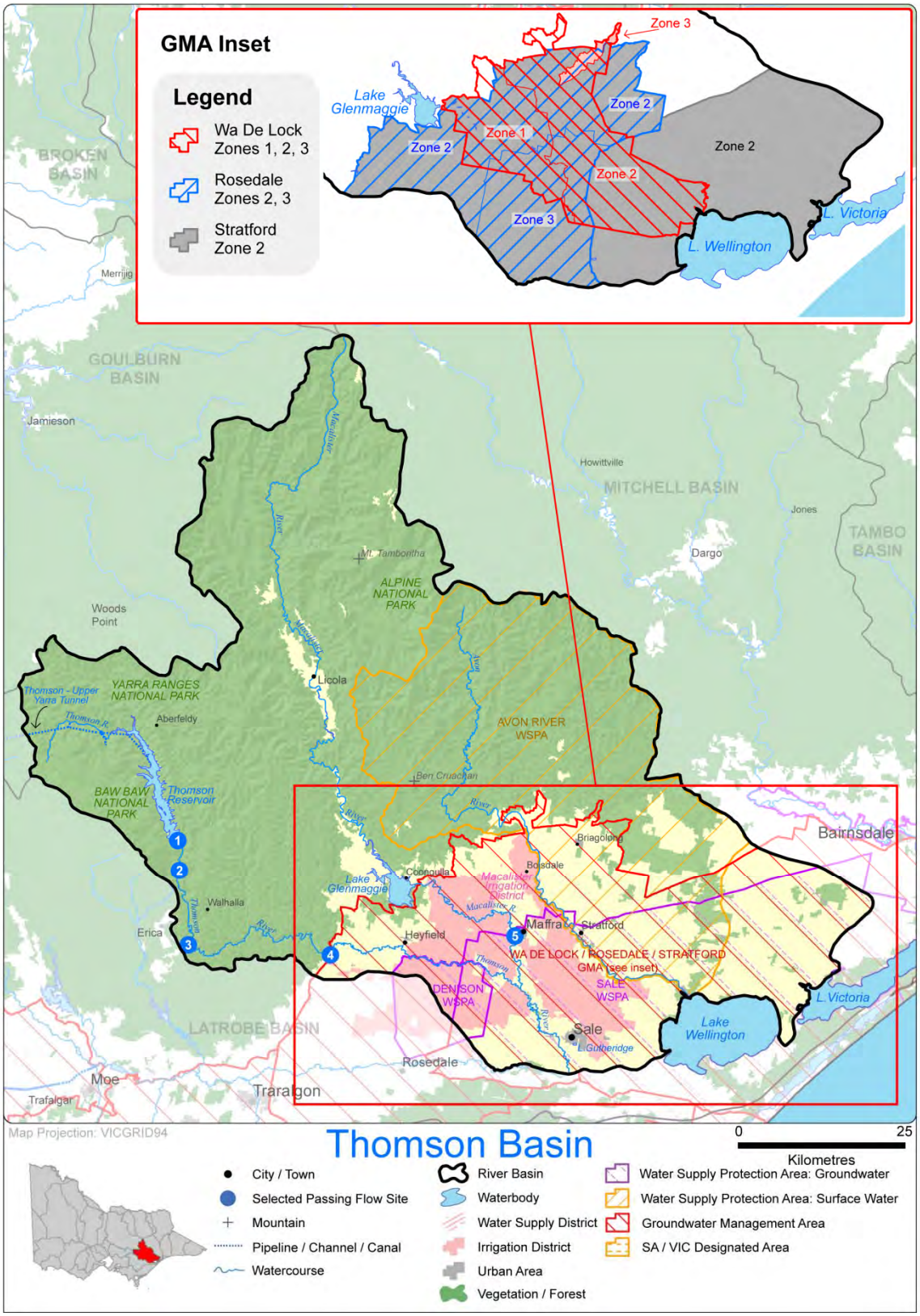
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(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 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 2011–12, rainfall in the Thomson basin ranged between 100% and 200% of the long-term average. The Thomson was one of the few basins to receive higher rainfall than 2010–11 and received between 80% and 150% of average. Accordingly, catchment inflows also increased to 162% of the long-term average, compared to 88% in 2010–11. The amount of water flowing from the Thomson basin into the Gippsland Lakes represented 78% of the total inflows in the basin in 2011–12.

The volume of water in major storages in the Thomson basin started the year at 47% of capacity and was 67% at the end of June 2012. Most of the change was attributable to the change in the level of the Thomson Reservoir, which was 41% of capacity at the start of the year and 64% at year end..

Towns in the Thomson basin were not subject to restrictions in 2011–12. The Melbourne supply system, which partially relies on Thomson Reservoir, eased from Stage 2 restrictions to Stage 1 in December 2011.

Irrigation allocations for the Macalister Irrigation District reached 100% for both high reliability and low reliability water shares. Water use for irrigation was lower than the previous year as a result of the higher rainfall. Groundwater use across the basin also decreased in 2011–12 when compared to 2010–11.

Licensed surface water diverters in the Thomson basin were largely unrestricted during the 2011–12.

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 2011–12 the EWR in the Thomson basin comprised:

- the Bulk Entitlement (Thomson River – Environment) Order 2005
- the Macalister River Environmental Entitlement 2010
- 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 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Thomson basin are shown in Table 6.13-2. A 33 ML portion of the recycled water resource presented in Table 6.13-2 was discharged from the Rawson treatment plant basin back into the Thomson waterways (see Table 6.13-10). This amount is also reported as 'treated

wastewater discharged back to river' in Table 6.13-3, therefore this volume is reported as both a surface water resource and recycled water resource in Table 6.13-2.

Table 6.13-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	1,852,988	148,466
Groundwater	75,353	25,763
Recycled water	368	335

6.13.3 Surface water resources

6.13.3.1 Water balance

A surface water balance for the Thomson basin is shown in Table 6.13-3. Irrigation water use in the Macalister Irrigation District comprised the majority of diversions within the basin.

A total volume of 123,295 ML was diverted from irrigation districts in 2011–12, which is lower than the volume used in 2010–11. Melbourne Water's diversion from the Thomson Reservoir significantly decreased to 1,100 ML in 2011–12.

Table 6.13-3 Balance of surface water in the Thomson basin

Water account component	2011–12 (ML) [1]
Major on-stream storage	
Volume in storage at start of year	586,123
Volume in storage at end of year	838,611
Change in storage	**252,488**
Inflows	
Catchment inflow[2]	1,788,987
Rainfall on major storages	38,182
Return flow from irrigation	25,786
Treated wastewater discharged back to river	33
Total inflows	**1,852,988**
Outflows	
Diversion	
Urban diversions	1,422
Transfers to Yarra River basin for urban use	1,100
Irrigation district diversions	123,295
Licensed diversions from regulated streams	8,572
Licensed diversions from unregulated streams	7,092
Small catchment dams	6,984
Total diversions	***148,466***
Losses	
Evaporation losses from major storages	28,985
Evaporation from small catchment dams	2,552
In-stream infiltration to groundwater, flows to floodplain and evaporation	29,757
Total losses	***61,294***
Water passed at outlet of basin	
River outflows to the Latrobe River	861,432
River outflows direct to Lake Wellington[5]	529,309
Total water passed at outlet of basin	***1,390,741***
Total outflows	**1,600,500**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

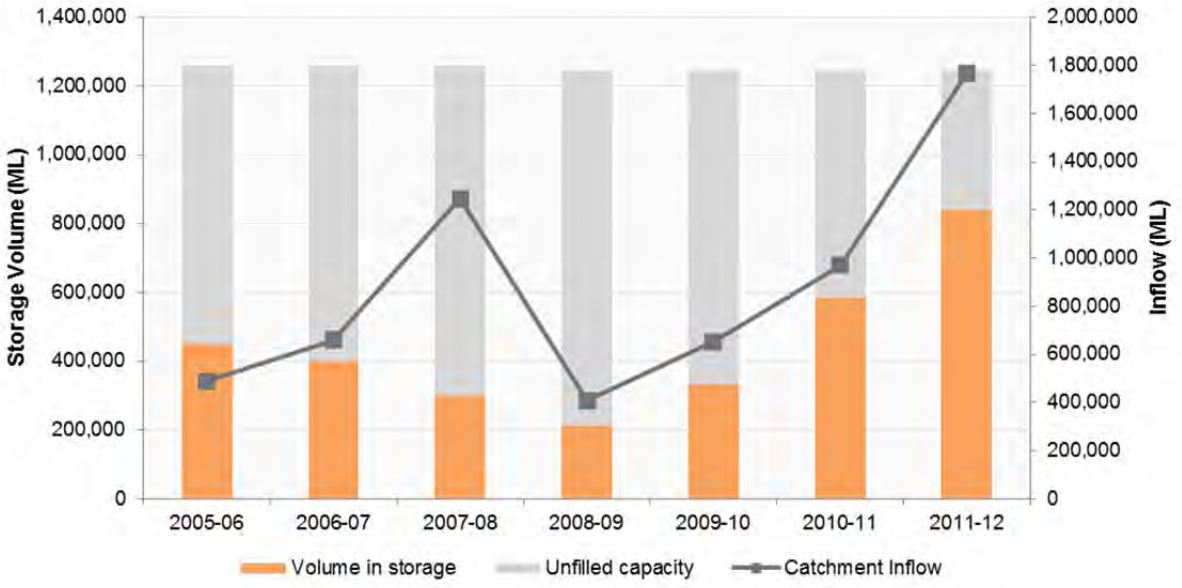
6.13.3.2 Storages and flows

Catchment inflows to the Thomson basin amounted to 1,788,987 ML in 2011–12, which is 162% of the long-term average (1,101,760 ML). The amount of water flowing from the Thomson basin into the Gippsland Lakes in 2011–12 was 1,390,741 ML. This represents 78% of catchment inflows. Outflows in 2011–12 were higher than the 521,500 ML of outflows in 2010–11, and proportionally more was discharged to the lakes in 2011–12.

The volume of water held in major storages was 838,611 ML (67% of capacity) at the end of June 2012 compared to 586,123 ML at the start of July 2011.

In the Thomson basin, major on-stream storages include Thomson Reservoir and Lake Glenmaggie. Melbourne's biggest water storage, Thomson Reservoir, began the year at 41% of capacity and increased to 64% by the end of June 2012. Lake Glenmaggie finished the year with a volume of 158,245 ML, which is 89% of its total capacity.

Figure 6.13-2 Major storages and catchment inflows



6.13.3.3 Volume diverted

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.

The Victorian Environmental Water Holder (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 the waterways.

Diversions under bulk entitlements by water corporations in 2011–12 are presented in Table 6.13-4. 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 also assessed against a 15-year average annual volume of 555,000 ML.

Table 6.13-4 Volume of water diverted under bulk entitlements

Bulk entitlement[1]	Bulk entitlement period (years)	Bulk entitlement volume (ML)	Net assignment of allocation (ML)	Volume diverted (ML)
Southern Rural Water				
Thomson/Macalister[2]	1	227,860	0	147,307
Gippsland Water				
Thomson Macalister towns – Gippsland Water[3]	1	2,335	0	1,422
Melbourne metropolitan retailers				
Thomson River[4][5]	15	171,800	0	1,100
2011–12 Total		**399,660**		**148,407**
2010–11Total		445,232	0	161,130

Notes:

(1) This table does not include bulk entitlements and environmental entitlements held by the VEWH. Water available under VEWH entitlements in the Thomson basin is used to support streamflows and is not diverted out of waterways.

(2) 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.

(3) Gippsland Water's Thomson Macalister towns bulk entitlement is omitted from the 2011–12 Total as the entitlement volume and volume diverted are already accounted under Southern Rural Water's Thomson/Macalister bulk entitlement.

(4) 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 2011–12 was 127,000 ML.

(5) 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 2011–12 was 421,300 ML.

The total volume of water diverted from unregulated streams by licence holders was lower in 2011–12 compared to 2010–11 (Table 6.13-5).

Table 6.13-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	17,246	7,092
2010–11	17,190	8,083

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

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.

6.13.4 Groundwater resources

The Thomson basin contains all of the Wa De Lock GMA as well as part of the Denison WSPA, Sale WSPA, Stratford GMA and Rosedale GMA. Groundwater resources supply licences, domestic and stock use and three towns in the area. The majority of Stratford and Rosedale GMA water use is for mine dewatering. While the groundwater levels in the Stratford GMA, Denison WSPA and Sale WSPA are stable, levels in the Rosedale GMA are declining.

A summary of the licensed entitlements and use from GMAs within the Thomson basin are shown Table 6.13-7. These volumes may include domestic and stock usage where it is part of an existing licence. Licensed groundwater use in the Thomson basin decreased by around 6% in 2011–12, compared to 2010–11.

Table 6.13-7 Licensed groundwater volumes

WSPA/GMA[1]	GMA/WSPA aquifer depth limits (m)	Entitlement limit(2) (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Rosedale GMA (35%)[3]	Zone 1: 50-150, Zone 2: 25-350, Zone 3: 200-300	7,921	7,942	2,747	0	2,747	2,678
Stratford GMA (44%)[3]	Zone 1 >150, Zone 2 >350	12,249	12,249	11,539	0	11,539	11,034
Wa De Lock GMA (100%)[4]	≤25	30,172	29,141	3,240	527	3,767	4,832
Denison WSPA (51%)[4]	≤25	9,095	9,484	1,318	216	1,534	1,894
Sale WSPA (69%)	25-200	14,736	14,754	4,393	0	4,393	4,977
Total		**74,174**	**73,570**	**23,238**	**743**	**23,981**	**25,414**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit.

(3) Use in Rosedale and Stratford includes volumes of metered and estimated extractions from Latrobe Valley mines apportioned to the Thomson basin.

(4) Non-metered use for Wa De Lock and Denison represent extractions for salinity control.

An estimate of domestic and stock groundwater use is provided in Table 6.13-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.13-7.

Table 6.13-8 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 (35%)	102	152
Stratford GMA (44%)	1	1
Wa De Lock GMA (100%)	446	669
Denison WSPA (51%)	119	178
Sale WSPA (69%)	521	782
Total	**1,188**	**1,783**

In the Thomson basin, groundwater is used as an urban water supply for the townships of Sale, Briagolong and Boisdale. The licensed entitlements and metered use for these groundwater supplies are provided in Table 6.13-9.

Table 6.13-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Boisdale	37	0	0
Briagolong	160	61	76
Sale	3,500	1,771	1,859
Total	**3,697**	**1,832**	**1,935**

6.13.5 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 2011–12 was slightly more than that produced in 2010–11. A total of 91% of wastewater was recycled in the basin in 2011–12 (Table 6.13-10).

Table 6.13-10 Volume of recycled water

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	48	48	100%	0	48	0	0	0	0
Maffra	171	171	100%	3	168	0	0	0	0
Rawson	33	0	0%	0	0	0	0	33	0
Stratford	116	116	100%	0	116	0	0	0	0
Total 2011–12	**368**	**335**	**91%**	**3**	**332**	**0**	**0**	**33**	**0**
Total 2010–11	301	271	90%	0	271	0	0	30	0

Notes:

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

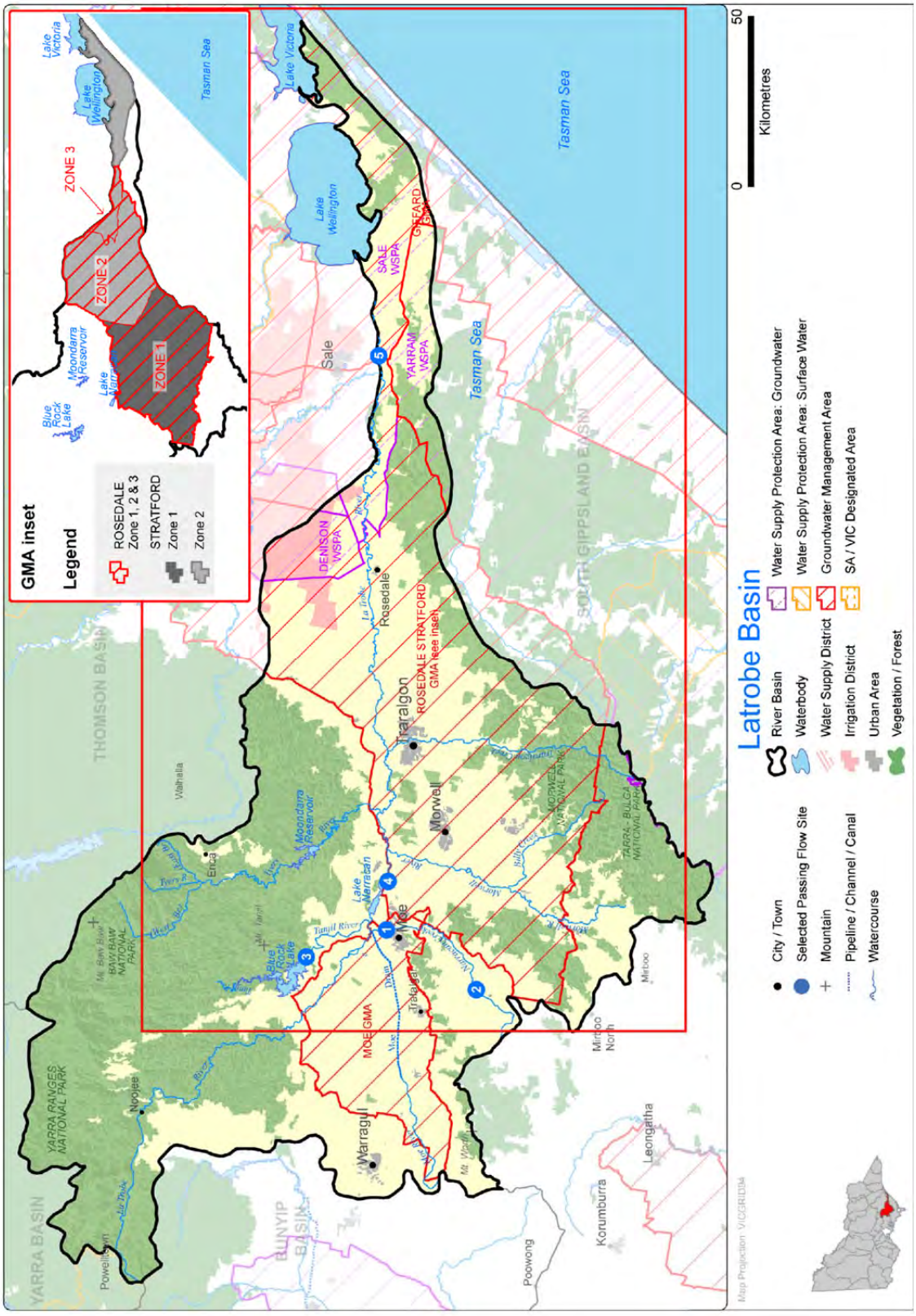
(2) Water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(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 (Table 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 2011–12, rainfall in the Latrobe basin ranged between 100% and 150% of the long-term average. Catchment inflows were 158% of the long-term average. The amount of water flowing from the Latrobe basin into the Gippsland Lakes (excluding the Thomson River), represented 93% of the total inflows in the basin in 2011–12.

The volume of water in major storages remained high throughout the year, starting the year at 97% of capacity and holding 99% at the end of June 2012.

Licensed surface water users were not subject to restrictions during 2011–12. The volume of water diverted from unregulated streams was more than double that of 2010–11.

Licensed groundwater users were also unrestricted and licensed groundwater use remained similar to the previous year.

Table 6.14-1 shows the responsibilities of the authorities within the Latrobe basin.

Table 6.14-1 Responsibilities for water resources management

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 groundwater and surface water 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 2011–12, the EWR in the Latrobe basin comprised:

- the Latrobe River Environmental Entitlement 2010
- 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.

6.14.2 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Latrobe basin are shown in Table 6.14-2. A 4,633 ML portion of the recycled water resource presented in Table 6.14-2 was discharged from treatment plants in the Latrobe basin back into the Latrobe waterways (see section 6.14.5). This amount is also reported as ‘treated wastewater discharged back to river’ in Table 6.14-3, therefore this volume is included as both a surface water resource and recycled water resource in Table 6.14-2.

Table 6.14-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	1,408,123	151,174
Groundwater	43,239	19,307
Recycled water	25,643	777

6.14.3 Surface water resources

6.14.3.1 Water balance

A surface water balance for the Latrobe basin is shown in Table 6.14-3. The major industrial water users in the basin include some electricity generators and Australian Paper. In 2011–12, these entities accounted for more than half of the surface water diversions in the Latrobe basin. They also returned 51,730 ML to the Latrobe River system.

Table 6.14-3 Balance of surface water in the Latrobe basin

Water account component	2011–12 (ML)[1]
Major on-stream storage	
Volume in storage at start of year	242,899
Volume in storage at end of year	243,291
Change in storage	**392**
Inflows	
Catchment inflow[2]	1,338,357
Rainfall on major storages	13,404
Return flow from power stations and major industry	51,730
Treated wastewater discharged back to river	4,633
Total inflows	**1,408,123**
Outflows	
Diversions	
Urban and industrial diversions	119,031
Licensed diversions from regulated streams	1,622
Licensed diversions from unregulated streams	9,974
Small catchment dams	20,547
Total diversions	***151,174***
Losses	
Evaporation losses from major storages	13,165
Evaporation from small catchment dams	5,612
In-stream infiltration to groundwater, flows to floodplain and evaporation[3]	n/a
Total losses	***18,777***
Water passed at outlet of basin	
River outflows to the Gippsland Lakes (excluding Thomson River)	1,237,780
Total water passed at outlet of basin	***1,237,780***
Total outflows	**1,407,731**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

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

6.14.3.2 Storages and flows

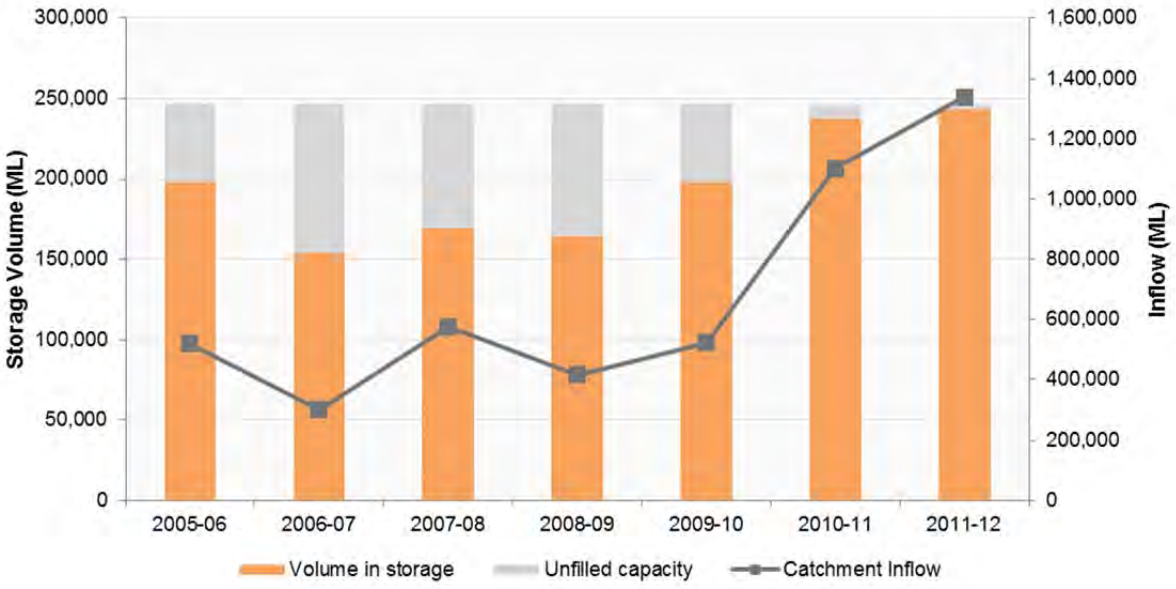
Inflows were 158% of the long-term average (of 847,400 ML), compared to 130% in 2010–11 (Figure 6.14-2).

The amount of water flowing from the Latrobe basin into the Gippsland Lakes (excluding the Thomson River) increased to 1,237,780 ML in 2011–12 from 956,400 ML in 2010–11.

Storage levels for all major storages in the basin totalled 243,291 ML (99% of capacity) in June 2012 compared to 242,899 ML in July 2011 (Figure 6.14-2).

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 210,021 ML (101% of capacity).

Figure 6.14-2 All major storages and catchment inflows



6.14.3.3 Volume diverted

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.

The volume of water diverted under bulk entitlements by water corporations and the Latrobe Valley power stations in 2011–12 is shown in Table 6.14-4.

Table 6.14-4 Bulk entitlement volumes and diversions

Bulk entitlement[1]	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation ML)	Volume diverted (ML)
Gippsland Water				
Boolarra	1	145	0	84
CGRWA – Blue Rock	3	15,150	0	1,115
Erica	1	340	0	96
Mirboo North	1	270	0	175
Moe – Narracan Creek	1	3,884	0	2,802
Moondarra Reservoir	2	62,000	0	48,924
Noojee[2]	1	73	0	0
Thorpdale	1	80	0	15
Southern Rural Water				
Latrobe – Loy Yang B	1	20,000	0	14,285
Latrobe – Southern Rural	2	13,400		1,622
AGL Loy Yang Partnership				
Latrobe – Loy Yang A	1	40,000	0	23,710
TRUEnergy				
Latrobe – Yallourn	1	36,500	0	27,825
Minister for Environment and Climate Change (on behalf of government)				
Latrobe – Loy Yang 3-4 Bench	1	25,000	0	0
2011–12 Total		**216,842**	**0**	**120,653**
2010–11 Total		216,842	16	125,102

Notes:

(1) This table does not include bulk entitlements and environmental entitlements held by the VEWH. Any diversions out of the waterway under VEWH entitlements are discussed below.

(2) 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 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 2011–12.

Licence holders diverted a much greater volume of water from unregulated streams in 2011–12 compared to 2010–11 (Table 6.14-5).

Table 6.14-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**19,192**	**9,974**
2010–11	23,915	4,222

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.

6.14.4 Groundwater resources

The Latrobe basin contains the entire Moe GMA as well as part of the Sale WSPA, Yarram WSPA, Denison WSPA, Stratford GMA and Rosedale GMA. Groundwater supplies licences and domestic and stock use in the area. Groundwater is also available for the town of Trafalgar, however it is not currently being metered or used for this town.

A summary of the licensed entitlements and use from GMUs within the Latrobe basin are shown in Table 6.14-7. These volumes may include domestic and stock usage where it is part of an existing licence. While groundwater levels in the Denison WSPA, Stratford GMA, Sale WSPA and Yarram WSPA are stable, levels in the Moe GMA and Rosedale GMA are declining. Licensed groundwater extracted from the Stratford and Rosedale GMAs are maily for mine depressurisation activities. The reported groundwater use in the Latrobe basin in 2011–12 was similar to that reported in 2010–11.

Table 6.14-7 Licensed groundwater volumes

WSPA/GMA[1]	GMA/WSPA aquifer depth limits(m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Moe GMA (100%)	>25	8,200	3,993	330	0	330	191
Rosedale GMA (58%)[3]	Zone 1: 50-150 Zone 2: 25-350 Zone 3: 200-300	13,040	13,074	4,523	0	4,523	4,408
Stratford GMA (41%)[3]	Zone 1: >150 Zone 2: >350	11,321	11,321	10,664	0	10,664	10,198
Denison WSPA (49%)[4]	≤25	8,648	9,017	1,253	205	1,458	1,801
Sale WSPA (17%)	25-200	3,612	3,617	1,077	0	1,077	1,220
Yarram WSPA (5%)	Zone 1: >200 Zone 2: All depths	1,286	1,305	342	0	342	349
Total		**46,107**	**42,327**	**18,189**	**205**	**18,395**	**18,167**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit.

(3) Use in Rosedale and Stratford includes volumes of metered and estimated extractions from Latrobe Valley mines apportioned to the Latrobe basin.

(4) Non-metered use for Denison represents an extraction for salinity control.

An estimate of domestic and stock groundwater use is provided in Table 6.14-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.14-7.

Table 6.14-8 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 (100%)	183	275
Rosedale GMA (58%)	167	251
Stratford GMA (41%)	1	1
Denison WSPA (49%)	113	170
Sale WSPA (17%)	128	192
Yarram WSPA (5%)	16	24
Total	608	912

In the Latrobe basin, groundwater is available as a water supply for the township of Trafalgar, however this entitlement is not currently metered or used (Table 6.14-9).

Table 6.14-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Trafalgar	100	0	0
Total	**100**	**0**	**0**

6.14.5 Recycled water

Gippsland Water treated over 25,000 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 2011–12 was similar to that for 2010–11, and represents around 3% of the wastewater produced.

Table 6.14-10 shows the volumes of water recycled in the Latrobe basin in 2011–12

Table 6.14-10 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	159	76	48%	9	67	0	0	83	0
Moe	2,797	0	0%	0	0	0	0	2,797	0
Morwell	700	700	100%	0	0	700	0	0	0
Dutson Downs (regional outfall sewer)	10,910	0	0%	0	0	0	0	0	10,910
Saline wastewater outfall pipeline	9,323	0	0%	0	0	0	0	0	9,323
Warragul	1,739	0	0%	0	0	0	0	1,739	0
Willow Grove	15	1	7%	0	1	0	0	14	0
Total 2011–12	**25,643**	**777**	**3%**	**9**	**68**	**700**	**0**	**4,633**	**20,233**
Total 2010–11	25,841	797	3%	31	53	713	0	4,632	20,411

Notes:

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

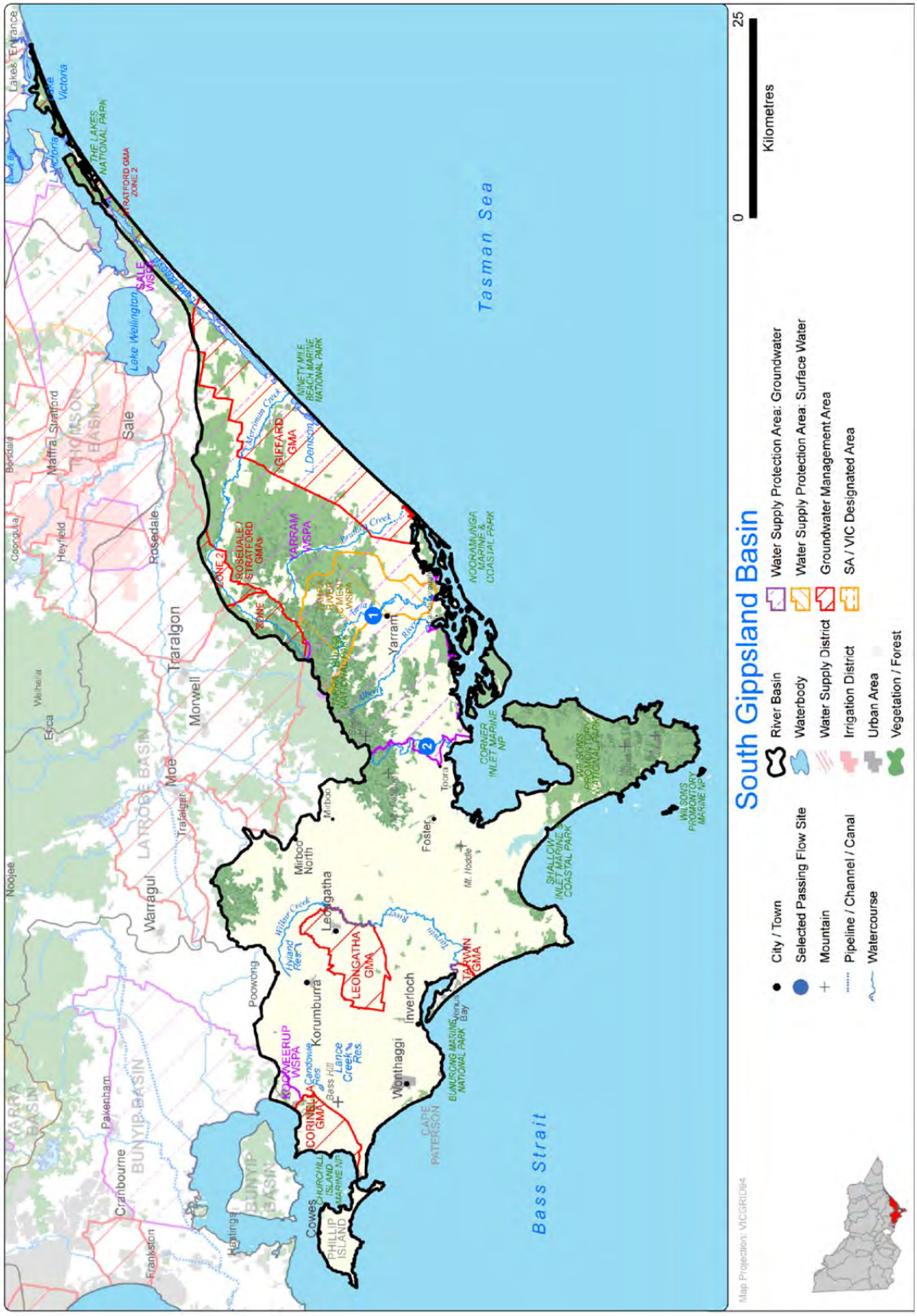
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flush of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(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 2011–12, rainfall across the South Gippsland basin ranged between 100% and 150% of the long-term average, which was similar to 2010–11. Catchment inflows in the basin increased for the third consecutive year and were 203% of the long-term average, compared to 172% in 2010–11. The amount of water flowing from the South Gippsland basin into Westernport Bay and Bass Strait represented 98% of the total inflows into the basin in 2011–12.

The major storage levels were close to full capacity at both the beginning and end of the year.

Water availability in 2011–12 enabled urban water corporations to provide unrestricted supplies to their customers throughout the year. The volume of diversions for urban water use was similar to 2010–11, as was licensed groundwater use and 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

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages groundwater and 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 2011–12, 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 Total water resources in the basin

The total volumes of water available and supplied from water resources in the South Gippsland basin are shown in Table 6.15-2. A 5,761 ML portion of the recycled water resource presented in Table 6.15-2 was discharged from South Gippsland Water and Westernport Water's treatment plants back into the South Gippsland waterways (see section 6.15.5). This amount is also reported as 'treated wastewater discharged back to river' in Table 6.15-3, and therefore this volume is included as both a surface water resource and recycled water resource in Table 6.15-2.

Table 6.15-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	1,862,320	35,074
Groundwater	39,205	12,089
Recycled water	5,949	216

6.15.3 Surface water resources

6.15.3.1 Water balance

Diversions make up a relatively small proportion of total inflows, with around 2% of basin inflows diverted for consumptive use in 2011–12. Most inflows leave the basin and flow into Bass Strait or Westernport Bay.

Table 6.15-3 Balance of surface water in the South Gippsland basin

Water account component	2011–12 (ML)[1]
Major on-stream storage	
Volume in storage at start of year	8,341
Volume in storage at end of year	8,271
Change in storage	**(70)**
Inflows	
Catchment inflow[2]	1,854,567
Rainfall on major storages	1,992
Treated wastewater discharged back to river	5,761
Total inflows	**1,862,320**
Outflows	
Diversions	
Urban diversions	7,564
Licensed diversions from unregulated streams	3,254
Small catchment dams	24,256
Total diversions	***35,074***
Losses	
Evaporation losses from major storages	1,484
Evaporation from small catchment dams	5,135
In-stream infiltration to groundwater, flows to floodplain and evaporation[3]	n/a
Total losses	***6,619***
Water passed at outlet of basin	
River outflows to Bass Strait and Westernport Bay	1,820,697
Total water passed at outlet of basin	***1,820,697***
Total outflows	**1,862,390**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

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

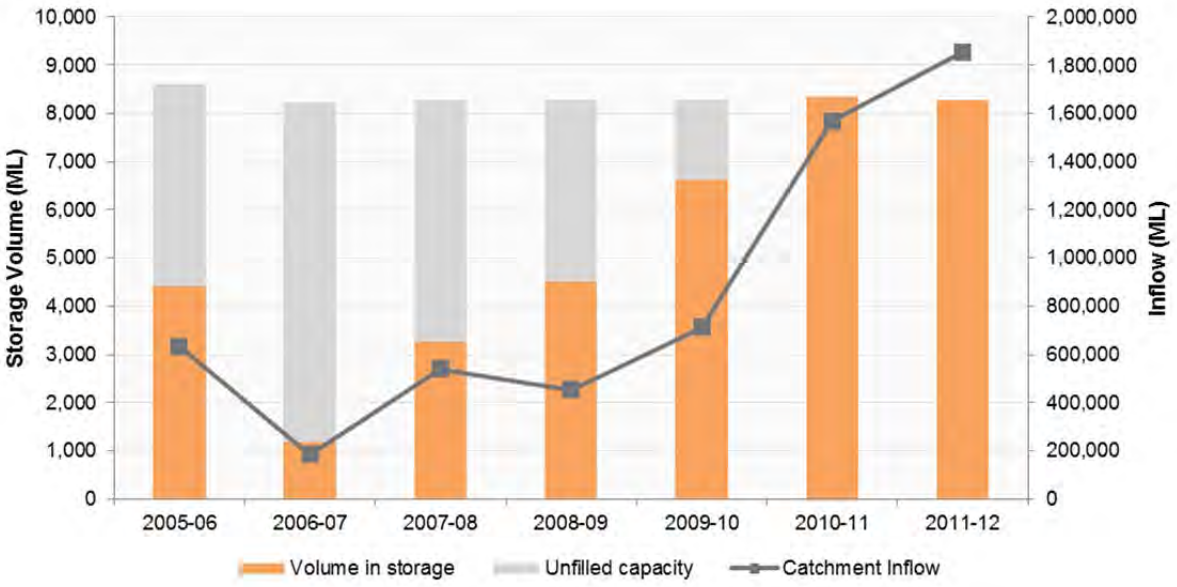
6.15.3.2 Storages and flows

Catchment inflows were 1,862,320 ML, or 203% of the long-term average (of 911,500 ML), an increase from 172% of average in 2010–11 (Figure 6.15-2).

The amount of water flowing from the South Gippsland basin into Westernport Bay and Bass Strait was 1,820,697 ML in 2011–12. This represents 98% of the total inflows into the basin.

Storage levels for all major on-stream storages in the basin (Lance Creek, Western, Candowie and Hyland reservoirs) at the end of June 2012 were similar to the previous year (Figure 6.15-2).

Figure 6.15-2 All major storages and catchment inflows



6.15.3.3 Volume diverted

In the South Gippsland basin, surface water is diverted by Gippsland Water, South Gippsland Water and Westernport Water. Melbourne Water sources 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.

The total volume of water diverted under bulk entitlements by the four water corporations in 2011–12 was similar to the total volume diverted in 2010–11 (Table 6.15-4).

Table 6.15-4 Bulk entitlement volumes and diversions

Bulk entitlement	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net temporary transfer (ML)	Volume diverted (ML)
Gippsland Water				
Seaspray	1	61	0	0
South Gippsland Water				
Devon North Alberton – Yarram and Port Albert	1	853	0	461
Dumbalk	1	100	0	23
Fish Creek	1	251	0	101
Foster	1	326	0	168
Korumburra	1	1,000	0	758
Leongatha	1	2,476	0	1,646
Loch, Poowong and Nyora	1	420	0	201
Meeniyan	1	200	0	49
Toora Port Franklin – Welshpool and Port Welshpool	1	1,617	0	531
Wonthaggi – Inverloch	1	3,800	0	1,805
Westernport Water				
Westernport	1	2,911	0	1,821
Westernport – Bass River	1	3,000		0
Melbourne Water				
Desalinated water – Retail Water Corp	5	150,000	0	0
2011–12 Total		**167,015**	**0**	**7,564**
2010–11 Total		17,015	0	7,675

The volume of water diverted from unregulated streams by licence holders in the South Gippsland basin was also similar in 2011–12 and 2010–11 (Table 6.15-5).

Table 6.15-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**12,844**	**3,254**
2010–11	12,921	3,784

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

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.

6.15.4 Groundwater resources

The South Gippsland basin contains all of the Corinella GMA, Giffard GMA, Tarwin GMA and Leongatha GMA, most of the Yarram WSPA, and part of the Sale WSPA, Rosedale GMA and Stratford GMA. Groundwater supplies licences, domestic and stock use and three towns in the area.

A summary of the licensed entitlements and use from GMUs within the South Gippsland basin is shown in Table 6.15-7. These volumes may include domestic and stock usage where it is part of an existing licence. Groundwater use in 2011–12 was similar to that reported in 2010–11.

Table 6.15-7 Licensed groundwater volumes

WSPA/GMA[1]	GMA/WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Corinella GMA (100%)	All depths	2,550	662	20	0	20	68
Giffard GMA (100%)	50–200	5,670	5,689	845	0	845	865
Leongatha GMA (100%)	All depths	6,500	1,841	72	0	72	31
Rosedale GMA (6%)[3]	Zone 1: 50–150 Zone 2: 25–350 Zone 3: 200–300	1,352	1,356	469	0	469	457
Stratford GMA (7%)[3]	Zone 1 >150 Zone 2 >350	2,048	2,048	1,930	0	1,930	1,846
Tarwin GMA (100%)	≤25	1,300	38	15	0	15	9
Sale WSPA (6%)	25–200	1,194	1,196	356	0	356	404
Yarram WSPA (95%)	Zone 1 >200 Zone 2: All depths	24,031	24,390	6,398	0	6,398	6,533
Total		**44,646**	**37,220**	**10,104**	**0**	**10,104**	**10,213**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit.

(3) Use in Rosedale and Stratford includes volumes of metered and estimated extractions from Latrobe Valley mines apportioned to the South Gippsland basin.

An estimate of domestic and stock groundwater use is provided in Table 6.15-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.15-7.

Table 6.15-8 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 (100%)	86	129
Giffard GMA (100%)	92	138
Leongatha GMA (100%)	89	134
Rosedale GMA (6%)	17	26
Stratford GMA (7%)	0	0
Tarwin GMA (100%)	693	1,040
Sale WSPA (6%)	42	63
Yarram WSPA (95%)	304	456
Total	**1,323**	**1,985**

In the South Gippsland basin, groundwater supplies are available for the towns of Corinella, Grantville, Leongatha and Yarram. The licensed entitlements and metered use for urban groundwater supplies is provided in Table 6.15-9. Very little water was extracted under these licences in 2011–12.

Table 6.15-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Corinella/Grantville	490	1	0
Leongatha	715	0	0
Yarram	94	0	23
Total	**1,299**	**1**	**23**

6.15.5 Recycled water

South Gippsland Water is responsible for eight wastewater treatment plants within the basin, with the Waratah Bay treatment plant the only site 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.

Across the basin, 3% of wastewater was reused, similar to 2010–11 (Table 6.15-10).

Table 6.15-10 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]		
Coronet Bay	213	87	41%	0	87	0	0	156	(30)
Cowes	1,296	42	3%	31	3	0	9	1,254	0
Foster	164	0	0%	0	0	0	0	164	0
Korumburra	771	0	0%	0	0	0	0	771	0
Leongatha Domestic	689	0	0%	0	0	0	0	689	0
Leongatha Trade Waste	1,036	0	0%	0	0	0	0	1,036	0
Seaspray	3	0	0%	0	0	0	0	0	3
Toora	73	2	2%	2	0	0	0	72	0
Waratah Bay	9	9	100%	0	9	0	0	0	0
Welshpool	24	21	89%	0	21	0	0	3	0
Wonthaggi / Cape Paterson / Inverloch	1,467	0	0%	0	0	0	0	1,467	0
Yarram/Tarraville	203	55	27%	0	55	0	0	148	0
Total 2011–12	**5,949**	**216**	**3%**	**32**	**176**	**0**	**9**	**5,761**	**(27)**
Total 2010–11	5,426	189	3%	28	153	0	8	5,153	83

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 2011–12, rainfall in most of the Bunyip basin was between 100% and 125% of the long-term average, with areas in the lower catchment receiving up to 150% of the long-term average. While rainfall was lower than the previous year, inflows to the Bunyip basin in 2011–12 were 191% of the long-term average, compared to 219% in 2010–11. The amount of water flowing from the Bunyip basin into Port Phillip Bay, Westernport Bay and Bass Strait represented approximately 98% of the catchment inflows in the basin.

The basin's only major storage, the Tarago Reservoir, ended the year at 90% of its effective capacity compared to 96% at the start.

Towns in the basin supplied by Gippsland Water were not subject to restrictions in 2011–12. Towns supplied by Melbourne Water remained on Stage 2 restrictions until December, when restrictions were eased to Stage 1.

Licensed groundwater use and licensed diversions from unregulated streams both increased when compared to 2010–11.

Table 6.16-1 shows the responsibilities of the authorities within the Bunyip basin.

Table 6.16-1 Responsibilities for water resources management

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages surface water and groundwater 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 2011–12, the Bunyip basin EWR comprised:

- the Tarago and Bunyip Rivers Environmental Entitlement 2009
- all other 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.

6.16.2 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Bunyip basin are shown in Table 6.16-2. These figures exclude water delivered directly to customers from Melbourne Water's supply system in the Yarra and Thomson basins. A 10,357 ML portion of the recycled water resource presented in Table 6.16-2 was discharged from treatment plants in the Bunyip basin back into the Bunyip waterways (see section 6.16.5). This amount is also reported as 'treated wastewater discharged back to river' in Table 6.16-3, and therefore is included as both a surface water resource and recycled water resource in Table 6.16-2.

Table 6.16-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	1,046,872	31,225
Groundwater	26,454	10,425
Recycled water	167,853	20,432

6.16.3 Surface water resources

6.16.3.1 Water balance

A surface water balance for the Bunyip basin is shown in Table 6.16-3.

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 Balance of surface water in the Bunyip basin

Water account component	2011–12 (ML)[1]
Major on-stream storage	
Volume in storage at start of year	24,000
Volume in storage at end of year	22,434
Change in storage	**(1,566)**
Inflows	
Catchment inflow[2]	1,033,964
Rainfall on major storages	2,552
Treated wastewater discharged back to river	10,357
Total inflows	**1,046,872**
Outflows	
Diversions	
Urban diversions	11,718
Licensed diversions from regulated streams	-
Licensed diversions from unregulated streams	3,982
Small catchment dams	15,525
Total diversions	***31,225***
Losses	
Evaporation losses from major storages	1,372
Losses from small catchment dams	556
In-stream infiltration to groundwater, flows to floodplain and evaporation	1,601
Total losses	***3,529***
Water passed at outlet of basin	
River outflows to Port Phillip Bay and Westernport Bay	1,013,685
Total water passed at outlet of basin	***1,013,685***
Total outflows	**1,048,438**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

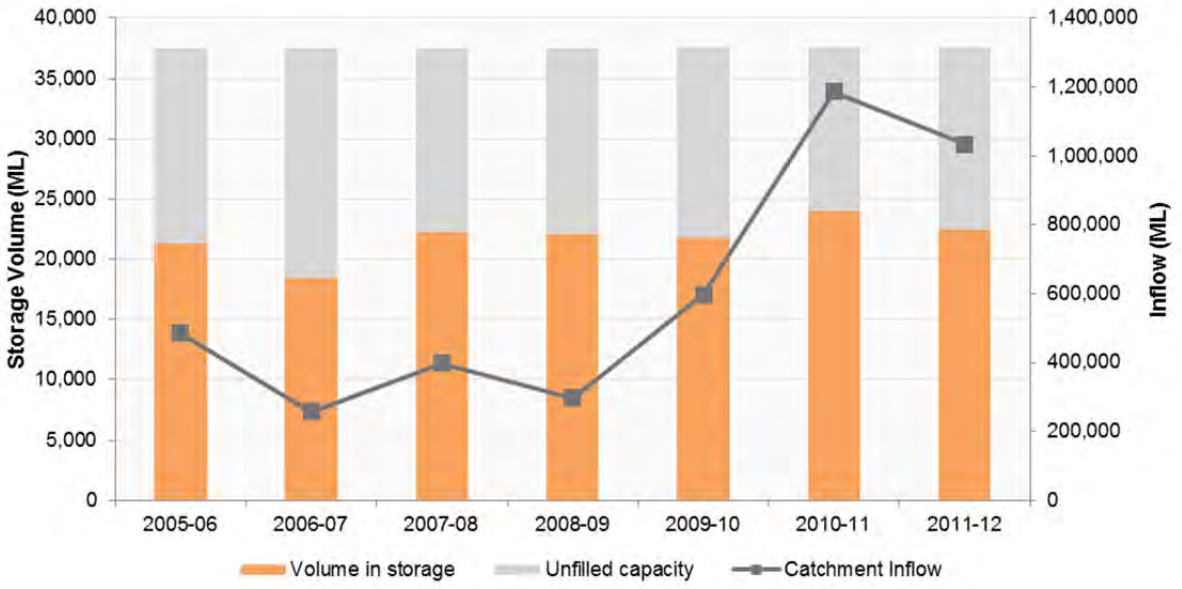
6.16.3.2 Storages and flows

Catchment inflows were 1,033,964, or 191% of the long-term average of 541,000 ML.

The amount of water flowing from the Bunyip basin into Port Phillip Bay, Westernport Bay and Bass Strait was 1,013,685 ML in 2011–12, compared to 1,158,200 ML in 2010–11. This represents 98% of the catchment inflows into the basin for 2011–12.

The Tarago Reservoir is the only major on-stream storage in the Bunyip basin. The Tarago Reservoir ended the year at 22,434 ML, or 90% of its effective capacity of 25,000 ML Figure 6.16-2). Tarago Reservoir has a capacity of 37,500 ML, however, as in previous years, it operated at a temporary capacity of 25,000 ML in 2011–12 for dam safety reasons.

Figure 6.16-2 All major storages and catchment inflows



6.16.3.3 Volume diverted

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. The Victorian Environmental Water Holder (VEWH) 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.

The total volume of water diverted under bulk entitlements by water corporations was lower in 2011–12 compared to 2010–11 Table 6.16-4).

Table 6.16-4 Bulk entitlement volumes and diversions

Bulk entitlement[1]	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
Gippsland Water				
Tarago River	5	4,825	0	3,018
Melbourne metropolitan retailers				
Tarago and Bunyip Rivers	5	30,510	0	8,700
Southern Rural Water				
Tarago River – Southern Rural Water[2]	5	1,260	0	0
2011–12 Total		**39,595**	**0**	**11,718**
2010–11 Total		39,595	0	19,268

Notes:

(1) This table does not include bulk entitlements and environmental entitlements held by the VEWH. Water available under VEWH entitlements in the Bunyip basin is used to support streamflows and is not diverted out of the waterway.

(2) Southern Rural Water did not take any water under this entitlement for supply to licensed diverters downstream of Tarago Reservoir in 2011–12.

The Tarago and Bunyip Rivers Environmental Entitlement 2009 provides the VEWH with a 10.3% 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. Streamflows in the Tarago and Bunyip Rivers were above average in 2011–12 and no water was released from storage under the entitlement.

The volume of water diverted from unregulated streams by licence holders in the Bunyip basin was greater in 2011–12 compared to 2010–11, despite the total licence volume in the basin decreasing (Table 6.16-5).

Table 6.16-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**19,167**	**3,982**
2010–11	19,450	3,675

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: No information available.

6.16.4 Groundwater resources

The Bunyip basin contains the Frankston GMA, Nepean GMA and Koo Wee Rup WSPA, as well as part of the Moorabbin GMA. A groundwater management plan was endorsed by the Minister for the Koo Wee Rup WSPA in 2010. Groundwater levels in the Koo Wee Rup WSPA are generally increasing, while levels in the Nepean and Frankston GMAs are stable. Insufficient observation bores are available to determine trends for the Moorabbin GMA. Groundwater resources supply licences and domestic and stock use in the area. Groundwater is also available for supply to the town of Lang Lang.

A summary of the licensed entitlements and use from GMUs within the Bunyip basin is presented Table 6.16-7. These volumes may include domestic and stock usage where it is part of an existing licence. Reported groundwater use in the Bunyip basin increased in 2011–12 compared to 2010–11, largely as a result of increased extractions from the Nepean GMA.

Table 6.16-7 Licensed groundwater volumes

WSPA/GMA(1)	GMA/WSPA aquifer depth limits (m)	Entitlement limit(2) (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Frankston GMA (100%)	50-200	3,200	1,685	119	0	119	72
Moorabbin GMA (63%)	All depths	1,692	1,640	547	0	547	341
Nepean GMA (100%)(3)	All depths	6,013	6,110	3,152	0	3,152	1,798
Koo-Wee-Rup WSPA (100%)	All depths	12,915	12,336	1,924	0	1,924	1,939
Total		**23,820**	**21,771**	**5,742**	**0**	**5,742**	**4,150**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit.

(3) Licence entitlement greater than entitlement limit due to correction of a licence volume in the Water Register. PCV to be amended.

An estimate of domestic and stock groundwater use is provided in Table 6.16-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.16-7. The number of domestic and stock bores in the Bunyip basin increased in 2011–12, compared to 2010–11.

Table 6.16-8 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 (100%)	134	201
Moorabbin GMA (63%)	238	356
Nepean GMA (100%)	2,249	2,249
Koo Wee Rup WSPA (100%)	1,251	1,877
Total	**3,872**	**4,683**

In the Bunyip basin, groundwater is used as an urban water supply for the township of Lang Lang. The licensed entitlements and metered use for this groundwater supply are provided in Table 6.16-9.

Table 6.16-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Lang Lang	119	3	4
Total	**119**	**3**	**4**

6.16.5 Recycled water

Gippsland Water, South East Water and Melbourne Water operate wastewater treatment plants within the Bunyip basin. Overall, 3% of wastewater was recycled for off-site purposes.

The largest treatment plant is the Eastern Treatment Plant operated by Melbourne Water, which recycled 2% of its total wastewater volume of 153,557 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 6.16-10 shows the volume of water recycled in the Bunyip basin in 2011–12.

Table 6.16-10 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	260	260	67%	0	175	0	0	85	0	0
Boneo	3,448	804	21%	0	738	0	0	66	2,644	0
Drouin	830	16	2%	0	0	16	0	0	814	0
Eastern Treatment Plant	153,557	18,139	2%	3,808	0	0	0	14,331	0	135,418
Kooweerup	146	24	16%	0	24	0	0	0	102	20
Lang Lang	90	47	52%	0	47	0	0	0	33	10
Longwarry	130	11	8%	0	0	11	0	0	134	(15)
Mt Martha	5,737	741	0%	0	18	0	0	723	4,996	0
Neerim South	44	0	0%	0	0	0	0	0	44	0
Pakenham	2,204	264	9%	0	148	43	0	73	380	1,560
Somers	1,406	126	6%	0	74	17	0	35	1,209	71
Total 2011–12	**167,853**	**20,432**	**3%**	**3,808**	**1,224**	**87**	**0**	**15,313**	**10,357**	**137,064**
Total 2010–11	174,624	18,439	2%	2,144	737	56	0	15,502	13,812	142,438

Notes:

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

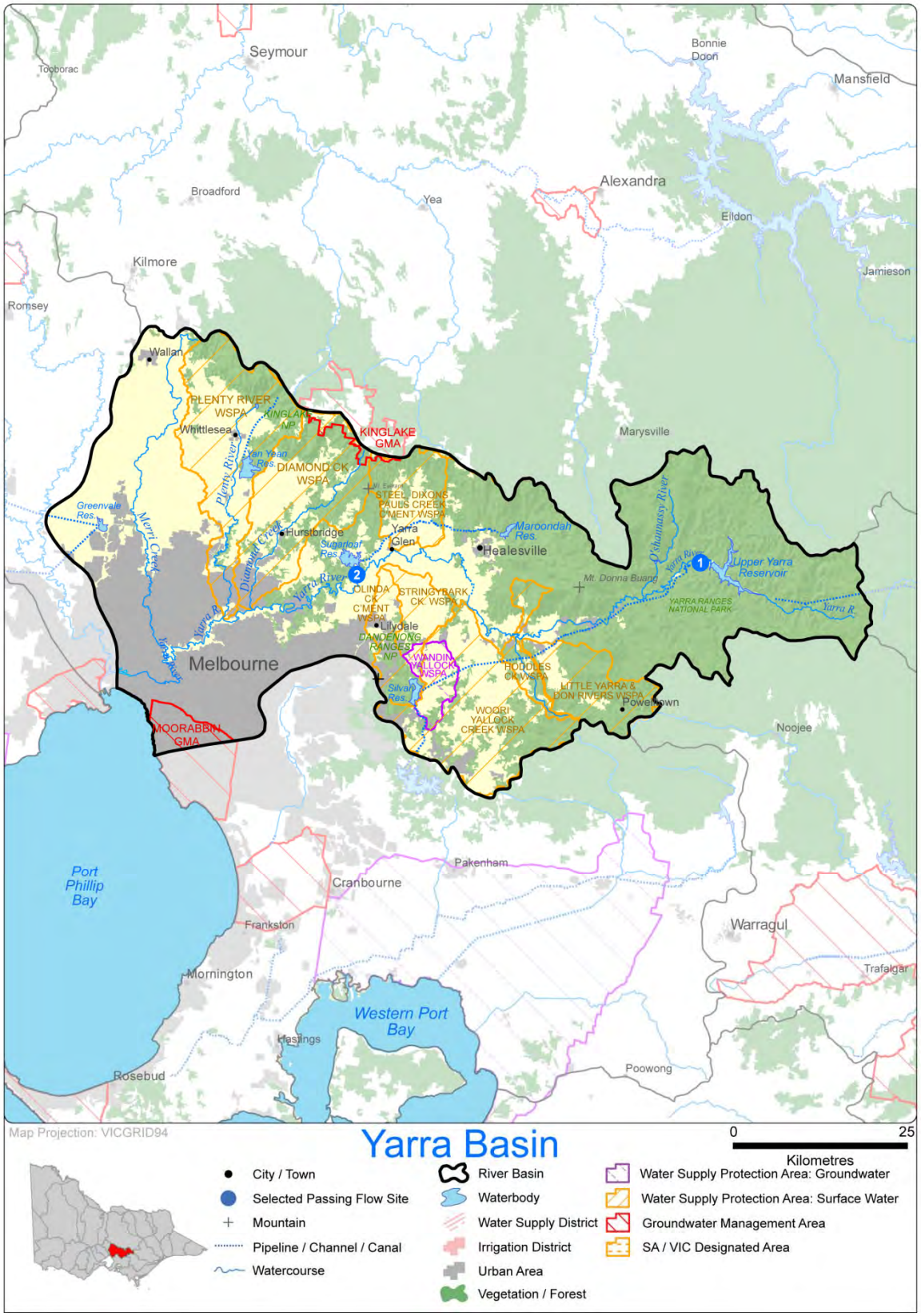
(2) 'Outside process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(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.

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 2011–12, rainfall across the Yarra basin ranged between 100% and 125% of the long-term average. Catchment inflows were 114% of the long-term average. While this was a decrease from the previous year's inflows of 138%, it was the second 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 slightly higher, from 77% of capacity at the start of the year and 80% by the end of June 2012.

Melbourne's urban water restrictions were reduced from Stage 2 to Stage 1 at the beginning of December 2011, and remained at Stage 1 throughout the rest of the year.

The total volume of water diverted by licence holders from unregulated streams was similar in 2011–12 compared to 2010–11. The volume of groundwater used in the Yarra basin was higher than in 2010–11, with extractions increasing in the Moorabbin GMA and Wandin Yallock WSPA.

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	
Southern Rural Water	Manages groundwater licensed diversions		
Victorian Environmental Water Holder			Holds and manages environmental entitlements in the basin

Notes:

(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 2011–12, the Yarra basin EWR comprised:

- the Yarra River Environmental Entitlement 2006
- 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 streamflow 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 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Yarra basin are shown in Table 6.17-2. A 8,243 ML portion of the recycled water resource presented in Table 6.17-2 was discharged from treatment plants in the Yarra basin back into Yarra waterways (see section 6.17.5). This amount is also reported as 'treated wastewater discharged back to river' in Table 6.17-3, therefore this volume is included as both a surface water resource and recycled water resource in Table 6.17-2.

Table 6.17-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	1,225,211	373,844
Groundwater	4,771	1,095
Recycled water	11,178	2,319

6.17.3 Surface water resources

6.17.3.1 Water balance

A surface water balance for the Yarra basin is shown in Table 6.17-3.

Table 6.17-3 Balance of surface water in the Yarra basin

Water account component	2011–12 (ML)[1]
Major on-stream storage	
Volume in storage at start of year	191,140
Volume in storage at end of year	196,989
Change in storage	**5,849**
Inflows	
Catchment inflow[2]	1,200,267
Rainfall on major storages	14,539
Transfers from Thomson	1,062
Transfers from Goulburn (Silver and Wallaby creeks)	1,100
Transfers from Goulburn via North-South pipeline[3]	0
Treated wastewater discharged back to river	8,243
Total inflows	**1,225,211**
Outflows	
Diversions	
Urban diversions	345,600
Licensed diversions from unregulated streams	12,420
Small catchment dams	15,824
Total diversions	***373,844***
Losses	
Evaporation losses from major storages	11,177
Evaporation from small catchment dams	1,268
In-stream infiltration to groundwater, flows to floodplain and evaporation[4]	n/a
Total losses	***12,445***
Water passed at outlet of basin	
River outflows to Port Phillip Bay	833,073
Total water passed at outlet of basin	***833,073***
Total outflows	**1,219,362**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

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

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

6.17.3.2 Storages and flows

Inflows to the Yarra basin during 2011–12 were 1,200,267 ML, or 14% higher than the long-term average (of 1,054,000 ML). This is lower than 2010–11 when the inflows were 1,453,600 ML or 38% higher than the long-term average (Figure 6.17-2).

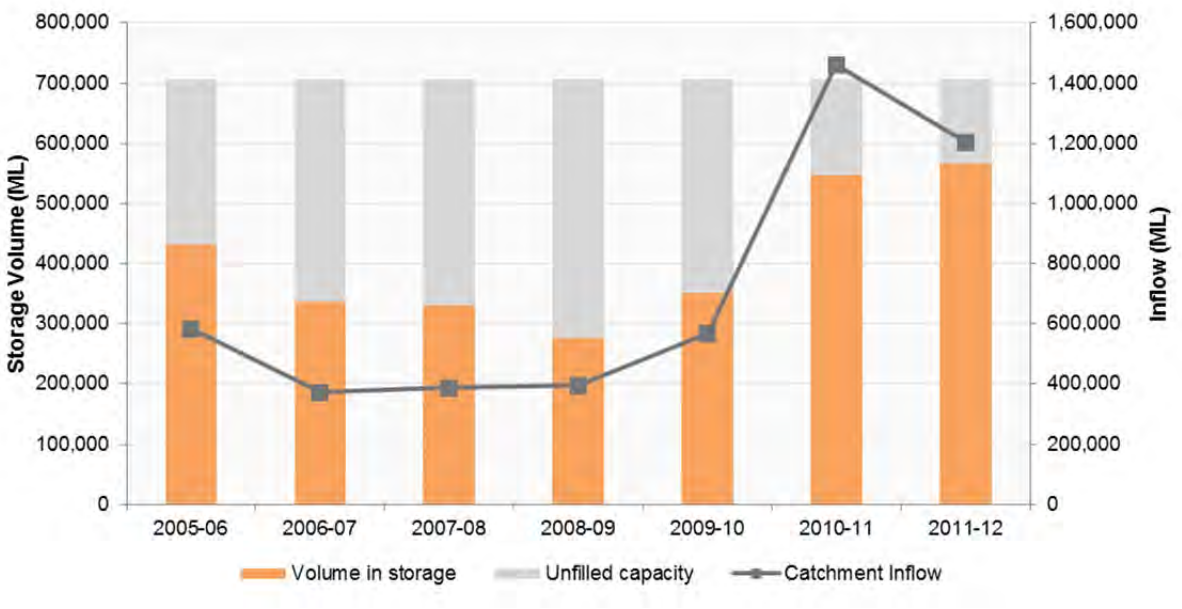
The amount of water flowing from the Yarra basin into Port Phillip Bay was 833,073 ML in 2011–12. This represents 69% of the catchment inflows to the basin, compared to 65% in 2010–11.

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 is an off-stream storage but has a dual role to harvest water and to act as a seasonal balancing reservoir. Silvan Reservoir, Yan Yean 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 (on-stream and off-stream) in the basin were 565,861 ML (80% of capacity) by the end of June 2012 compared to 546,300 ML in July 2011 (Figure 6.17-2).

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 were 196,989 ML in June 2012 compared to 191,140 ML in July 2011.

6.17.3.3 Volume diverted

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.

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 by water corporations under bulk entitlements in the Yarra basin was lower in 2011–12 compared to 2010–11 (Table 6.17-4).

Table 6.17-4 Bulk entitlement volumes and diversions

Bulk entitlement[(1)]	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
Melbourne metropolitan retailers				
Yarra River[(2)(3)]	15	400,000	0	343,400
Western Water				
Melbourne headworks system[(4)]	1	18,250	0	4,910
Total 2011–12		**400,000**	**0**	**343,400**
Total 2010–11[(5)]		400,000		456,400

Notes:

(1) This table does not include bulk entitlements and environmental entitlements held by the VEWH. Water available under VEWH entitlements in the Yarra basin is used to support streamflows and is not diverted out of the waterway.

(2) 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 2011–12 was 289,500 ML.

(3) 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 2011–12 was 421,300 ML.

(4) This bulk entitlement is not included in the totals for Bulk Entitlement Volume and Volume Diverted as the entitlement volume and volume diverted is already accounted under the Melbourne metropolitan retailers' desalinated water bulk entitlement in the South Gippsland basin.

(5) While the 2010–11 diversion was 456,400 ML, the 15-year rolling average diverted volume remained less than 400,000 ML per year.

The total volume of water diverted by licence holders from unregulated streams was similar in 2011–12 compared to 2010–11 (Table 6.17-5).

Table 6.17-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**43,251**	**12,420**
2010–11	50,874	12,101

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

6.17.4 Groundwater resources

The Yarra basin contains the Wandin Yallock WSPA as well as part of the Kinglake GMA and part of the Moorabbin GMA. Groundwater levels in the Wandin Yallock WSPA showed an increasing trend in 2011–12. Insufficient observation bores are available to determine trends in the Kinglake and Moorabbin GMAs. Groundwater is not used to augment urban supplies in the Yarra basin.

A summary of the licensed entitlements and use from GMUs within the Yarra basin are shown in Table 6.17-7. These volumes may include domestic and stock usage where it is part of an existing licence. Reported groundwater use in the Yarra basin was higher in 2011–12 compared to 2010–11 due to increased extraction in the Moorabbin GMA and Wandin Yallock WSPA.

Table 6.17-7 Licensed groundwater volumes

WSPA/GMA[1]	GMA/WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Kinglake GMA (22%)	All depths	446	410	33	0	33	31
Moorabbin GMA (37%)	All depths	1,008	977	326	0	326	203
Wandin Yallock WSPA (100%)[3]	All depths	2,924	2,933	285	0	285	198
Total		**4,378**	**4,320**	**644**	**0**	**644**	**432**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit.

(3) The licensed entitlement for Wandin Yallock was able to exceed the entitlement limit under the current PCV order as part of the Dairy Shed Water Licence Transition Program. The PVC will be amended for Wandin Yallock WSPA once the program is finalised.

An estimate of domestic and stock groundwater use is provided in Table 6.17-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.17-7.

Table 6.17-8 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (ML)
Kinglake GMA (22%)[1]	56	113
Moorabbin GMA (37%)[2]	141	212
Wandin Yallock WSPA (100%)[2]	84	126
Total	**282**	**451**

Note:

(1) Estimated domestic and stock use for Kinglake GMA is calculated using a factor of 2 ML per bore.

(2) Estimated domestic and stock use for Moorabbin GMA and Wandin Yallock WSPA is calculated using a factor of 1.5 ML per bore.

6.17.5 Recycled water

Yarra Valley Water operates eight wastewater treatment plants within the Yarra basin. A summary of the volume of recycled water is provided below in Table 6.17-9.

Wastewater was reused at three of the plants in 2011–12. Compared with 2010–11, the volume of wastewater entering the treatment plants and the volume of water recycled decreased during the year. Overall, 5% of wastewater was reused in the basin, which is the same in 2010–11.

Table 6.17-9 shows the volumes of water recycled in the Yarra basin in 2011–12.

Table 6.17-9 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	594	127	0%	0	0	0	127	0	467
Brushy Creek	4,247	817	0%	19	0	0	798	3,842	(412)
Craigieburn	990	132	0%	4	0	0	128	858	(0)
Healesville	486	91	0%	0	0	0	91	396	(0)
Lilydale	2,964	532	4%	110	0	0	422	2,114	318
Monbulk	20	0	0%	0	0	0	0	20	0
Upper Yarra	984	171	0%	0	0	0	171	798	15
Wallan	615	333	54%	71	262	0	0	215	67
Whittlesea	278	117	33%	93	0	0	25	0	161
Total 2011–12	**11,178**	**2,319**	**5%**	**297**	**262**	**0**	**1,761**	**8,243**	**616**
Total 2010–11	11,435	2,425	5%	371	201	0	1,854	8,842	168

Notes:

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

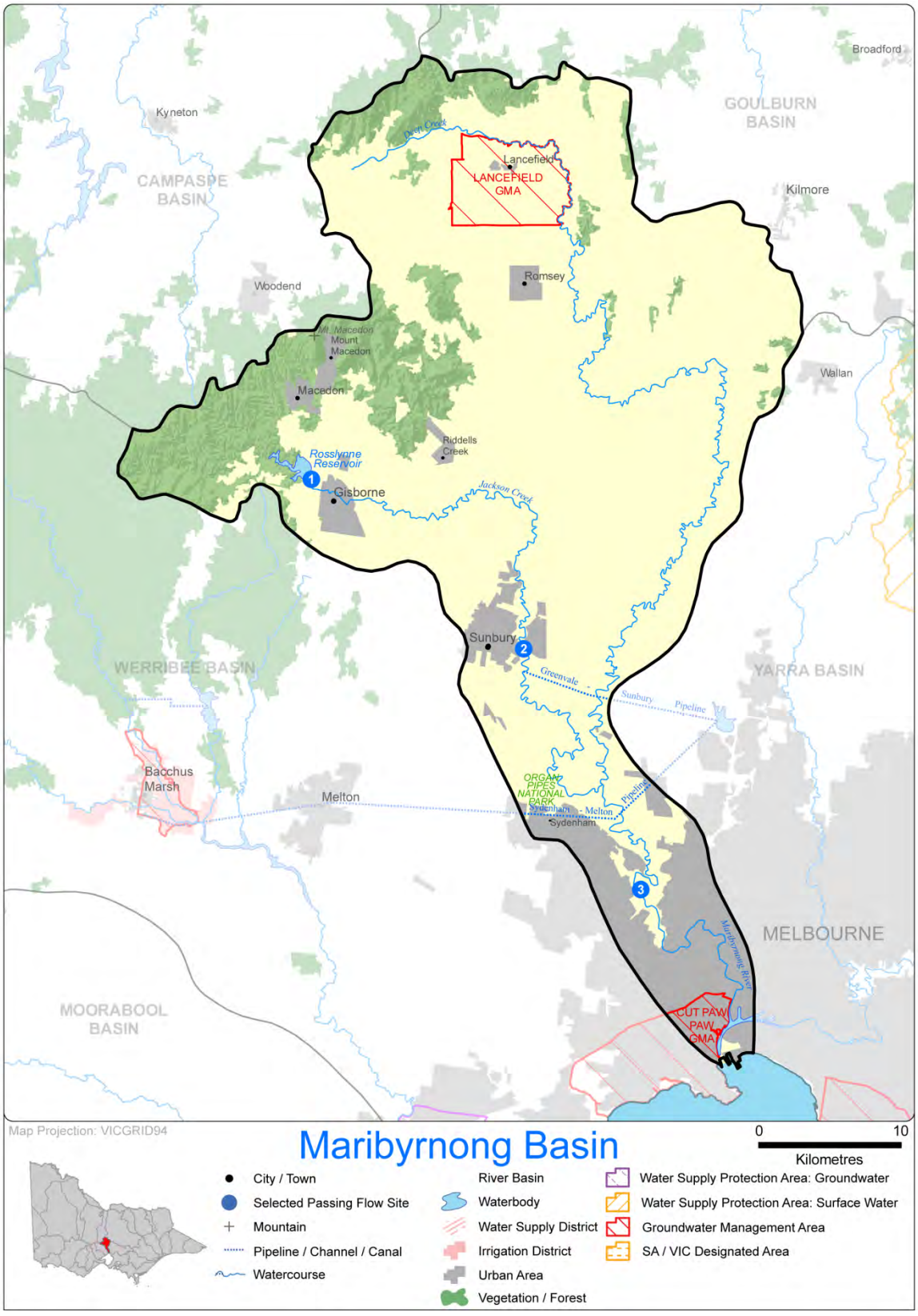
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(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 the Maribyrnong basin ranged between 100% and 125% of the long-term average in 2011–12. Catchment inflows were 54% of the long-term average, significantly lower than in 2010–11, which saw inflows of more than twice the long-term average.

The storage volume in Rosslynne Reservoir started the year at 66% of capacity and held 72% at the end of June 2012.

Western Water eased restrictions from Stage 2 to Stage 1 in December 2011, in line with Melbourne Water.

Southern Rural Water's licensed surface water users were unrestricted during the year.

Table 6.18-1 shows the responsibilities of the authorities within the Maribyrnong basin.

Table 6.18-1 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 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 2011–12, 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 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Maribyrnong basin are shown in Table 6.18-2. A 2,493 ML portion of the recycled water resource presented in Table 6.18-2 was discharged from treatment plants in the Maribyrnong basin back into the Maribyrnong waterways (see section 6.18.5). This amount is also reported as 'treated wastewater discharged back to river' in Table 6.18-3, therefore this volume is included as both a surface water resource and recycled water resource in Table 6.18-2.

Table 6.18-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	65,134	9,648
Groundwater	1,608	244
Recycled water	3,198	1,378

6.18.3 Surface water resources

6.18.3.1 Water balance

A surface water balance for the Maribyrnong basin is shown in Table 6.18-3.

Table 6.18-3 Balance of surface water in the Maribyrnong basin

Water account component	2011–12 (ML) [1]
Major on-stream storage	
Volume in storage at start of year	16,715
Volume in storage at end of year	18,388
Change in storage	**1,673**
Inflows	
Catchment inflow[2]	60,885
Rainfall on major storages	1,756
Treated wastewater discharged back to river	2,493
Total inflows	**65,134**
Outflows	
Diversions	
Urban diversions	1,375
Licensed diversions from regulated streams	52
Licensed diversions from unregulated streams	439
Small catchment dams	7,782
Total diversions	***9,648***
Losses	
Evaporation losses from major storages	1,455
Evaporation from small catchment dams	4,861
In-stream infiltration to groundwater, flows to floodplain and evaporation	1,365
Total losses	***7,681***
Water passed at outlet of basin	
River outflows to Port Phillip Bay	46,132
Total water passed at outlet of basin	***46,132***
Total outflows	**63,461**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

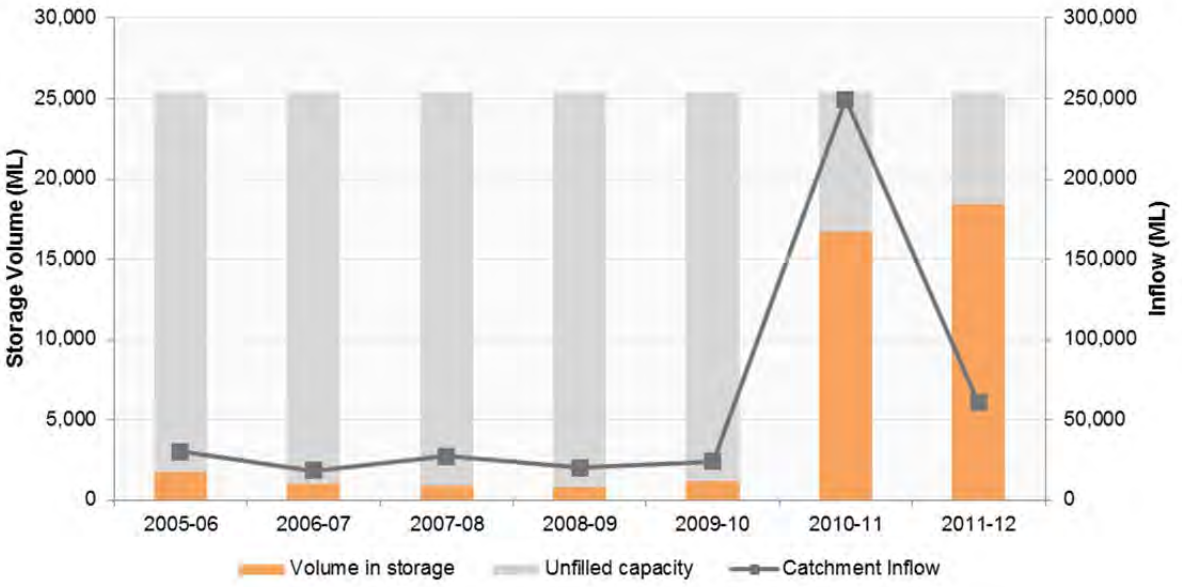
6.18.3.2 Storages and flows

Catchment inflows were 60,885 ML, or 54% of the long-term average of 113,000 ML and significantly lower than 2010–11, which was more than double the long-term average (Figure 6.18-2).

The amount of water flowing into Port Phillip Bay in 2010–11 was 46,132 ML compared to 222,200 ML in 2010–11. This represents 76% of the catchment inflows into the basin.

Rosslynne Reservoir, with a capacity of 25,368 ML, is the only major storage located within the basin. The storage volume was 18,388 ML (72% of capacity) at the end of June 2012 compared to 16,715 ML (66% of capacity) at the start of July 2011 (Figure 6.18-2).

Figure 6.18-2 All major storages and catchment inflows



6.18.3.3 Volume diverted

Melbourne Water, Western Water and Southern Rural Water hold bulk entitlements to divert surface water in the Maribyrnong basin. Surface water is also diverted by licence holders and harvested in small catchment dams.

The total volume of water diverted under bulk entitlements by water corporations was greater in 2011–12 compared to 2010–11 (Table 6.18-4).

Table 6.18-4 Bulk entitlement volumes and diversions

Bulk entitlement	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
Western Water				
Gisborne – Barringo Creek	5	320	0	0
Lancefield	1	315	0	169
Macedon and Mt Macedon(1)	5	645	0	723
Riddells Creek	1	300	0	10
Romsey	1	460	0	321
Maribyrnong (Rosslynne Reservoir)	5	6,100	0	152
Melbourne Water				
Maribyrnong	5	1,396	0	42
Southern Rural Water				
Maribyrnong	5	382	0	10
2011–12 Total		**9,918**	**0**	**1,427**
2010–11 Total		9,918	0	1,167

Note:

(1) Under this entitlement the maximum volume that can be taken on average over any 5-year period is 645 ML. The entitlement also specifies that up to 873 ML can be diverted in any one year.

The volume of water diverted from unregulated streams by licence holders in the Maribyrnong basin was similar in 2011–12 compared to 2010–11 (Table 6.18-5).

Table 6.18-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**1,993**	**439**
2010–11	2,011	402

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

6.18.4 Groundwater resources

The Maribyrnong basin contains the Lancefield GMA and part of the Cut Paw Paw GMA. Groundwater resources supply licences and domestic and stock use in the area; it is also available to supply the towns of Lancefield and Romsey. Groundwater levels in the Lancefield GMA are stable. Insufficient observation bores are available to determine a trend for the Cut Paw Paw GMA.

Licensed groundwater entitlements and use for these GMAs in the Maribyrnong basin are presented in Table 6.18-7. These volumes may include domestic and stock usage where it is part of an existing licence. Reported groundwater use in the Maribyrnong basin was higher in 2011–12 compared with 2010–11. This is largely as a result of increased extractions from the Lancefield GMA.

Table 6.18-7 Licensed groundwater volumes

WSPA/GMA[1]	GMA/WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Cut Paw Paw GMA (21%)	>50	777	110	18	0	18	6
Lancefield GMA (100%)	All depths	1,485	1,378	106	0	106	51
Total		**2,262**	**1,488**	**124**	**0**	**124**	**58**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit.

An estimate of domestic and stock groundwater use is provided in Table 6.18-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.18-7.

Table 6.18-8 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)
Cut Paw Paw GMA (21%)	8	12
Lancefield GMA (100%)	72	108
Total	**80**	**120**

Within the Maribyrnong basin, groundwater is used as an urban water supply for the townships of Lancefield and Romsey. The licensed entitlements and metered use for this supply are provided in Table 6.18-9.

Table 6.18-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Lancefield	294	0	12
Romsey	600	0	0
Total	**894**	**0**	**12**

6.18.5 Recycled water

All wastewater treatment plants within the basin are operated by Western Water. Overall, 21% of wastewater was reused in 2011–12, an increase of 3% on the proportion reused in 2010–11. While the volume of wastewater produced decreased, the volume of water recycled increased in 2011–12 when compared to 2010–11.

Table 6.18-10 shows the volumes of water recycled in the Maribyrnong basin in 2011–12.

Table 6.18-10 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]		
Gisborne	555	443	5%	28	0	0	415	499	(387)
Riddells Creek	212	19	9%	4	15	0	1	132	61
Romsey	367	106	29%	17	89	0	0	261	0
Sunbury	2,064	811	25%	260	261	0	290	1,601	(348)
Total 2011–12	**3,198**	**1,378**	**21%**	**308**	**365**	**0**	**706**	**2,493**	**(673)**
Total 2010–11	3,531	1,196	18%	229	392	0	575	2,676	(341)

Notes:

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

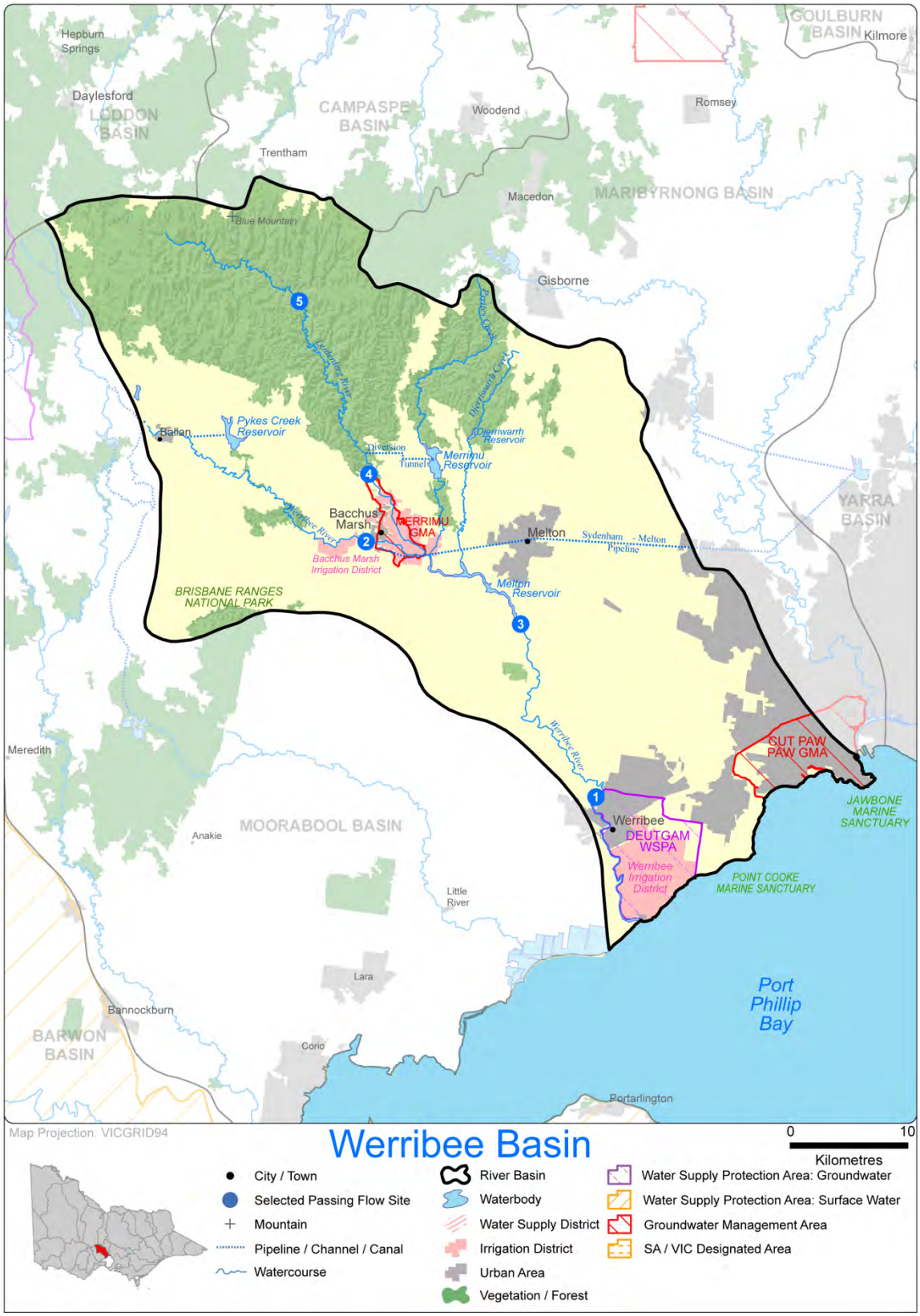
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percent recycled, consistent with its treatment in the ESC's performance report.

(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 generally ranged between 100% and 125% of the long-term average in 2011–12, with the upper catchment being slightly drier, receiving 80% to 100% of the average rainfall. Catchment inflows were 63% of the long-term average, significantly lower than 2010–11 when inflows were more than double the average volume. The amount of water flowing from the Werribee basin into Port Phillip Bay represented 41% of the catchment flows into the basin in 2011–12.

Major storages in the Werribee basin started the year at 92% of capacity at the start of the year, and finished the year lower at 88% by the end of June 2012, largely due to the Merrimu reservoir storage dropping considerably.

The towns of Bacchus Marsh, Melton, Toolern Vale, Myrniong and Long Forest retained Stage 2 restrictions at the start of the year. However, in line with Melbourne Water, Western Water eased restrictions to Stage 1 in December 2011 and these stayed in place for the remainder of the year.

After being subject to Stage 3 restrictions for the duration of 2010–11, towns supplied from Central Highlands Water's Blackwood system had restrictions eased to Stage 2 in July 2011, and they remained in place for the rest of the year.

High reliability water shares in the Werribee system were allocated 100% in July 2011, and the allocation for low reliability water shares reached 75% by June 2012.

Licensed diversions from unregulated streams in the Werribee basin were unrestricted throughout the year.

Table 6.19-1 shows the responsibilities of the authorities within the Werribee basin.

Table 6.19-1 Responsibilities for water resources management

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 groundwater and surface water 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 2011–12, the Werribee basin EWR comprised:

- the Werribee 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 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 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Werribee basin are shown in Table 6.19-2. A 4,357 ML portion of the recycled water resource presented in Table 6.19-2 was discharged from the Altona, Melton and Parwan treatment plants back into the Werribee waterways (see section 6.19.5). This amount is also reported as 'treated wastewater discharged back to river' in Table 6.19-3, therefore this volume is included as both a surface water resource and recycled water resource in Table 6.19-2.

Table 6.19-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	73,643	31,077
Groundwater	6,293	1,556
Recycled water	179,182	35,238

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6.19.3 Surface water resources

6.19.3.1 Water balance

A surface water balance for the Werribee basin is shown in Table 6.19-3. 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 6.19-3 Balance of surface water in the Werribee basin

Water account component	2011–12 (ML)(1)
Major on-stream storage	
Volume in storage at start of year	64,380
Volume in storage at end of year	61,588
Change in storage	**(2,792)**
Inflows	
Catchment inflow(2)	64,557
Rainfall on major storages	4,653
Transfers from other basins	0
Return flow from irrigation	77
Treated wastewater discharged back to river	4,357
Total inflows	**73,643**
Outflows	
Diversions	
Urban diversions	5,517
Irrigation district diversions and licensed diversions from regulated systems	15,938
Licensed diversions from unregulated streams	275
Small catchment dams	9,347
Total diversions	***31,077***
Losses	
Evaporation losses from major storages	8,215
Evaporation from small catchment dams	5,371
In-stream infiltration to groundwater, flows to floodplain and evaporation	5,103
Total losses	***18,688***
Water passed at outlet of basin	
River outflows to Port Phillip Bay	26,670
Total water passed at outlet of basin	***26,670***
Total outflows	**76,435**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML; volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

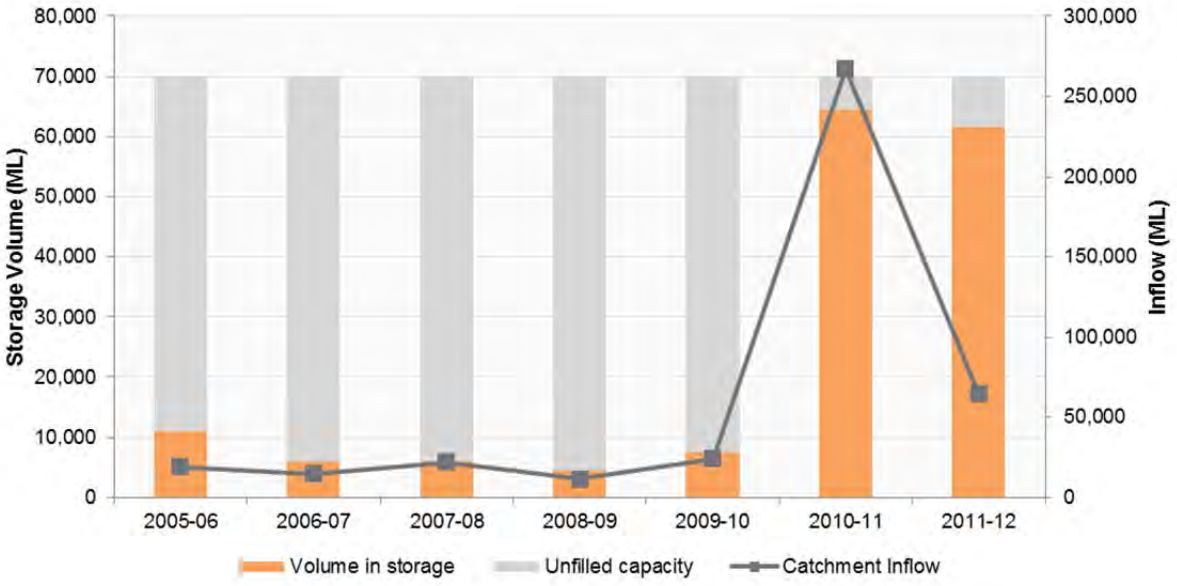
6.19.3.2 Storages and flows

Catchment inflows were 64,557 ML, or 63% of the long-term average of 102,000 ML. This was significantly lower than the 2010–11 inflows of 267,000 ML (Figure 6.19-2).

In 2011–12, 26,670 ML of water flowed from the Werribee basin into Port Phillip Bay. This represents 41% of the catchment inflows into the basin. About 178,000 ML flowed into Port Phillip Bay in 2010–11.

Storage levels for all major storages in the basin were 61,588 ML (88% of capacity) in June 2012 compared to 64,380 ML in July 2011 (Figure 6.19-2). Only volumes for major on-stream storages have been included in the water balance. In the Werribee basin, this includes the Melton, Merrimu, Pykes Creek and Djerriwarrh reservoirs.

Figure 6.19-2 All major storages and catchment inflows



6.19.3.3 Volume diverted

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. The Victorian Environmental Water Holder 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 15,938 ML to supply water share holders in the Werribee and Bacchus Marsh irrigation districts in 2011–12 (Table 6.19-4). The total volume of water diverted under bulk entitlements in the basin was considerably greater in 2011–12 compared to 2010–11.

Table 6.19-4 Bulk entitlement volumes and diversions

Bulk entitlement[1]	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
Central Highlands Water				
Ballan	1	451	0	0
Blackwood and Barry's Reef	1	140	0	50
Western Water				
Myrniong	1	58	0	39
Werribee system – Western Water	5	9,986	0	5,428
Southern Rural Water				
Werribee system – Irrigation	5	27,040	0	15,938
2011–12 Total		**37,675**	**0**	**21,455**
2010–11 Total		37,675	0	12,958

Note:

(1) This table does not include bulk entitlements and environmental entitlements held by the Victorian Environmental Water Holder (VEWH). Water available under VEWH entitlements in the Werribee basin is used to support streamflows and is not diverted out of the waterway.

The volume of water diverted from unregulated streams by licence holders in the Werribee basin in 2011–12 was similar to 2010–11 (Table 6.19-5). The total volume permitted by licences in the basin reduced slightly.

Table 6.19-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**1,098**	**275**
2010–11	1,109	296

The estimated volume of water harvested from small catchment dams represents 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

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.

6.19.4 Groundwater resources

The Werribee basin contains the Deutgam WSPA and Merrimu GMA as well as part of the Cut Paw Paw GMA. In 2011–12, groundwater levels in the Deutgam WSPA were increasing and levels in Merrimu GMA were declining. Insufficient observation bores were available to determine water levels trends for the Cut Paw Paw GMA. Groundwater resources supply licences and domestic and stock use in the area. Groundwater is also available for supply to the town of Blackwood.

A summary of the licensed entitlements and use from GMUs within the Werribee basin is presented in Table 26-8. These volumes may include domestic and stock usage where it is part of an existing licence. Licensed groundwater use across the Werribee basin increased significantly in 2011–12 compared to 2010–11.

Table 6.19-7 Licensed groundwater volumes

WSPA/GMA[1]	GMA/WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Cut Paw Paw GMA (79%)	>50	2,873	405	66	0	66	24
Merrimu GMA (100%)	≤30	451	440	145	0	145	177
Deutgam WSPA (100%)	≤30	5,100	5,082	979	0	979	244
Total		**8,424**	**5,927**	**1,190**	**0**	**1,190**	**445**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit. The Deutgam WSPA was subject to a 25% ban from 1 July 2011, lifted by the end of the season.

An estimate of domestic and stock groundwater use is provided in Table 6.19-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.19-7.

Table 6.19-8 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)
Cut Paw Paw GMA (79%)	31	46
Merrimu GMA (100%)	17	26
Deutgam WSPA (100%)	196	294
Total	**244**	**366**

In the Werribee basin, groundwater is available as an urban water supply for the township of Blackwood. The licensed entitlements and metered use for this groundwater supply are provided in Table 6.19-9.

Table 6.19-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Blackwood	50	0	0
Total	**50**	**0**	**0**

6.19.5 Recycled water

Five wastewater treatment plants operate within the Werribee basin. The volume of wastewater produced in 2011–12 was 179,182 ML, a decrease of 11,087 ML compared to 2010–11. Around 20% of wastewater was reused in 2011–12.

The majority of water recycling in the basin occurs at Melbourne Water's Western Treatment Plant, which reused 18% of wastewater. This included 13,988 ML for on-site irrigation and environmental management and 16,467 ML for habitat management at Ramsar-listed wetlands.

Table 6.19-10 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]		
Altona	5,172	1,174	21%	0	1,068	0	0	106	3,523	476
Ballan	55	55	100%	0	0	55	0	0	0	0
Melton	3,407	2,800	77%	0	390	2,242	0	168	775	(168)
Parwan (Bacchus Marsh)	651	593	91%	0	0	593	0	0	59	(0)
Western Treatment Plant	169,897	30,617	18%	161	1	13,988	16,467	0	0	139,280
Total 2011–12	**179,182**	**35,238**	**20%**	**161**	**1,458**	**16,878**	**16,467**	**274**	**4,357**	**139,587**
Total 2010–11	190,269	33,023	17%	1,921	474	11,640	18,723	266	6,572	150,674

Notes:

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

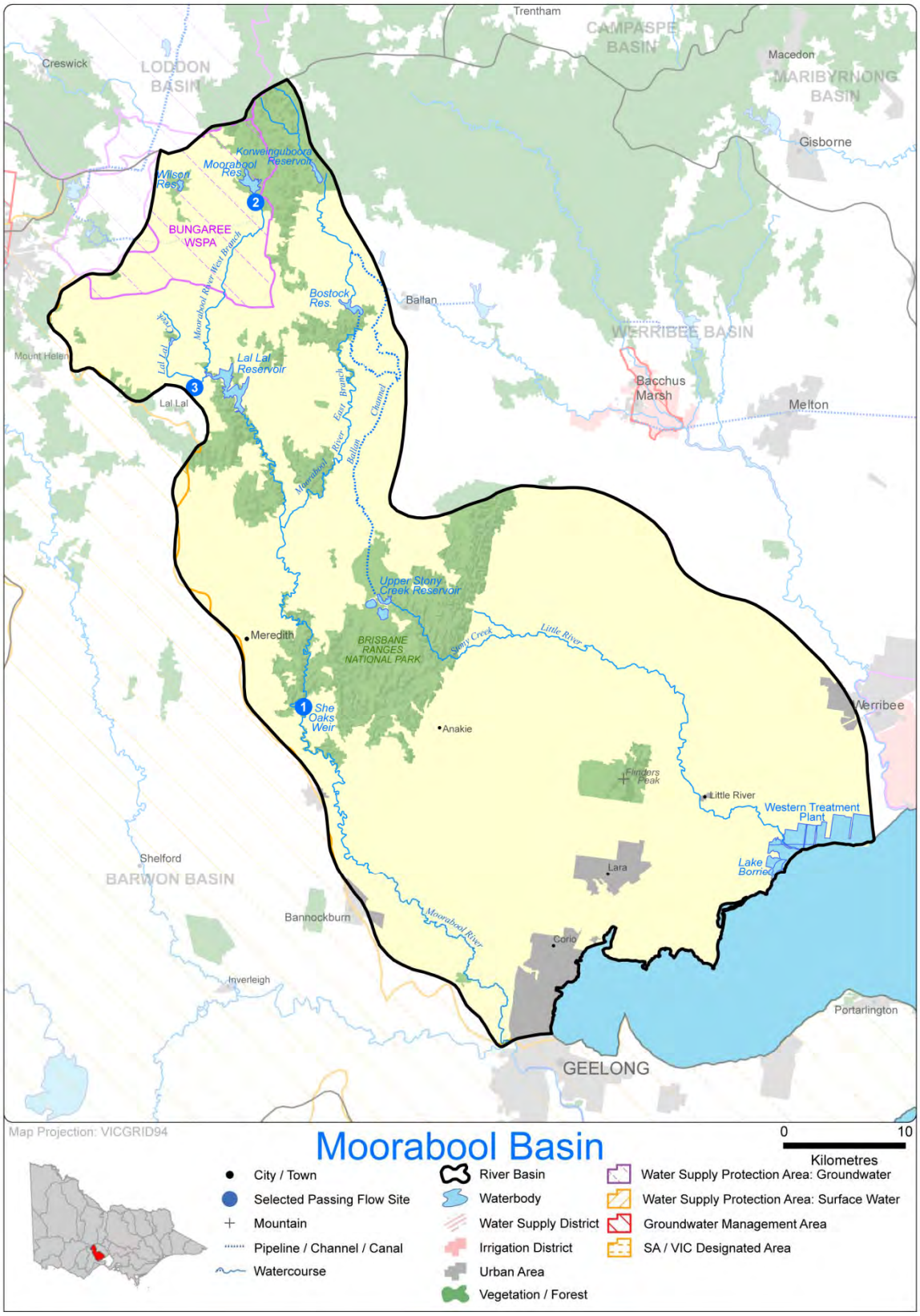
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(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 2011–12 was generally between 100% and 125% of the long-term average, with slightly lower rainfall in the uppermost part of the catchment. Inflows were 112% of the long-term average, and much lower than 2010–11, which saw inflows almost three times the long-term average.

Storage levels for the major storages in the basin started the year at 90% of capacity, and held 88% at the end of June 2012. Geelong's storages in the Barwon basin finished the year at 79% of capacity.

Urban water use in the Moorabool basin was unrestricted throughout 2011–12.

Licensed diversions from the Moorabool River were subject to a ban during summer, but unrestricted throughout the rest of 2011–12. Licensed groundwater use was unrestricted and the volume of groundwater used was around three times that of 2010–11.

Table 6.20-1 shows the responsibilities of the authorities within the Moorabool basin.

Table 6.20-1 Responsibilities for water resources management

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages groundwater and surface water 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 2011–12, the Moorabool basin EWR comprised:

- the Moorabool River Environmental Entitlement 2010
- 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 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Moorabool basin are shown in Table 6.20-2.

Table 6.20-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	114,584	35,660
Groundwater	3,802	1,568
Recycled water	-	-

6.20.3 Surface water resources

6.20.3.1 Water balance

A surface water balance for the Moorabool basin is shown in Table 6.20-3.The majority of water used for consumptive purposes in the basin was sourced from small catchment dams.

Table 6.20-3 Balance of surface water in the Moorabool basin

Water account component	2011–12 (ML)[1]
Major on-stream storage	
Volume in storage at start of year	70,191
Volume in storage at end of year	69,855
Change in storage	**(336)**
Inflows	
Catchment inflow[2]	109,037
Rainfall on major storages	5,547
Total inflows	**114,584**
Outflows	
Diversions	
Urban diversions[3]	9,518
Transfers to Barwon basin (White Swan Reservoir)[4]	2,724
Licensed diversions from unregulated streams	1,220
Small catchment dams	22,197
Total diversions	***35,660***
Losses	
Evaporation losses from major storages	6,961
Evaporation from small catchment dams	7,266
In-stream infiltration to groundwater, flows to floodplain and evaporation	7,270
Total losses	***21,497***
Water passed at outlet of basin	
River outflows to Port Phillip Bay (Little River) and other small coastal streams	30,098
River outflows to the Barwon River (Moorabool River)	27,665
Total water passed at outlet of basin	***57,763***
Total outflows	**114,920**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

(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 2,724 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).

6.20.3.2 Storages and flows

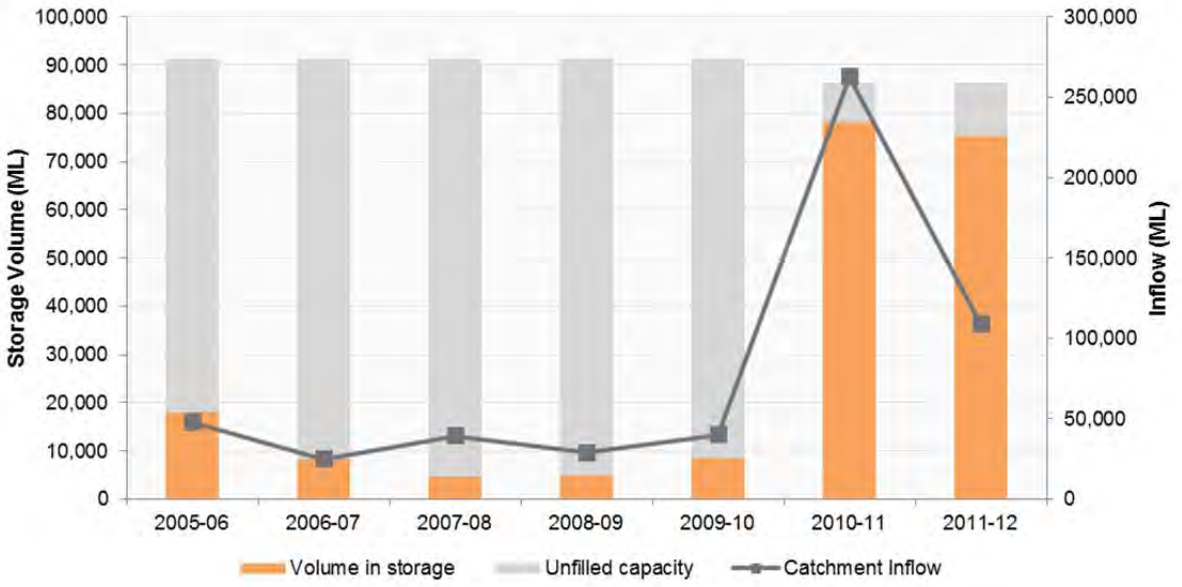
Catchment inflows were 109,037 ML or 112% of the long-term average of 97,000 ML. This was significantly lower than the 2010–11 inflows of 262,800 ML (Figure 6.20-2).

The amount of water flowing from the Moorabool basin into Port Phillip Bay and the Barwon River was 57,763 ML in 2011–12, or 53% of the catchment inflows.

The Moorabool basin has six main storages: the Bostock, Upper Stony Creek, Korweinguboora, Lal Lal, Wilson and Moorabool 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 75,370 ML (88% of capacity) at the end of June 2012 compared to 78,1061 ML (90% of capacity) at the beginning of the year..

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 70,191 ML and ended at 69,855 ML in June 2012.

Figure 6.20-2 All major storages and catchment inflows



6.20.3.3 Volume diverted

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, but the water available under the entitlement is used to support streamflows and is not diverted out of the waterway.

The total volume of water diverted by the two water corporations was much greater in 2011–12 compared to 2010–11 Table 6.20-4).

Table 6.20-4 Bulk entitlement volumes and diversions

Bulk entitlement[(1)]	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
Barwon Water				
Lal Lal – Barwon	3	5,925	0	2,144
Meredith	1	600	0	0
Upper East Moorabool System	1	9,000	0	3,349
She Oaks	3	2,000	0	0
Central Highlands Water				
Lal Lal – Central Highlands	3	12,575	0	4,025
Upper West Moorabool System	1	10,500	0	2,724
2011–12 Total		**40,600**		**12,242**
2010–11 Total		40,600	0	7,487

Note:

(1) This table does not include bulk entitlements and environmental entitlements held by the VEWH. Water available under VEWH entitlements in the Moorabool basin is used to support streamflows and is not diverted out of the waterway.

The volume of water diverted from unregulated streams by licence holders in the Moorabool basin was much greater in 2011–12 compared to 2010–11, despite the total licensed volume in the basin decreasing (Table 6.20-5).

Table 6.20-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**3,610**	**1,220**
2010–11	3,744	721

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.

6.20.4 Groundwater resources

The Moorabool basin contains part of the Bungaree GMA. Groundwater resources supply licences and domestic and stock use in the area. The town of Ballarat is also supplied out of the Bungaree WSPA.

A summary of the licensed entitlements and use for the Bungaree WSPA in the Moorabool basin is presented in Table 6.20-7. These volumes may include domestic and stock usage where it is part of an existing licence. In 2011–12, usage within the Bungaree WSPA increased significantly compared to 2010–11.

Table 6.20-7 Licensed groundwater volumes

WSPA/GMA[1]	GMA/WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Bungaree WSPA (67%)[3]	All depths	3,555	3,553	1,318	0	1,318	489
Total		**3,555**	**3,553**	**1,318**	**0**	**1,318**	**489**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit.

(3) The licensed entitlement volume for Bungaree WSPA includes a 55 ML mineral water licence.

An estimate of domestic and stock groundwater use is provided in Table 6.20-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.20-7.

Table 6.20-8 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)
Bungaree WSPA (67%)	166	250
Total	**166**	**250**

In the Moorabool basin, groundwater is provided to the city of Ballarat. The licensed entitlement and metered use for this groundwater supply is provided in Table 6.20-9.

Table 6.20-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Ballarat	120	54	0
Total	**120**	**54**	**0**

6.20.5 Recycled water

There are no wastewater treatment plants within the Moorabool basin.

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 2011–12, rainfall in the Barwon basin generally ranged between 80% and 100% of the long-term average, compared to 100% to 150% in 2010–11. Catchment inflows in the Barwon basin in 2011–12 were 53% of the long-term average – almost half the inflow volume seen in the previous year.

Despite the reduced inflows, storage levels in the Barwon basin finished the year higher, starting the year at 69% of capacity and ending with 79% at the end of June 2012. Geelong's storages in the Moorabool basin finished the year slightly lower, with 88% of capacity at the end of June 2012.

Urban water use in the Barwon basin was unrestricted throughout 2011–12. Licensed diversions were restricted for a few rivers and creeks during January, but were unrestricted throughout the rest of the year. Groundwater use across the Barwon basin was significantly less than in 2010–11.

Table 6.21-1 shows the responsibilities of the authorities within the Barwon basin.

Table 6.21-1 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		
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 the 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 2011–12, 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 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Barwon basin are summarised in Table 6.21-2. A 26,121 ML portion of the recycled water resource presented in Table 6.21-2 was discharged from the Black Rock, Ballarat South and Ballarat North treatment plants back into the Barwon waterways (see section 6.21.5). This amount is also reported as 'treated wastewater discharged back to river' in Table 6.21-3, therefore this volume is included as both a surface water resource and recycled water resource in Table 6.21-2. 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 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	251,443	62,791
Groundwater	21,592	642
Recycled water	29,291	3,978

6.21.3 Surface water resources

6.21.3.1 Water balance

A surface water balance for the Barwon Basin is shown in Table 6.21-3.

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 decreased from 3,840 ML in 2010–11 to 2,724 ML in 2011–12. This water was transferred to White Swan Reservoir and used to supply the Ballarat system. The Goldfields Superpipe was used to transfer 110 ML from the Campaspe Basin to White Swan Reservoir to augment supplies to Ballarat.

Table 6.21-3 Balance of surface water in the Barwon basin

Water account component	2011–12 (ML)[1]
Major on-stream storage	
Volume in storage at start of year	25,686
Volume in storage at end of year	32,611
Change in storage	**6,925**
Inflows	
Catchment inflow[2]	191,647
Rainfall on major storages	3,015
Inflows from the Moorabool River	27,665
Transfers from the Corangamite basin via Woady Yaloak Channel	160
Transfers from Moorabool basin to White Swan Reservoir[3]	2,724
Transfers from Campaspe basin to White Swan Reservoir	110
Treated wastewater discharged back to river	26,121
Total inflows	**251,443**
Outflows	
Diversions	
Urban diversions	30,225
Licensed diversions from unregulated streams	1,668
Small catchment dams	30,898
Total diversions	***62,791***
Losses	
Evaporation losses from major storages	3,153
Evaporation from small catchment dams	12,543
In-stream infiltration to groundwater, flows to floodplain and evaporation	10,654
Total losses	***26,350***
Water passed at outlet of basin	
River outflows to the ocean	155,376
Total water passed at outlet of basin	***155,376***
Total outflows	**244,517**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

(3) The 2,724 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).

6.21.3.2 Storages and flows

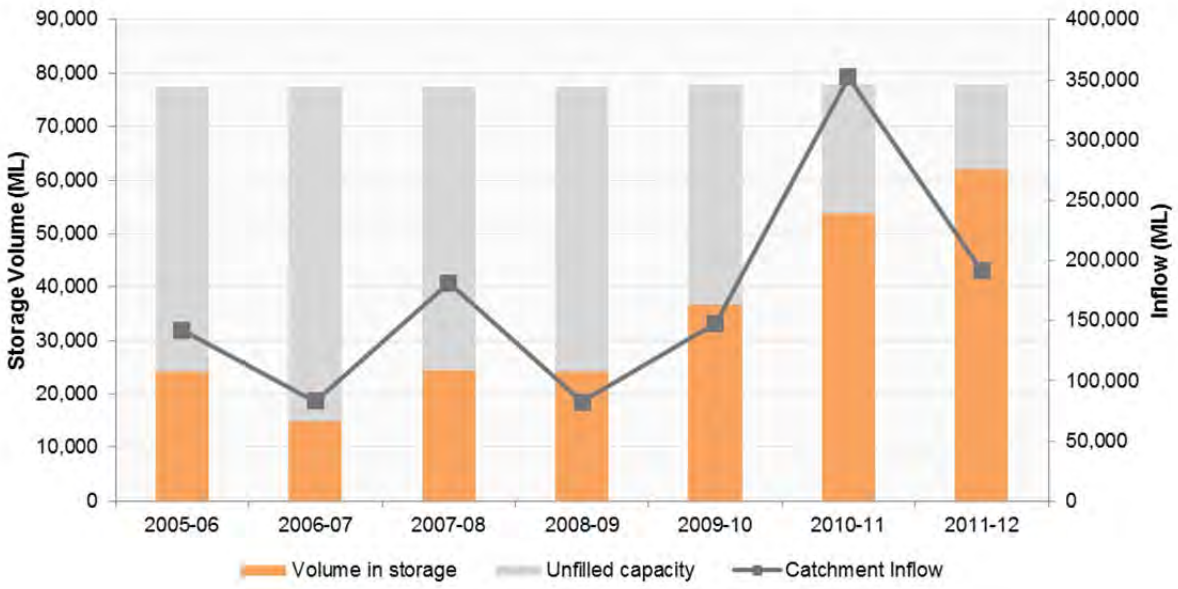
Inflows to the Barwon basin amounted to 191,647 ML in 2011–12, which is 53% of the long-term average (of 360,000 ML). This is a decrease from inflows of 100% of the long-term average in 2010–11 (Figure 6.21-2).

The amount of water flowing from the Barwon basin into Corio Bay and Bass Strait was 155,376 ML in 2011–12. This represents 81% of the catchment inflows to the basin.

Storage levels for all major storages (greater than 1,000 ML capacity) in the basin started the year at 53,691 ML in July 2011 and were 61,885 ML (79% of capacity) at the end of June 2012 (Figure 6.21-2).

Only volumes for major on-stream storages have been included in the water balance; Wurdee Boluc Reservoir has not been included. The volume of water in the major on-stream storages in the basin (West Barwon, White Swan and Gong Gong reservoirs) was 32,611 ML at the end of 2011–12 compared to 25,686 ML at the beginning.

Figure 6.21-2 All major storages and catchment inflows



6.21.3.3 Volume diverted

In the Barwon basin, surface water is diverted by Barwon Water, Central Highlands Water, the Victorian Environmental Water Holder (VEWH) and licensed diverters, and surface water is harvested in small catchment dams.

The total volume of water diverted by the two water corporations was much lower in 2011–12 compared to 2010–11 (Table 6.21-4).

Table 6.21-4 Bulk entitlement volumes and diversions

Bulk entitlement[1]	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
Barwon Water				
Upper Barwon system	3	43,467	0	23,832
Central Highlands Water				
Yarrowee-White Swan system[2]	3	12,267	0	6,393
2011–12 Total		**55,733**	**0**	**30,225**
2010–11 Total		55,733	0	40,885

Notes:

(1) This table does not include bulk entitlements and environmental entitlements held by the VEWH. Any diversions out of the waterway under VEWH entitlements are discussed below.

(2) 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.

A new environmental entitlement was granted in the Barwon basin in July 2011. 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 2011–12.

The estimated volume of water diverted by licence holders was greater in 2011–12 compared to 2010–11. The total licensee volume in the basin also increased (Table 6.21-5).

Table 6.21-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**5,650**	**1,668**
2010–11	5,587	1,428

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.

6.21.4 Groundwater resources

The Barwon basin contains part of the Cardigan GMA, Gellibrand GMA, Gerangamete GMA and Bungaree WSPA. Groundwater levels in Bungaree WSPA are generally increasing, while levels are stable in Cardigan GMA and declining in Gellibrand and Gerangamete GMAs.

A summary of licensed entitlements and use for GMUs that overlap the Barwon basin is presented in Table 6.21-7. These volumes may include domestic and stock usage only if it is part of an existing licence. Groundwater extractions in the Barwon basin were significantly reduced in 2011–12 compared to 2010–11. This is primarily due to the decrease in use in the Gerangamete GMA, with Barwon Water ceasing to pump from the Barwon Downs borefield in August 2010.

Table 6.21-7 Licensed groundwater volumes

WSPA/GMA[1]	GMA/ WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Cardigan GMA (20%)[3]	All depths	194	178	33	0	33	22
Gellibrand GMA (8%)	All depths	0	0	0	0	0	0
Gerangamete GMA (86%)[4]	>60	20,000	20,000	0	0	0	1,144
Bungaree WSPA (24%)[5]	All depths	1,281	1,281	475	0	475	176
Total		**21,475**	**21,459**	**508**	**0**	**508**	**1,342**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit.

(3) Cardigan GMA has 60.1% of its service area in the Hopkins Basin, 19.9% in the Corangamite Basin and 20.1% in the Barwon Basin. Only the non-urban volumes have been allocated according to the surface area percentages. For example, of 3,887 ML of licensed entitlement in the Cardigan GMA, 3,000 ML is licensed for Ballarat urban use and all is extracted from the Hopkins Basin. The remainder of the licensed entitlement was shared proportionally between Hopkins, Barwon and Corangamite basins. 129 ML was extracted from the Cardigan GMA within the Hopkins Basin for urban supplies. The remaining 165 ML of metered use (non-urban) was shared proportionally between Hopkins, Barwon and Corangamite basins.

(4) 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 6.21-7 represents the single year limit, however compliance would also need to be assessed at the 10-year and 100-year level.

(5) The licensed entitlement volume for Bungaree WSPA includes a 55 ML mineral water licence.

An estimate of domestic and stock groundwater use is provided in Table 6.21-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.21-7.

Table 6.21-8 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 (20%)	20	29
Gellibrand GMA (8%)	0	0
Gerangamete GMA (86%)	9	14
Bungaree WSPA (24%)	60	90
Total	89	134

Groundwater contributed to the urban water supply for Geelong in 2011–12. The licensed entitlements and metered use for this supply are provided in Table 6.21-9.

Table 6.21-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Greater Geelong[1]	8,000	0	1,144
Total	**8,000**	**0**	**1,144**

Note:
(1) In a drought year, up to 20,000 ML can be used.

6.21.5 Recycled water

Both Barwon Water and Central Highlands Water operate wastewater treatment plants within the Barwon basin.

In 2011–12, 8% of wastewater in the Barwon basin was recycled. This is an increase from 2% in 2010–11.

Table 6.21-10 shows the volumes of water recycled in the Barwon basin in 2011–12.

Table 6.21-10 Volume of recycled water

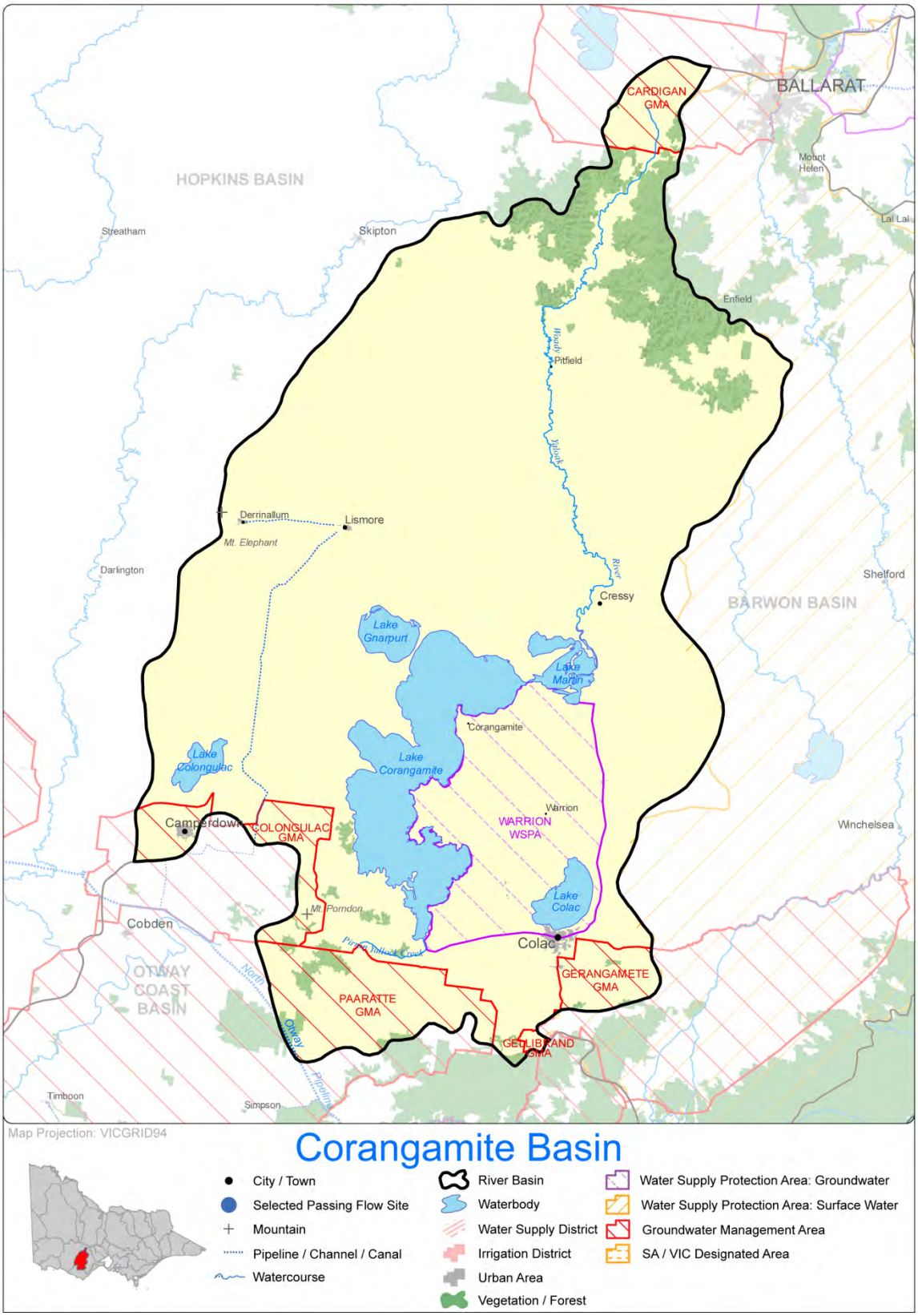
Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process[2])	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other[3] (ML)
				Urban and industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Ballarat North	2,416	661	14%	0	0	341	320	1,755	0
Ballarat South	6,287	51	0%	0	0	0	51	6,236	0
Bannockburn	98	98	46%	0	45	0	53	0	0
Black Rock	20,053	2,731	10%	867	1,057	0	808	18,130	(808)
Portarlington	404	404	23%	0	93	0	310	0	0
Winchelsea	33	33	6%	0	2	0	31	0	0
Total 2011–12	**29,291**	**3,978**	**8%**	**867**	**1,198**	**341**	**1,573**	**26,121**	**(808)**
Total 2010–11	30,305	2,603	2%	0	531	223	1,849	28,427	(725)

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 2011–12, rainfall in the Corangamite basin ranged from 60% to 100% of the long-term average, a decrease on rainfall in the previous year, which was between 150% and 200% of average. Inflows across the basin were 52% of the long-term average, significantly lower than 2010–11 when the inflows were 167% of the long-term average. The amount of water flowing from the Corangamite basin into the Ramsar-listed Western District Lakes represented 90% of the catchment inflows in the basin in 2011–12.

Groundwater licences remained unrestricted in 2011–12. Reported groundwater use in the Corangamite basin increased significantly in 2011–12 compared to 2010–11, largely as a result of increased extractions from the Warrion WSPA.

Water availability for urban customers is not directly affected by inflows in the Corangamite basin as all towns are supplied by other basins. Urban water use for towns within the basin was unrestricted during 2011–12. Licensed surface water users were also 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

Authority	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Manages groundwater and surface water 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 2011–12, 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 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Corangamite basin are shown in Table 6.22-2. A 2,116 ML portion of the recycled water resource presented in Table 6.22-2 was discharged from the Camperdown and Colac treatment plants back into the Corangamite waterways (see section 6.22.5). This amount is also reported as 'treated wastewater discharged back to river' in Table 6.22-3, therefore this volume is included as both a surface water resource and recycled water resource in Table 6.22-2.

Table 6.22-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	166,362	12,551
Groundwater	16,885	4,639
Recycled water	2,294	333

6.22.3 Surface water resources

6.22.3.1 Water balance

A surface water balance for the Corangamite basin is shown in Table 6.22-3. 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 6.22-3 Balance of surface water in the Corangamite basin

Water account component	2011–12 (ML) (1)
Major on-stream storage	
Volume in storage at start of year	-
Volume in storage at end of year	-
Change in storage	-
Inflows	
Catchment inflow(2)	164,247
Rainfall on major storages	-
Treated wastewater discharged back to river	2,116
Total inflows	166,362
Outflows	
Diversions	
Licensed diversions from unregulated streams	185
Small catchment dams	12,366
Total diversions	***12,551***
Losses	
Evaporation losses from major storages	-
Evaporation from small catchment dams	6,534
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	n/a
Total losses	***6,534***
Water passed at outlet of basin	
River outflows to the Corangamite Lakes	147,117
River outflows to Barwon Basin via Woady Yaloak Channel	160
Total water passed at outlet of basin	***147,277***
Total outflows	166,362

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

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

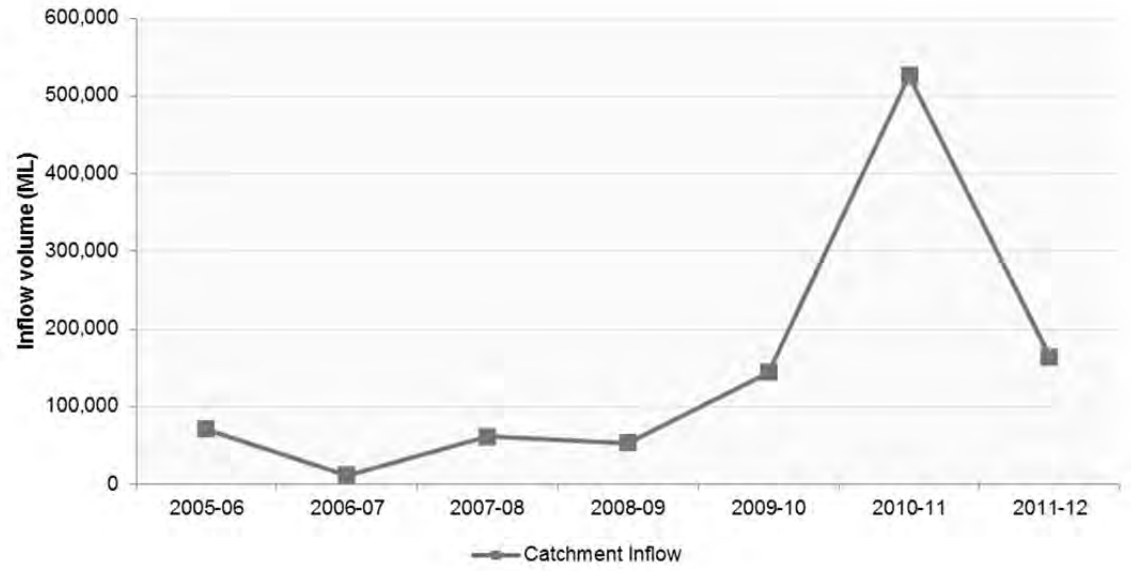
6.22.3.2 Storages and flows

Inflows across the basin were 52% of the long-term average of 316,000 ML, which is significantly lower than 2010–11 where the inflows were 167% of the long-term average (Figure 6.22-2).

Outflows from the Corangamite basin into the Western District Lakes were 147,277 ML in 2011–12, or 90% of the catchment inflows.

There are no major water supply storages in the Corangamite basin.

Figure 6.22-2 Catchment inflows



6.22.3.3 *Volume diverted*

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 2011–12 compared to 2010–11. The total licensed volume in the basin also reduced (Table 6.22-4).

Table 6.22-4 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**1,242**	**185**
2010–11	1,261	216

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

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.

6.22.4 Groundwater resources

The Corangamite basin contains the Warrion WSPA as well as part of the Colongulac GMA, Cardigan GMA and Paaratte GMA. Groundwater supplies licences and domestic and stock use in the area. Groundwater is not used to supply towns within the Corangamite basin. Groundwater levels in the Cardigan GMA and Paaratte GMA are generally stable, while levels in the Warrion WSPA are stable. Insufficient observation bores were available to determine a trend for Colongulac GMA.

A summary of the licensed entitlements and use for GMUs that overlap the Corangamite basin is shown in Table 6.22-6 These volumes may include domestic and stock usage where it is part of an existing licence. Reported groundwater use in the Corangamite basin increased significantly in 2011–12 compared to 2010–11, largely as a result of increased extractions from the Warrion WSPA, which has the largest volume of entitlements within the basin.

Table 6.22-6 Licensed groundwater volumes

WSPA/GMA[1]	GMA/WSPA aquifer depth limits (m)	Entitlement limit[2][3] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Cardigan GMA (20%)[4]	All depths	192	176	33	0	33	22
Colongulac GMA (35%)	≤60	1,654	1,475	373	0	373	100
Paaratte GMA (14%)	>120	657	458	46	0	46	42
Warrion WSPA (100%)	All depths	13,836	14,086	3,497	0	3,497	992
Total		**16,339**	**16,195**	**3,949**	**0**	**3,949**	**1,156**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit. The PCV for Warrion WSPA is currently under review. The licensed entitlements are greater than PCV due to the Dairy Shed Water Licence Transition Scheme.

(3) Barwon Water is the sole licence holder in the Gerangamete GMA and uses groundwater to supplement Geelong's water supply. As all of this groundwater would be used in the Barwon basin, all volumes have been 100% allocated to the Barwon basin despite the Gerangamete GMA having 14% of its surface area in the Corangamite basin. See Table 6.21-7 in the Barwon basin chapter for Gerangamete GMA volumes.

(4) Cardigan GMA has 60.1% of its service area in the Hopkins Basin, 19.9% in the Corangamite Basin and 20.1% in the Barwon Basin. Only the non-urban volumes have been allocated according to the surface area percentages: for example, of 3,887 ML of licensed entitlement in the Cardigan GMA, 3,000 ML is licensed for Ballarat urban use, all extracted from the Hopkins Basin. The remainder of the licensed entitlement was shared proportionally between Hopkins, Barwon and Corangamite basins. 129 ML was extracted from the Cardigan GMA within the Hopkins Basin for urban supplies. The remaining 165 ML of metered use (non-urban) was shared proportionally betweenHopkins, Barwon and Corangamite basins.

An estimate of domestic and stock groundwater use is provided in Table 6.22-7. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.22-6.

Table 6.22-7 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 (20%)	19	29
Colongulac GMA (35%)	45	68
Gerangamete GMA (14%)	2	2
Paaratte GMA (14%)	42	63
Warrion WSPA (100%)	352	528
Total	**460**	**690**

6.22.5 Recycled water

A wastewater treatment plant at Colac is operated by Barwon Water and a treatment plant at Camperdown is operated by Wannon Water. Recycled water was primarily used for agricultural purposes. Compared to 2010–11 the volume and percentage of water recycled increased in 2011–12, with around 13% recycled.

Table 6.22-8 shows the volumes of water recycled in the Corangamite basin in 2011–12.

Table 6.22-8 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]		
Camperdown Industrial	24	0	0%	0	0	0	0	0	24
Camperdown Municipal	390	289	74%	13	276	0	0	235	(134)
Colac	1,881	44	0%	0	0	0	44	1,881	(44)
Total 2011–12	**2,294**	**333**	**13%**	**13**	**276**	**0**	**44**	**2,116**	**(155)**
Total 2010–11	2,695	185	6%	7	152	0	26	2,146	364

Notes:

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

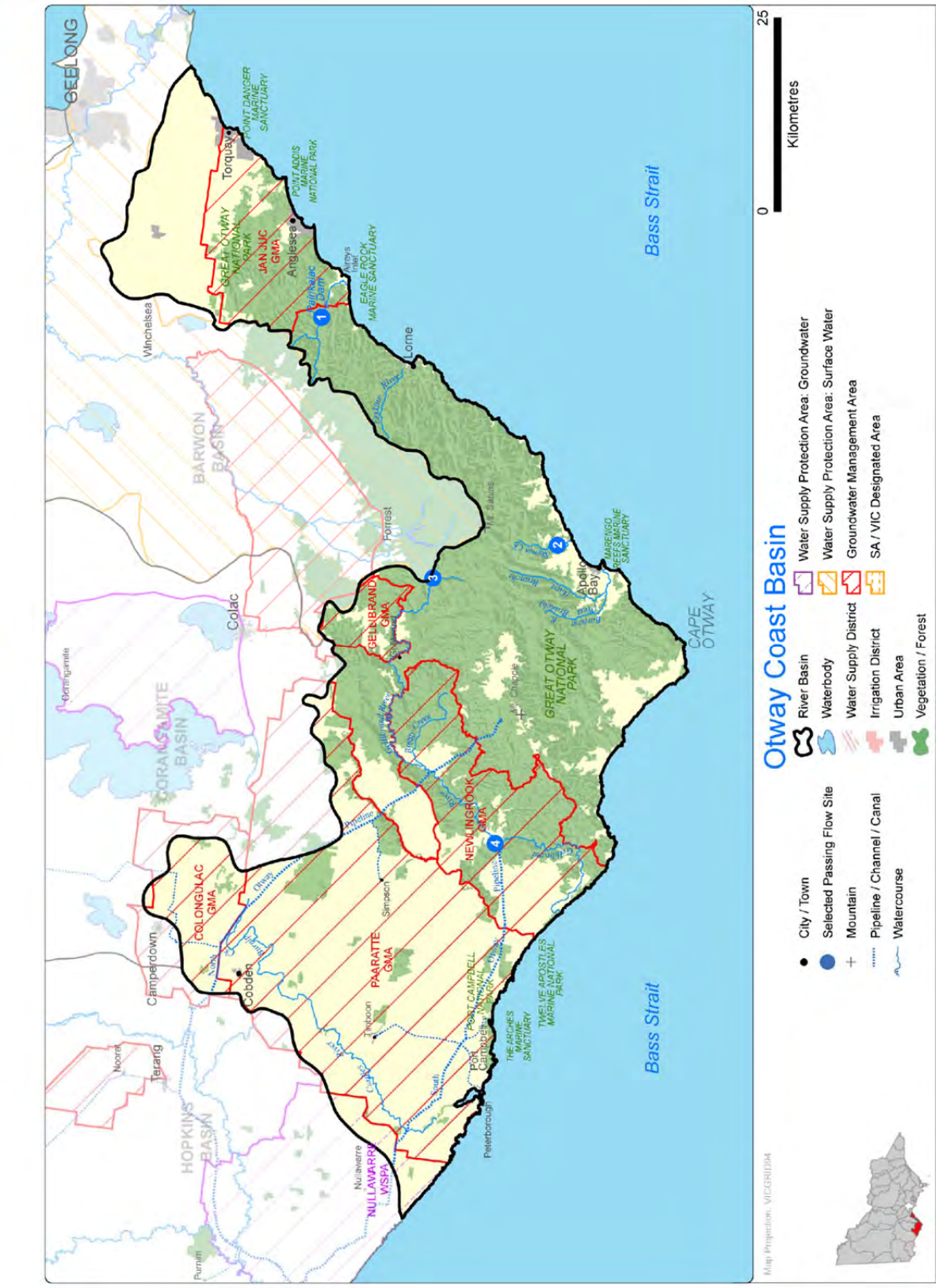
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(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 2011–12, rainfall in the Otway Coast basin ranged between 60% and 125% of the long-term average, with the higher rainfall experienced in the eastern half of the basin. Inflows in the Otway Coast basin in 2011–12 were 88% of the long-term average, compared to 166% in 2010–11. The amount of water flowing into Bass Strait represented 96% of the catchment inflows in the basin in 2011–12.

The storage level in West Gellibrand Reservoir began and ended the year at full capacity.

Apollo Bay, Skenes Creek and Marengo were placed on Stage 2 restrictions between November and April to reduce the risk of water shortage over the tourist season. Restrictions on licensed diversions were largely unrestricted throughout the year.

The total volume of licensed diversions from unregulated streams was higher than the previous year, and groundwater use also increased.

Table 6.23-1 shows the responsibilities of the authorities within the Otway Coast basin.

Table 6.23-1 Responsibilities for water resources management

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water		Manages groundwater and surface water licensed diversions		
Wannon Water	Provides domestic and stock supplies to farms across parts of the Otway Coast, Corangamite, Hopkins and Portland Coast basins(1)		Supplies towns in the west of the basin including Cobden, Timboon, Peterborough and Port Campbell(1)	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

Note:

(1) The Otway water supply system extends westward to Warrnambool and Koroit and north to Lismore and Derrinallum, supplying Cobden, Camperdown, Terang and Allansford on the way. Port Campbell, Timboon and Peterborough are supplied via a separate, linked system drawing on the Dilwyn aquifer at Port Campbell.

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 2011–12, 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 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Otway Coast basin are shown in Table 6.23-2. A 1,084 ML portion of the recycled water resource presented in Table 6.23-2 was discharged from treatment plants in the Otway Coast basin back into the Otway Coast waterways (see section 6.23.5). This amount is also reported as 'treated wastewater discharged back to river' in Table 6.23-3, therefore this volume is included as both a surface water resource and recycled water resource in Table 6.23-2.

Table 6.23-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	782,059	28,999
Groundwater	21,413	10,502
Recycled water	1,343	273

6.23.3 Surface water resources

6.23.3.1 Water balance

A surface water balance for the Otway Coast basin is shown in Table 6.23-3.

Table 6.23-3 Balance of surface water in the Otway Coast basin

Water account component	2011–12 (ML) [1]
Major on-stream storage	
Volume in storage at start of year	1,856
Volume in storage at end of year	1,856
Change in storage	**0**
Inflows	
Catchment inflow[2]	780,800
Rainfall on major storages	175
Treated wastewater discharged back to river	1,084
Total inflows	**782,059**
Outflows	
Diversions	
Urban diversions	14,194
Licensed diversions from unregulated streams	2,078
Small catchment dams	12,728
Total diversions	***28,999***
Losses	
Evaporation losses from major storages	225
Evaporation from small catchment dams	3,455
In-stream infiltration to groundwater, flows to floodplain and evaporation[3]	n/a
Total losses	***3,680***
Water passed at outlet of basin	
River outflows to the ocean	749,379
Total water passed at outlet of basin	***749,379***
Total outflows	**782,059**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

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

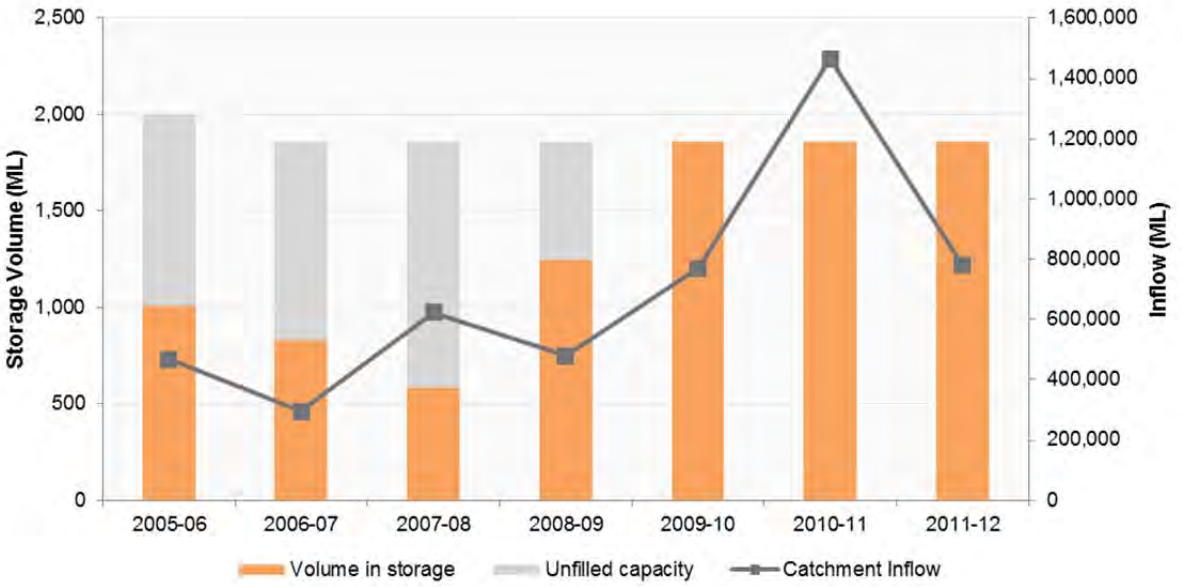
6.23.3.2 Storages and inflows

Inflows in 2011–12 were 88% of the long-term average of 884,000 ML, compared to 166% in 2010–11 (Figure 6.23-2).

The amount of water flowing from the Otway Coast basin into Bass Strait decreased to 749,379 ML in 2011–12. This represented 96% of the catchment inflows into the basin, compared to 98% in 2010–11.

The only major storage in the basin is the West Gellibrand Reservoir, which began and ended the year at full capacity (Figure 6.23-2).

Figure 6.23-2 All major storages and catchment inflows



6.23.3.3 Volume diverted

In the Otway Coast basin, surface water is diverted by Barwon Water, Wannon Water and licensed diverters, and surface water is harvested in small catchment dams.

The total volume of water diverted by the two water corporations was greater in 2011–12 compared to 2010–11.

Table 6.23-4 Bulk entitlement volumes and diversions

Bulk entitlement	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
Barwon Water				
Aireys Inlet	1	317	0	178
Apollo Bay	1	800	0	355
Colac	1	5,400	0	3,565
Gellibrand	1	60	0	27
Lorne	1	510	0	382
Wannon Water				
Otway system	1	12,580	0	9,686
2011–12 Total		**19,667**	**0**	**14,194**
2010–11 Total		19,667	0	12,919

The volume of water diverted from unregulated streams by licence holders in the Otway Coast basin was slightly greater in 2011–12 compared to 2010–11 (Table 6.23-5). The total volume of licences in the basin also increased.

Table 6.23-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**6,724**	**2,078**
2010–11	6,663	1,866

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: No information available

6.23.4 Groundwater resources

The Otway Coast basin contains the Jan Juc GMA and Newlingrook GMA as well as part of the Colongulac GMA, Gellibrand GMA, Paaratte GMA and Nullawarre WSPA. Groundwater resources supply licences, domestic and stock use and a number of towns in the area.

A summary of licensed entitlements and use from GMUs within the Otway Coast basin are presented in Table 6.23-7. These volumes may include domestic and stock usage where it is part of an existing licence. Total groundwater use in the Otway Coast basin for 2011–12 was 3,274 ML more than in 2010–11.

Table 6.23-7 Licensed groundwater volumes

WSPA/GMA[1]	GMA/ WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Colongulac GMA (56%)	All depths	2,614	2,331	590	0	590	159
Gellibrand GMA (92%)	All depths	0	0	0	0	0	0
Jan Juc GMA (100%)[3]	Zone 1: All depths Zone 2: Eastern View formation	39,250	11,250	7,806	0	7,806	5,717
Newlingrook GMA (100%)	All depths	1,977	1,958	24	0	24	8
Paaratte GMA (86%)	>120	3,949	2,754	276	0	276	252
Nullawarre WSPA (11%)	≤250	2,309	2,467	1,153	0	1,153	441
Total		**50,099**	**20,761**	**9,850**	**0**	**9,850**	**6,576**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit.

(3) The PCV for Jan Juc GMA is as follows: Zone 1 (all formations) at 250 ML per year; Zone 2 (Upper Easter View Formation) at 4,000 ML per year; Zone 2 (Lower Eastern View Formation) at 35,000 ML in total in any five-year period and Zone 2 (all formations other than Upper Eastern View and Lower Eastern View) at 0 ML per year.

An estimate of domestic and stock groundwater use is provided in Table 6.23-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.23-7.

Table 6.23-8 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)
Colongulac GMA (56%)	72	108
Gellibrand GMA (92%)	2	3
Jan Juc GMA (100%)	4	6
Newlingrook GMA (100%)	4	6
Paaratte GMA (86%)	251	377
Nullawarre WSPA (11%)	102	153
Total	**435**	**652**

In the Otway Coast basin, groundwater is used for urban water supply in the townships of Port Campbell, Timboon and Peterborough, the city of Greater Geelong, and areas around Carlisle. The licensed entitlements and metered use for these groundwater supplies are provided in Table 6.23-9. 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. Groundwater extraction under the bulk entitlement in 2011–12 was 4,019 ML.

Table 6.23-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Otway system (Carlisle)	1,800	4	2
Port Campbell, Timboon and Peterborough	3,159	322	294
Greater Geelong (Anglesea borefield)(1)	7,000	4,019	1,948
Total	**11,959**	**4,345**	**2,244**

Note:

(1) Greater Geelong (Anglesea, Torquay, and Lorne) is split into Greater Geelong (Anglesea boreield) and Greater Geelong (Barwon Downs boreield). 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.

6.23.5 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. In 2011–12, some 12% of the volume of treated wastewater was used within the Otway Coast basin (Table 6.23-10), which represents a small increase in the percentage of recycled water used in 2010–11.

Table 6.23-10 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)		
Aireys Inlet	58	58	0%	0	0	0	58	0	0
Anglesea	275	85	20%	0	55	0	30	220	(30)
Apollo Bay	399	15	0%	0	0	0	15	399	(15)
Cobden	179	27	15%	0	27	0	0	96	56
Lorne	271	15	0%	0	0	0	15	271	(15)
Peterborough	24	0	0%	0	0	0	0	0	24
Port Campbell	54	17	32%	0	17	0	0	29	7
Simpson	26	0	0%	0	0	0	0	9	17
Timboon	58	56	97%	0	56	0	0	60	(58)
Total 2011–12	**1,343**	**273**	**12%**	**0**	**155**	**0**	**117**	**1,084**	**(13)**
Total 2010–11	1,572	294	9%	0	110	26	159	1,274	3

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.

6.24 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 2011–12, rainfall in the Hopkins basin ranged between 60% and 100% of the long-term average. Catchment inflows in 2011–12 were 48% of the long-term average, significantly less than 2010–11, which saw inflow volumes at 169% of the long-term average. The volume of water flowing from the Hopkins basin into Bass Strait represented 70% of the catchment inflows, compared to 92% in 2010–11.

Groundwater is a significant resource in the Hopkins basin; many of Wannon Water's towns are supplied solely by groundwater, and it is an important supplement for Central Highlands Water and GWMWater towns. Total licensed groundwater use in 2011–12 was more than double the volume used in 2010–11, largely due to the increase in extractions in the Glenormiston GMA, Nullawarre WSPA and Yangery WSPA. However, urban use of groundwater decreased by 30% compared to the previous year.

Urban water use in the Hopkins basin was unrestricted throughout 2011–12. Licensed diversions were restricted or banned for a few rivers and creeks during the summer months, but were unrestricted throughout the rest of the year.

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 2011–12, 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 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Hopkins basin are shown in Table 6.24-2. A 5,356 ML portion of the recycled water resource presented in Table 6.24-2 was discharged from treatment plants in the Hopkins basin back into Hopkins waterways (see section 6.24.5). This amount is also reported as 'treated wastewater discharged back to river' in Table 6.24-3, therefore this volume is included as both a surface water resource and recycled water resource in Table 6.24-2.

Table 6.24-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	308,842	67,430
Groundwater	39,824	15,681
Recycled water	6,065	647

6.24.3 Surface water resources

6.24.3.1 Water balance

A water balance for the Hopkins basin is shown in Table 6.24-3. 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 6.24-3 Balance of surface water in the Hopkins basin

Water account component	2011–12 (ML)[1]
Major on-stream storage	
Volume in storage at start of year	-
Volume in storage at end of year	-
Change in storage	**-**
Inflows	
Catchment inflow[2]	303,486
Rainfall on major storages	-
Treated wastewater discharged back to river	5,356
Total inflows	**308,842**
Outflows	
Diversions	
Urban diversions	200
Licensed diversions from unregulated streams	2,693
Small catchment dams	64,538
Total diversions	***67,430***
Losses	
Evaporation losses from major storages	-
Evaporation from small catchment dams	30,166
In-stream infiltration to groundwater, flows to floodplain and evaporation[3]	n/a
Total losses	***30,166***
Water passed at outlet of basin	
River outflows to the ocean	211,246
Total water passed at outlet of basin	***211,246***
Total outflows	**308,842**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

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

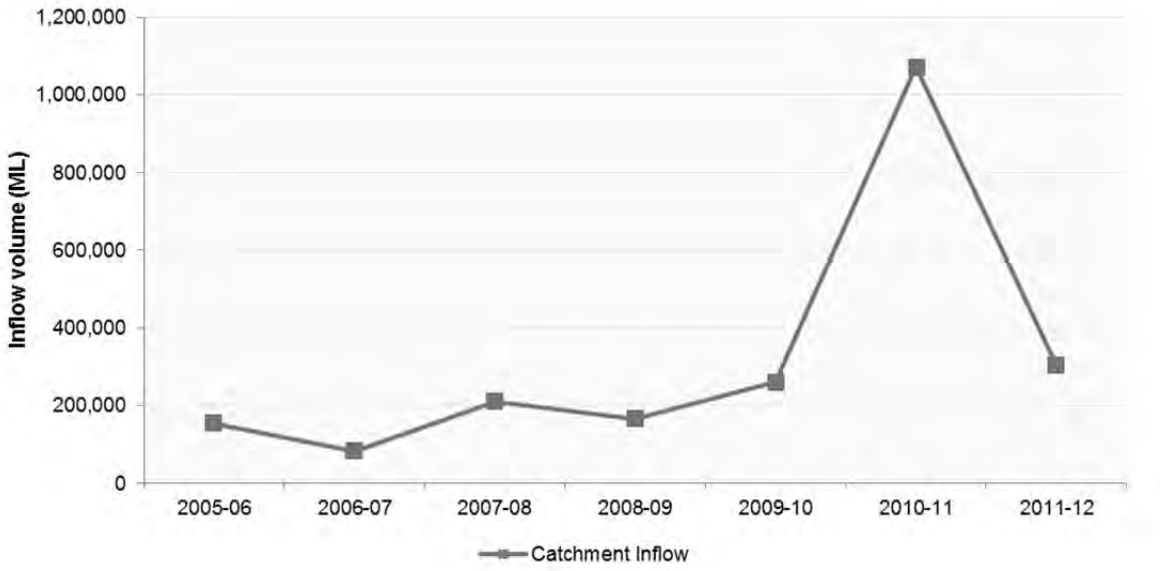
6.24.3.2 Storages and flows

Inflows in 2011–12 were 48% of the long-term average (of 635,000 ML), which is significantly than to 2010–11 (Figure 6.24-2).

The volume of water flowing from the Hopkins basin into Bass Strait was 211,246 ML in 2011–12, which represented 70% of the catchment inflows. This is a decrease from 982,100 ML in 2010–11, which represented 92% of catchment inflows.

There are no major storages in the Hopkins basin.

Figure 6.24-2 Catchment inflows



6.24.3.3 Volume diverted

In the Hopkins basin, surface water is diverted by Central Highlands Water, GWMWater and licensed diverters, and surface water is harvested into small catchment dams.

The total volume of surface water diverted by the two water corporations was greater in 2011–12 compared to 2010–11 (Table 6.24-4). The total volume of bulk entitlements in the basin has increased with the conversion of GWMWater's historical right to harvest water from the Mt William Creek system to a bulk entitlement in May 2012.

Table 6.24-4 Bulk entitlement volumes and diversions

Bulk entitlement	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
Central Highlands Water				
Beaufort	1	419	0	152
Skipton[(1)]	1	210	0	0
GWMWater				
Willaura Elmhurst and Buangor systems[(2)]	1	76	0	48
2011–12 Total		**705**	**0**	**200**
2010–11 Total		629	0	154

Notes:

(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.

(2) Historical rights to supply these towns were converted to a bulk entitlement in May 2012.

The volume of water diverted from unregulated streams by licence holders in the Hopkins basin showed a marked increase from 2010–11 to 2011–12 (Table 6.24-5). The total volume of licences in the basin also increased.

Table 6.24-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**11,253**	**2,693**
2010–11	10,691	895

The estimated volume of water harvested from small catchment dams represents the largest diversion of water in the Hopkins basin (Table 6.24-6).

Table 6.24-6 Estimated small catchment dam information

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.

6.24.4 Groundwater resources

The Hopkins basin contains the Glenormiston GMA as well as parts of the Nullawarre WSPA, Yangery WSPA, Cardigan GMA, Loddon Highlands WSPA and Colongulac GMA. Groundwater resources supply licences, domestic and stock use and a number of towns in the area. In 2011–12, groundwater levels in Yangery and Loddon Highlands WSPAs were generally increasing, while levels were stable in Nullawarre WSPA and Cardigan GMA. Insufficient observation bores were available to determine a trend for Colongulac and Glenormiston GMAs.

A summary of the licensed entitlements and use from GMUs within the Hopkins basin is presented in Table 6.24-7. These volumes may include domestic and stock usage where it is part of an existing licence.

Groundwater use in the Hopkins basin increased by about 117% in 2011–12 compared to 2010–11. This is largely due to the increase in extractions in the Glenormiston GMA, Nullawarre WSPA and Yangery WSPA.

Table 6.24-7 Licensed groundwater volumes

WSPA/GMA[1]	GMA/ WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Cardigan GMA (60%)[3]	All depths	3,581	3,533	228	0	228	669
Colongulac GMA (9%)	≤60	427	381	96	0	96	26
Glenormiston GMA (100%)	≤60	2,565	2,691	1,261	0	1,261	458
Nullawarre WSPA (89%)	≤250	18,971	20,274	9,477	0	9,477	3,619
Yangery WSPA (60%)	≤100	8,486	8,635	1,809	0	1,809	1,169
Loddon Highlands WSPA (9%)[4]	All depths	1,913	1,882	382	0	382	159
Total		**35,942**	**37,395**	**13,253**	**0**	**13,253**	**6,100**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit. The PCV for Glenormiston GMA, Nullawarre WSPA and Yangery WSPA are currently under review. The licensed entitlements are greater than PCV due to the Dairy Shed Water Licence Transition Scheme.

(3) Cardigan GMA has 60.1% of its service area in the Hopkins Basin, 19.9% in the Corangamite Basin and 20.1% in the Barwon Basin. Only the non-urban volumes have been allocated according to the surface area percentages: for example, of 3,887 ML of licensed entitlement in the Cardigan GMA, 3,000 ML is licensed for Ballarat urban use, all extracted from the Hopkins Basin. The remainder of the licensed entitlement was shared proportionally between Hopkins, Barwon and Corangamite basins. 129 ML was extracted from the Cardigan GMA within the Hopkins Basin for urban supplies. The remaining 165 ML of metered use (non-urban) was shared proportionally between Hopkins, Barwon and Corangamite basins

(4) Loddon Highlands WSPA replaced Spring Hill WSPA and Upper Loddon WSPA in 2010–11.

An estimate of domestic and stock groundwater use is provided in Table 6.24-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.24-7.

Table 6.24-8 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 (60%)	59	88
Colongulac GMA (9%)	12	18
Glenormiston GMA (100%)	84	126
Loddon Highlands WSPA (9%)	77	154
Nullawarre WSPA (89%)	838	1,257
Yangery WSPA (60%)	524	786
Total	**1,594**	**2,429**

In the Hopkins basin, groundwater is provided to the townships of Mortlake, Warrnambool, Koroit, Allansford, Caramut, Darlington, Beaufort, Streatham and Willaura, as well as the city of Ballarat. The licensed entitlements and metered use for these groundwater supplies are provided in Table 6.24-9.

Table 6.24-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Ballarat[1]	3,000	129	604
Beaufort	200	0	5
Caramut	50	26	19
Darlington	10	2	2
Koroit	524	2	1
Mortlake (part)	335	29	27
Streatham	60	44	38
Warrnambool, Allansford and Koroit (part)	750	446	454
Willaura System	140	191	103
Total	**5,069**	**870**	**1,251**

Note:

(1) Volume of the licence for Ballarat is 1,700 ML, but up to 3,000 ML can be taken in any one year during a water shortage. The value in the table above was updated to 3,000 ML in 2010–11, in line with the volume in the water register.

6.24.5 Recycled water

Three water authorities operate wastewater treatment plants in the Hopkins basin. The largest volume of water is from the Warrnambool Treatment Plant. There was a 4% increase in water recycled in 2011–12 compared to 2010–11.

Table 6.24-10 shows the volumes of water recycled in the Hopkins basin in 2011–12.

Table 6.24-10 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]		
Ararat	512	384	74%	120	257	0	7	0	128
Beaufort	113	0	0%	0	0	0	0	113	0
Cardigan Village	0	0	0%	0	0	0	0	0	0
Mortlake	114	19	17%	8	12	0	0	57	38
Terang[4]	217	244	112%	0	244	0	0	104	(131)
Warrnambool	5,082	0	0%	0	0	0	0	5,082	0
Willaura	27	0	0%	0	0	0	0	0	27
Total 2011–12	**6,065**	**647**	**11%**	**128**	**512**	**-**	**7**	**5,356**	**62**
Total 2010–11	6,585	437	7%	24	408	-	6	5,458	689

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.

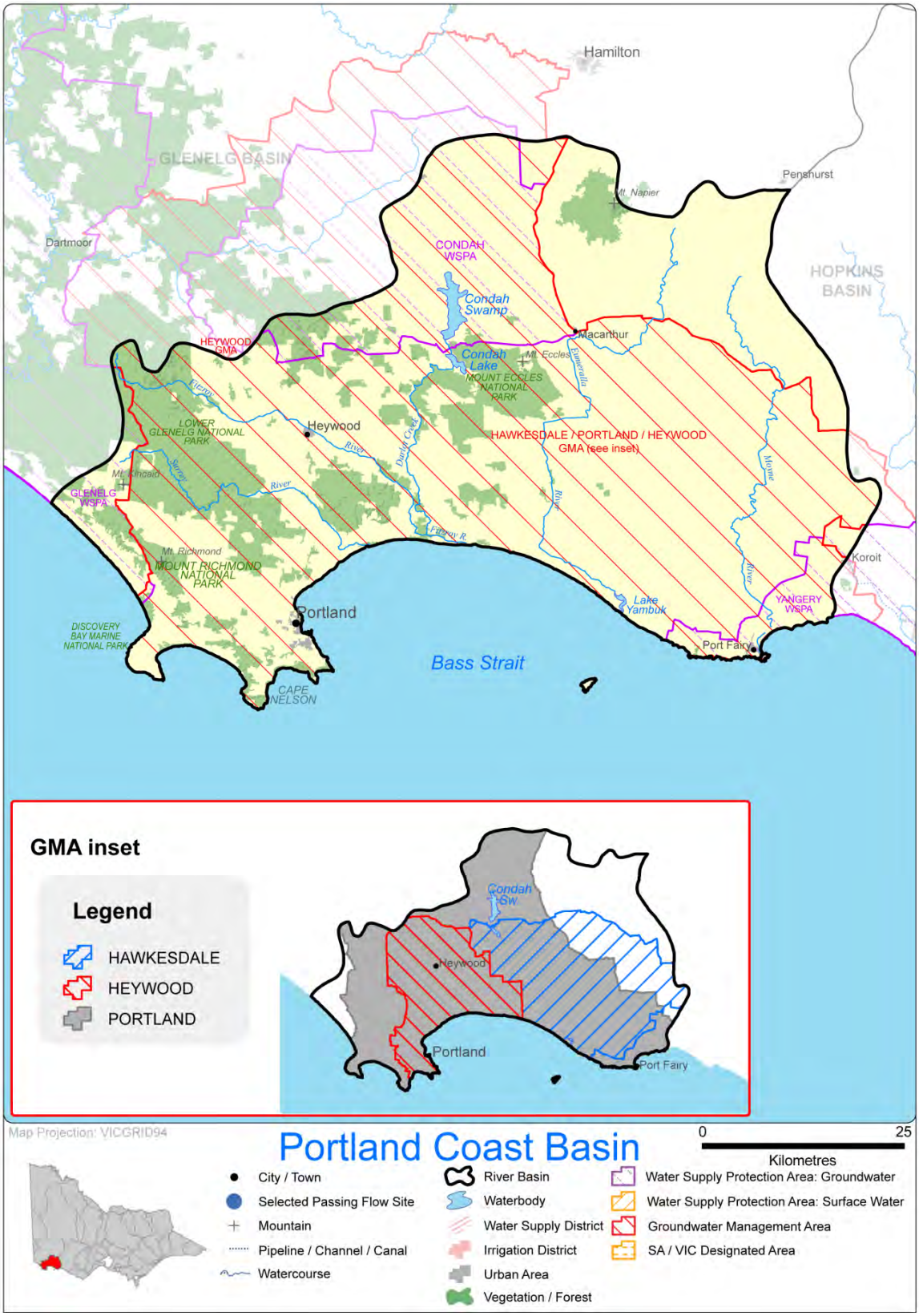
(3) 'Other' refers to a change in on-site wastewater storage or items affecting the annual water balance for recycled water that are not otherwise accounted for.

(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 2011–12, rainfall in the Portland Coast basin generally ranged between 80% and 100% of the long-term average, with the westernmost part of the basin receiving up to 125% of the average. Inflows in 2011–12 were 121% of the long-term average, compared to 145% in 2010–11. The amount of water flowing from the Portland Coast basin into Bass Strait represented 96% of the catchment inflows in the basin in 2011–12.

As with other river basins in western Victoria, groundwater is a significant resource in the Portland Coast basin. Groundwater extraction accounted for over half of the total water usage in the basin.

The major towns in the basin are also supplied by groundwater, particularly from the Dilwyn aquifer. Irrigation bans were in place for licensed diversions during January for the Surrey and Fitzroy rivers, but diversions were otherwise unrestricted in the Portland Coast basin throughout 2011–12.

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 groundwater and surface water licensed diversion		
Wannon Water		Supplies Koroit, Port Fairy, Heywood and Portland	
Glenelg Hopkins Catchment Management Authority			Manages waterways in the whole Portland Coast basin

Environmental Water Reserve

In 2011–12, 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 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Portland Coast basin are shown in Table 6.25-2. A 2,796 ML portion of the recycled water resource presented in Table 6.25-2 was discharged from treatment plants in the Portland Coast basin back into the Portland Coast waterways (see section 6.25.5). This amount is also reported as ‘treated wastewater discharged back to river’ in Table 6.25-3, therefore this volume is included as both a surface water resource and recycled water resource in Table 6.25-2.

Table 6.25-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	439,968	16,260
Groundwater	41,305	16,964
Recycled water	3,016	113

6.25.3 Surface water resources

6.25.3.1 Water balance

A water balance for the Portland Coast basin is shown in Table 6.25-3. Of the total inflows, approximately 3% 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 6.25-3 Balance of surface water in the Portland Coast basin

Water account component	2011–12 (ML) [1]
Major on-stream storage	
Volume in storage at start of year	-
Volume in storage at end of year	-
Change in storage	**-**
Inflows	
Catchment inflow[2]	437,172
Rainfall on major storages	-
Transfers from other basins	-
Treated wastewater discharged back to river	2,796
Total inflows	**439,968**
Outflows	
Diversions	
Licensed diversions from unregulated streams	125
Small catchment dams	16,135
Total diversions	***16,260***
Losses	
Net evaporation losses from major storages	-
Evaporation from small catchment dams	4,484
In-stream infiltration to groundwater, flows to floodplain and evaporation[3]	n/a
Total losses	***4,484***
Water passed at outlet of basin	
River outflows to the ocean	419,224
Total water passed at outlet of basin	***419,224***
Total outflows	**439,968**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

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

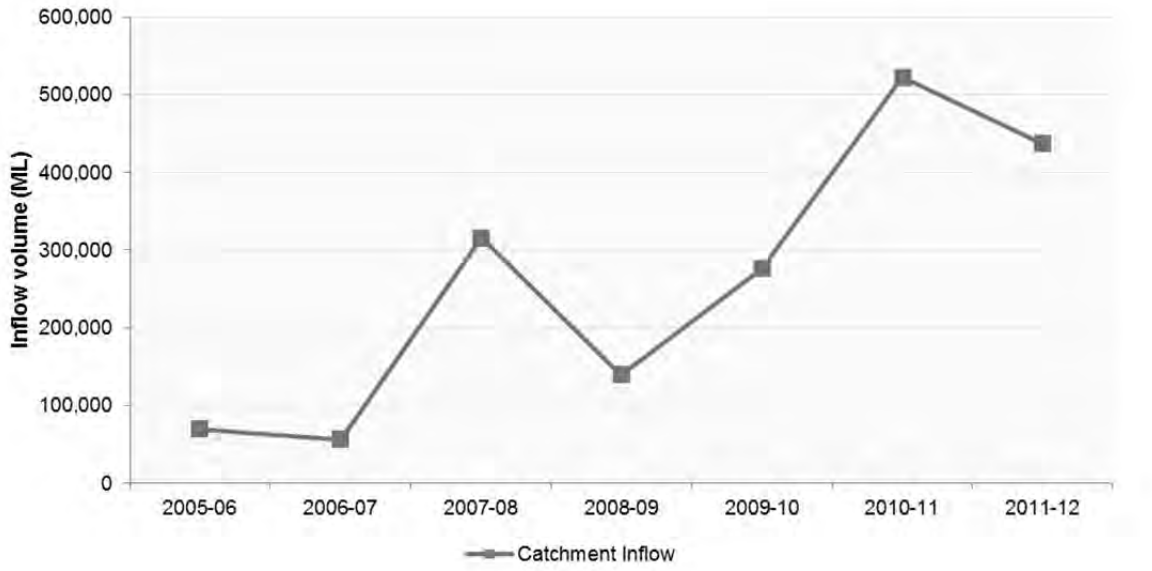
6.25.3.2 Storages and flows

Inflows in 2011–12 were 121% of the long-term average of 361,000 ML, compared to 145% in 2010–11 (Figure 6.25-2).

The amount of water flowing from the Portland Coast basin into Bass Strait was 419,224 ML in 2011–12, a decrease from the previous year. This represents 96% of catchment inflows into the basin.

There are no major storages in the basin.

Figure 6.25-2 Catchment inflows



6.25.3.3 Volume diverted

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.

The estimated volume of water diverted by licence holders was much larger in 2011–12 compared to 2010–11. This is despite a significant reduction in the total volume of licences in the basin (Table 6.25-4).

Table 6.25-4 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**1,177**	**125**
2010–11	1,744	78

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

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: No information available.

6.25.4 Groundwater resources

The Portland Coast basin contains the Heywood GMA and Hawkesdale GMA, as well as part of the Condah WSPA (53%), Yangery WSPA (40%) and Portland GMA (73%). Groundwater resources supply licences, domestic and stock use and three towns in the area. Groundwater levels in the Hawkesdale GMA and Portland GMA are stable. Groundwater levels in the Condah WSPA and Yangery WSPA are increasing however insufficient observation bores were available to determine trends for the Heywood GMA.

A summary of the licensed entitlements and use from GMUs within the Portland Coast basin is presented in Table 6.25-6. These volumes may include domestic and stock usage where it is part of an existing licence. The Portland Coast basin recorded an increase of 67% in groundwater use, compared to 2010–11.

Table 6.25-6 Licensed groundwater volumes

WSPA/GMA[1]	GMA/ WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Hawkesdale GMA (100%)	As per Plan	16,161	12,455	5,630	0	5,630	2,689
Heywood GMA (100%)	≤70	8,500	6,920	1,749	0	1,749	912
Portland GMA (73%)[3]	>200	7,737	7,736	2,639	0	2,639	2,466
Condah WSPA (53%)	70-200	3,920	3,972	1,243	0	1,243	588
Yangery WSPA (40%)	≤100	5,617	5,716	1,197	0	1,197	774
Total		**41,935**	**36,799**	**12,458**	**0**	**12,458**	**7,429**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. The water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit. The PCVs for Condah WSPA and Yangery WSPA are currently under review. The licensed entitlements are greater than PCV due to the Dairy Shed Water Licence Transition Scheme.

(3) Portland GMA has 73% of its service area in the Portland Basin and 27% in the Glenelg. Only the non-urban usage volumes have been allocated according to the surface area percentages. For example, of 7,794 ML of licensed entitlement in the Portland GMA, 7,581 ML is licensed for Portland, Port Fairy and Heywood urban use, all extracted from the Portland Basin. The remainder of the licensed entitlement was shared on a proportional basis between Portland Coast and Glenelg basins. The Portland GMA within the Portland Coast basin had 2,639 ML extracted for urban supplies. There was no non-urban metered use in 2011–12.

An estimate of domestic and stock groundwater use is provided in Table 6.25-7. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.25-6.

Table 6.25-7 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 (100%)	1,171	1,757
Heywood GMA (100%)	1,251	1,877
Portland GMA (73%)	2	3
Condah WSPA (53%)	233	349
Yangery WSPA (40%)	347	520
Total	**3,004**	**4,506**

Groundwater is used as an urban water supply for the townships of Heywood, Port Fairy and Portland. The licensed entitlements and metered use for these groundwater supplies are provided in Table 6.25-8.

Table 6.25-8 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Heywood	333	172	150
Port Fairy	1,026	634	665
Portland	6,222	1,832	1,651
Total	**7,581**	**2,639**	**2,466**

6.25.5 Recycled water

Wannon Water operates all treatment plants within the Portland Coast basin. In 2011–12, 4% of the total wastewater produced in the basin was reused, including 20% of the total wastewater at the Heywood treatment plant which was used for wood lot irrigation (an increase from 14% in 2010–11).

Table 6.25-9 shows the volumes of water recycled in the Portland Coast basin in 2011–12.

Table 6.25-9 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]		
Heywood	563	113	20%	0	113	0	0	342	108
Port Fairy	1,029	0	0%	0	0	0	0	1,029	0
Portland	1,425	0	0%	0	0	0	0	1,425	(0)
Total 2011–12	**3,016**	**113**	**4%**	**0**	**113**	**0**	**0**	**2,796**	**107**
Total 2010–11	2,776	53	2%	0	53	0	0	2,633	90

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 2011–12, rainfall in the Glenelg basin ranged between 80% and 100% of the long-term average, compared to 125% to 200% in 2010–11. Inflows in the Glenelg basin in 2011–12 were 67% of the long-term average, significantly lower than the volume of inflow in 2010–11. The basin's largest water storage, Rocklands Reservoir, started the year at 38% of capacity, and finished at 31% by the end of June 2012.

Stage 1 restrictions for urban water use in the town of Harrow continued throughout 2011–12 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 largely unrestricted in 2011–12. Licensed groundwater use was also unrestricted in the Glenelg basin, and urban groundwater use increased significantly compared to the previous year.

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 groundwater and surface water licensed diversions for the entire basin except the Glenelg River north of the bridge on the Casterton-Harrow Road		
Grampians Wimmera Mallee Water	Manages groundwater and surface water 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 EWR to function ecologically. Other important environmental assets that also rely on the Environmental Water Reserve (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 2011–12, the Glenelg basin EWR comprised:

- the *Wimmera and Glenelg Rivers Environmental Entitlement 2010*
- 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 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Glenelg basin are shown in Table 6.26-2. A 623 ML portion of the recycled water resource presented in Table 6.26-2 was discharged from treatment plants back into

the Glenelg waterways (see section 6.26.5). This amount is also reported as 'treated wastewater discharged back to river' in Table 6.26-3, therefore this volume is included as both a surface water resource and recycled water resource in Table 6.26-2.

Table 6.26-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	667,469	58,518
Groundwater	28,119	7,593
Recycled water	1,277	483

6.26.3 Surface water resources

6.26.3.1 Water balance

A water balance for the Glenelg basin is shown in Table 6.26-3. A volume of 1,259 ML was diverted to the Wimmera-Mallee system in 2011–12.

Table 6.26-3 Balance of surface water in the Glenelg basin

Water account component	2011–12 (ML) [1]
Major on-stream storage	
Volume in storage at start of year	141,839
Volume in storage at end of year	113,903
Change in storage	**(27,936)**
Inflows	
Catchment inflow[2]	648,620
Rainfall on major storages	18,227
Treated wastewater discharged back to river	623
Total inflows	**667,469**
Outflows	
Diversions	
Urban diversions	1,523
Transfers to the Wimmera basin[3]	1,259
Licensed diversions from unregulated streams	253
Small catchment dams	55,483
Total diversions	***58,518***
Losses	
Evaporation losses from major storages	16,494
Evaporation from small catchment dams	24,622
In-stream infiltration to groundwater, flows to floodplain and evaporation	38,640
Total losses	***79,755***
Water passed at outlet of basin	
River outflows to the ocean	557,131
Total water passed at outlet of basin	***557,131***
Total outflows	**695,405**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

(3) Transfers from the Glenelg basin to the Brimpaen Storages in the Wimmera basin, via the Moora Channel.

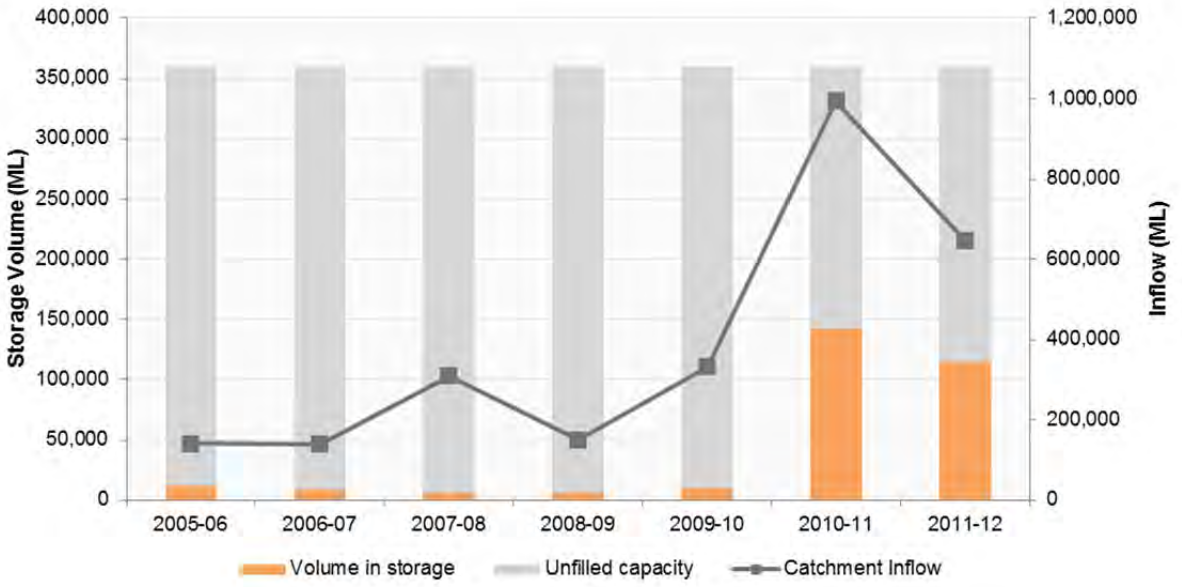
6.26.3.2 Storages and flows

Inflows across the basin were 648,620 ML. This was 67% of the long-term average, significantly lower than the volume of inflow in 2010–11 (Figure 6.26-2).

The volume of water flowing from the Glenelg basin into Bass Strait was 557,131 ML in 2011–12, a decrease from the previous year (Figure 6.26-2). This represented 86% of the catchment inflows into the basin, compared to 71% in 2009–10.

Four major storages are located within the basin. Rocklands Reservoir, which accounts for 97% of the total capacity of Glenelg basin storages, was holding 31% of capacity at the end of 2011–12.

Figure 6.26-2 All major storages and catchment inflows



6.26.3.3 Volume diverted

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.

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 Table 6.26-4 below and Table 6.28-4 in the Wimmera basin chapter, but are only included in the total figures in the Wimmera basin.

Wannon Water also holds four other bulk entitlements for supply to towns within the Glenelg basin.

Table 6.26-4 Bulk entitlement volumes and diversions

Bulk entitlement[1]	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
GWM Water				
Wimmera and Glenelg Rivers[2][3]	1	125,500	0	36,336
Coliban Water				
Wimmera and Glenelg Rivers[3]	1	300	0	148
Wannon Water				
Wimmera and Glenelg Rivers[3]	1	2,120	0	113
Coleraine, Casterton, Sandford	1	855	0	104
Dunkeld	1	170	0	0
Glenthompson	1	94	0	21
Hamilton	1	3,435	0	1,285
2011–12 Total		**4,554**	**0**	**1,410**
2010–11 Total		4,554	0	2,789

Notes:

(1) This table does not include bulk entitlements and environmental entitlements held by the Victorian Environmental Water Holder. Water (VEWH) available under VEWH entitlements in the Glenelg basin is used to support streamflows and is not diverted out of the waterway.

(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.

(3) Diversions under these bulk entitlements are not included in the Total in this table or the water balance for the Glenelg basin because diversions are taken from both the Glenelg and Wimmera river systems and cannot be disaggregated. They are accounted for in the Wimmera basin – see section 6.28.

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 total volume of water diverted from unregulated streams by licence holders in the Glenelg basin was similar in 2011–12 compared to 2010–11 (Table 6.26-5).

Table 6.26-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**1,042**	**253**
2010–11	1,043	264

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

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.

6.26.4 Groundwater resources

The Glenelg basin contains part of the Portland GMA, Condah WSPA and Glenelg WSPA. Groundwater levels in Condah WSPA are increasing, while levels in Portland GMA and Glenelg are stable. Groundwater resources supply licences, domestic and stock use and a number of towns in the area.

A summary of the licensed entitlements and use for GMUs that overlap the Glenelg basin is presented in Table 6.26-7. These volumes may include domestic and stock usage where it is part of an existing licence. Groundwater use in the Glenelg basin increased significantly in 2011–12 compared to 2010–11.

Table 6.26-7 Licensed groundwater volumes

WSPA/GMA[1]	GMA/WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Portland GMA (27%)[3]	>200	59	58	0	0	0	0
Condah WSPA (47%)	70-200	3,517	3,563	1,115	0	1,115	527
Glenelg WSPA (70%)	All depths	22,940	22,940	4,920	0	4,920	2,360
Total		**26,516**	**26,561**	**6,035**	**0**	**6,035**	**2,887**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the basin is given in parentheses. The water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit. The PCV for Condah WSPA is currently under review. Where the licensed entitlements are greater than PCV it is due to the Dairy Shed Water Licence Transition Scheme.

(3) Portland GMA has 73% of its service area in the Portland basin and 27% in the Glenelg. Only the non-urban volumes have been allocated according to the surface area percentages. For example, of 7,794 ML of licensed entitlement in the Portland GMA, 7,581 ML is licensed for Portland, Port Fairy and Heywood urban use, all extracted from the Portland basin. The remainder of the licensed entitlement was shared on a proportional basis between Portland Coast and Glenelg basins. Some 2,639 ML was extracted from the Portland GMA within the Portland basin for urban supplies. There was no non-urban metered use in 2011–12.

An estimate of domestic and stock groundwater use is provided in Table 6.26-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.26-7.

Table 6.26-8 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)
Portland GMA (27%)	1	1
Condah WSPA (47%)	209	314
Glenelg WSPA (70%)	829	1,243
Total	**1,039**	**1,558**

Groundwater is used as an urban water supply for some townships in the basin. Urban groundwater usage increased slightly in 2011–12. The licensed entitlements and metered use for these groundwater supplies are provided in Table 6.26-9.

Table 6.26-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Casterton	1,000	469	392
Dartmoor	150	17	17
Hamilton, Tarrington, Dunkeld	1,102	3	13
Harrow	29	49	28
Macarthur	130	34	24
Merino	100	0	0
Penshurst	250	111	90
Total	**2,761**	**684**	**565**

6.26.5 Recycled water

Wannon Water operates four wastewater treatment plants in the Glenelg basin. The volume of wastewater produced in 2011–12 decreased compared to 2010–11, but more was recycled. In 2011–12, 38% of wastewater was recycled, compared to 24% in 2010–11.

Table 6.26-10 shows the volumes of water recycled in the Glenelg basin in 2011–12.

Table 6.26-10 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	124	14	11%	0	14	0	0	146	(36)
Coleraine	77	4	5%	0	4	0	0	26	47
Dunkeld	36	24	67%	24	0	0	0	21	(9)
Hamilton	1,040	441	42%	167	274	0	0	430	169
Total 2011–12	**1,277**	**483**	**38%**	**192**	**291**	**0**	**0**	**623**	**171**
Total 2010–11	1,550	368	24%	170	197	0	0	215	968

Notes:

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

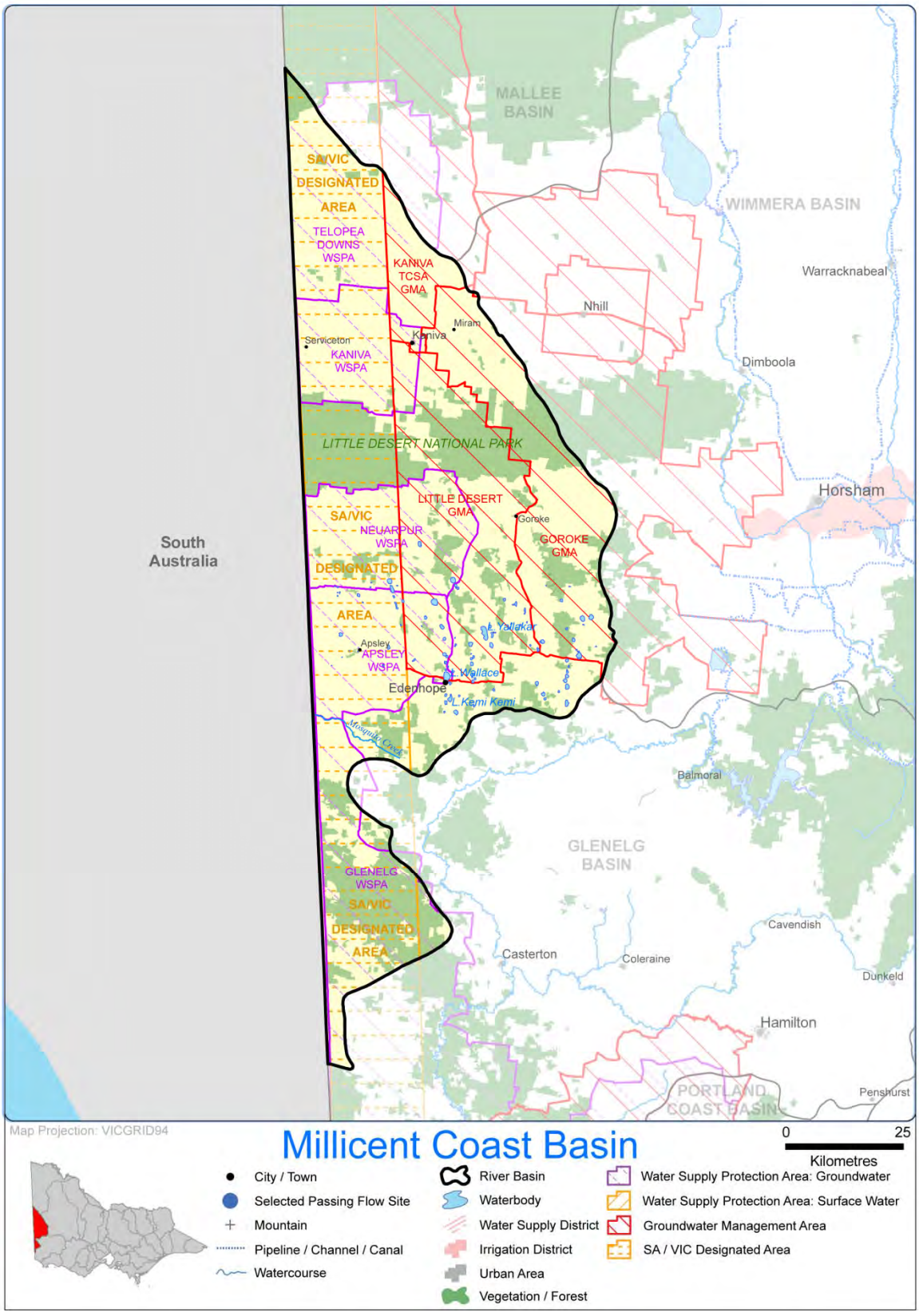
(2) 'Within process' refers to water reused in wastewater treatment processes, for example back-flushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's performance report.

(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, mainly in the south, with several minor waterways which only 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 2011–12, rainfall across the Millicent Coast basin generally ranged between 80% and 100% of the long-term average, compared to 125% to 200% in 2010–11.

Groundwater is the main source of water supply in the Millicent Coast basin. During 2011–12, the newly formed West Wimmera GMA replaced Goroke GMA, Kaniva TCSA GMA, Little Desert GMA, Apsley WSPA, Kaniva WSPA, Neuarpur WSPA and Telopea Downs WSPA.

Groundwater use in the Glenelg GMA more than doubled compared with use in 2010–11. However, groundwater use in the West Wimmera GMA was 37% less when compared to the equivalent areas in 2010–11. Licensed entitlements to groundwater in Neuarpur sub-zone 1 were restricted to 96% of their licence volume in 2011–12.

Edenhope was the only town to be subject to urban water restrictions during 2011–12, remaining on Stage 1 for the entire year. 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 groundwater(1) and surface water licensed diversions within the Millicent Coast basin	Supplies all towns including Kaniva and Edenhope	
Southern Rural Water	Manages groundwater licensed diversions in the Glenelg WSPA		
Wimmera Catchment Management Authority			Manages waterways in the whole of the Millicent Coast basin

Note:

(1) Groundwater management is undertaken jointly by South Australia and Victoria under the *Victoria–South Australia Groundwater (Border Agreement) 1985*.

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 2011–12, the Millicent Coast basin EWR comprised all water in the basin not allocated for consumptive use.

6.27.2 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Millicent Coast basin are shown in Table 6.27-2. The volume of the surface water resource has notionally been set to the water diverted from unregulated streams in 2011–12.

Table 6.27-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	4	4
Groundwater	29,426	8,549
Recycled water	15	67

6.27.3 Surface water resources

6.27.3.1 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.

6.27.3.2 Storages and flows

No reliable stream flow 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.

6.27.3.3 Small catchment dams

No information regarding small catchment dams is readily available within the Millicent Coast basin.

6.27.3.4 Volume diverted

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 2011–12, the licensed volume totalled 4.4 ML and use was estimated to be 4.4 ML.

6.27.4 Groundwater resources

The main water supply in the Millicent Coast basin is groundwater, which supplies licences, domestic and stock use and several towns in the area. The Millicent Coast basin contains part of the Glenelg WSPA and part of the West Wimmera GMA. In 2011–12, the newly formed West Wimmera GMA replaced Goroke GMA, Kaniva TCSA GMA, Little Desert GMA, Apsley WSPA, Kaniva WSPA, Neuarpur WSPA and Telopea Downs WSPA.

Groundwater levels are generally stable in the area, however levels in the western part of the West Wimmera GMA 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 96% of their licence volume during 2011–12.

A summary of the licensed entitlements and use from GMUs within the Millicent Coast basin is shown in Table 6.27-3. These volumes may include domestic and stock usage where it is part of an existing licence.

Table 6.27-3 Licensed groundwater volumes

WSPA/GMA[1]	GMA/WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Glenelg WSPA (30%)	All depths	9,720	9,719	2,084	0	2,084	1,000
West Wimmera GMA (35%)	All depths	18,718	18,718	5,476	0	5,476	8,677
Total		**28,437**	**28,437**	**7,560**	**0**	**7,560**	**9,677**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit.

An estimate of domestic and stock groundwater use is provided in Table 6.27-4. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.27-3.

Table 6.27-4 Number of domestic and stock bores and estimated use

WSPA/GMA	No. of domestic and stock bores	Estimated domestic and stock use (ML)
Glenelg WSPA (30%)[1]	351	527
West Wimmera GMA (35%)[2]	231	462
Total	**582**	**989**

Note:

(1) Estimated domestic and stock use is calculated using a factor of 1.5 ML per bore for Glenelg WSPA.

(2) Estimated domestic and stock use is calculated using a factor of 2 ML per bore for West Wimmera GMA.

In the Millicent Coast basin, groundwater is used as an urban water supply for the townships of Apsley, Edenhope, Goroke, Kaniva, Lillimur, Miram and Serviceton. The licensed entitlements and metered use for these groundwater supplies are provided in Table 6.27-5.

Table 6.27-5 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Apsley	40	26	11
Edenhope	250	148	133
Goroke	86	54	38
Kaniva	600	191	87
Lillimur	32	8	7
Miram	7	2	1
Serviceton	25	9	6
Total	**1,040**	**438**	**283**

6.27.5 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 6.27-6.

Table 6.27-6 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]		
Edenhope[4]	10	67	693%	67	0	0	0	0	(57)
Kaniva North	0	0	0%	0	0	0	0	0	0
Kaniva South	0	0	0%	0	0	0	0	0	0
Serviceton	5	0	0%	0	0	0	0	0	5
Total 2011–12	**15**	**67**	**469%**	**67**	**0**	**0**	**0**	**0**	**(52)**
Total 2010–11	133	45	34%	45	0	0	0	0	88

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.

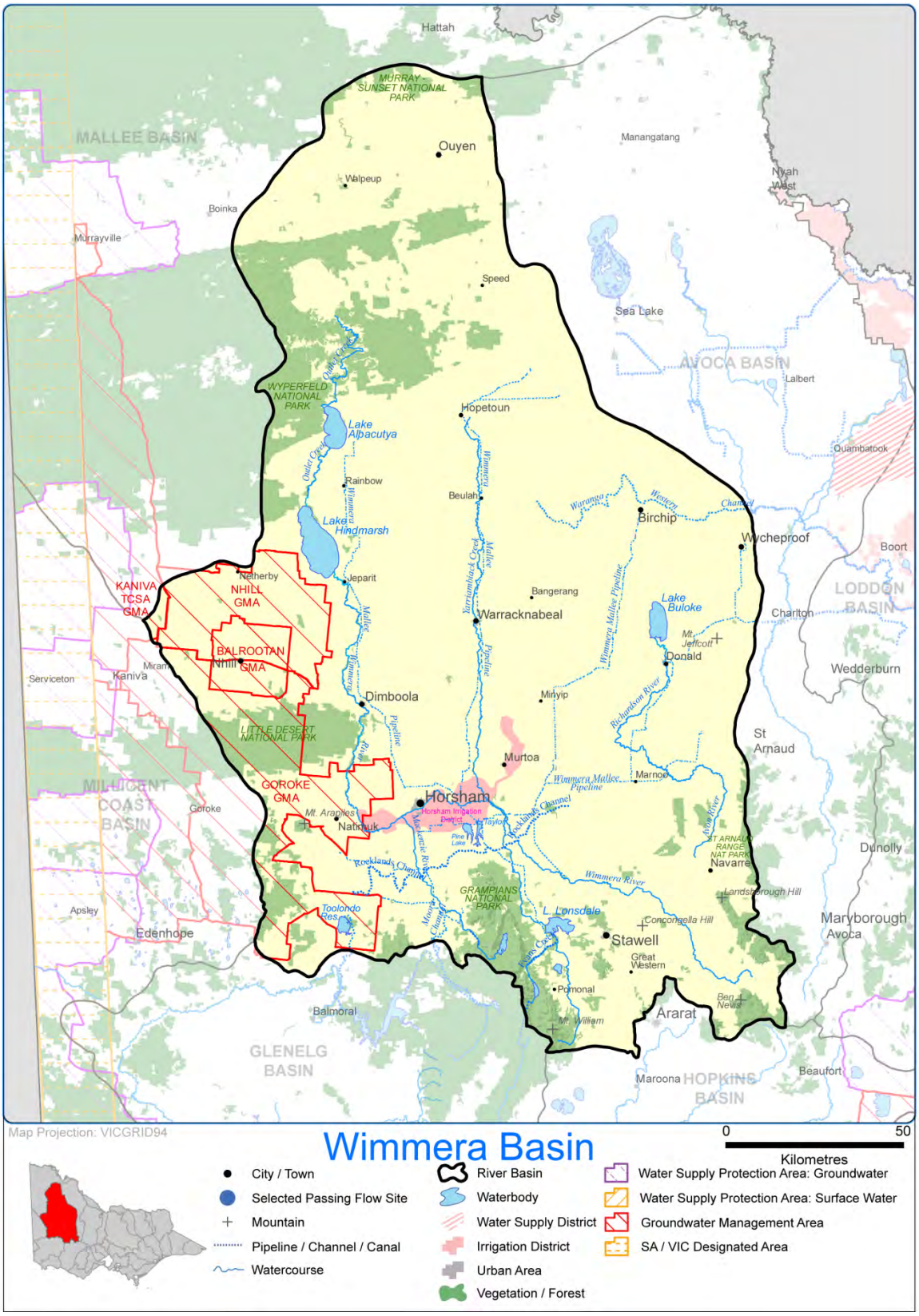
(3) 'Other' refers to a change in on-site wastewater storage or items affecting the annual water balance for recycled water that are not otherwise accounted for.

(4) Volume recycled greater than volume produced due to water stored on-site carried over from previous year.

6.28 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 and 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 2011–12, rainfall across most of the Wimmera basin ranged between 80% and 100% of the long-term average, with the northern and south-western areas of the basin recording only 60% to 80% of the average. This is in contrast to 2010–11, when the basin received up to 300% of the long-term average rainfall. Consequently, catchment inflows in the Wimmera basin in 2011–12 were also much lower than the previous year; only 46% of the long-term average, compared to 240% in 2010–11.

After beginning the year at 48% of capacity, storages in the Wimmera basin finished the year slightly lower at 45% of capacity at the end of June 2012.

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

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 groundwater and surface water 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 that includes Lakes Bellfield, Wartook, Lonsdale and Fyans and Taylors lakes
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 also 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 2011–12, the EWR in the Wimmera basin contained the following components:

- the Wimmera and Glenelg Rivers Environmental Entitlement 2010 which comprises 40,560 ML of Wimmera-Mallee pipeline water and 1,000 ML of wetland water
- 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 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Wimmera basin are shown in Table 6.28-2.

Table 6.28-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	180,118	33,617
Groundwater	16,502	5,109
Recycled water	1,507	1,724

6.28.3 Surface water resources

6.28.3.1 Water balance

A surface water balance for the Wimmera basin is shown in Table 6.28-3.

Table 6.28-3 Balance of surface water in the Wimmera basin

Water account component	2011–12 (ML)[1]
Major on-stream storage	
Volume in storage at start of year	184,056
Volume in storage at end of year	177,776
Change in storage	**(6,280)**
Inflows	
Catchment inflow[2]	145,567
Rainfall on major storages	33,292
Transfer from Glenelg basin	1,259
Return flow from irrigation	0
Treated wastewater discharged back to river	0
Total inflows	**180,118**
Outflows	
Diversions	
Urban diversions and domestic and stock use	18,792
Diversions for irrigation	0
Licensed diversions from unregulated streams	466
Environmental water diversions to wetlands	22
Small catchment dams	14,337
Total diversions	***33,617***
Losses	
Evaporation losses from major storages	74,894
Losses from small catchment dams	8,642
In-stream infiltration to groundwater, flows to floodplain and evaporation	21,890
Total losses	***105,426***
Water passed at outlet of basin	
River outflows to Lake Hindmarsh (measured at Tarranyurk)	1,146
River outflows to Lake Buloke	46,209
Total water passed at outlet of basin	***47,355***
Total outflows	**186,398**

Notes:

(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

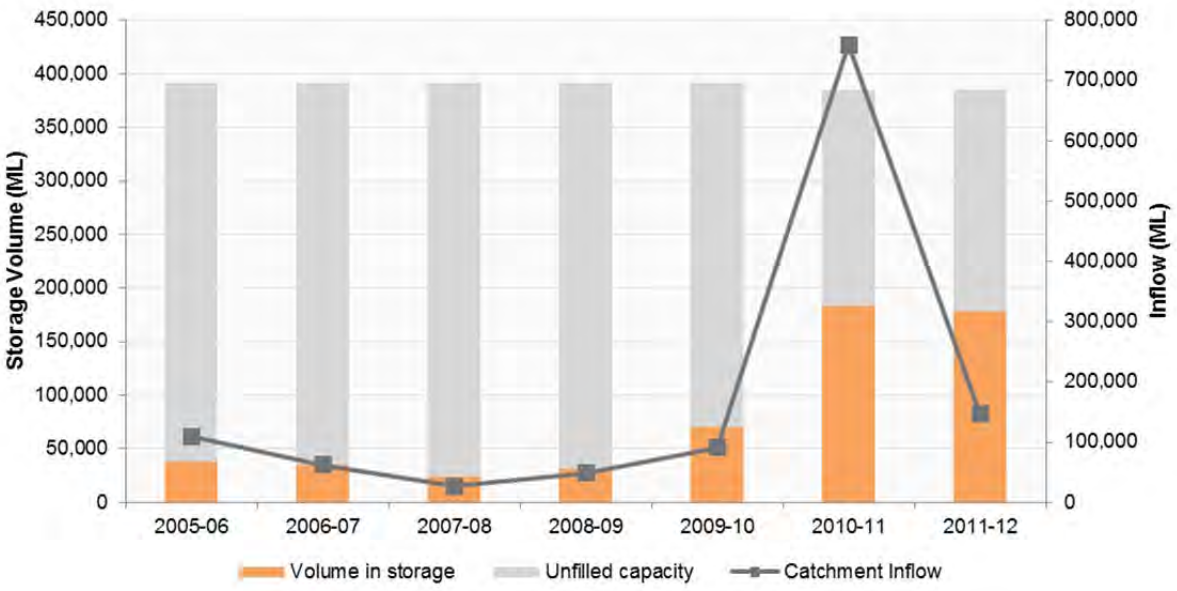
(2) Catchment inflow is the balancing item in this water balance. It is the difference between the total outflows, and the known inflows and net change in storage volume.

6.28.3.2 Storages and flows

Catchment inflows were 46% of the long-term average of 316,400 ML; this is significantly lower compared to 2010–11, when inflows were 240% of the long-term average (Figure 6.28-2). The volume of water flowing from the Wimmera basin into the terminal lakes in 2011–12 was 47,355 ML.

Storage levels for all major storages in the basin started the year at 184,056 ML and finished slightly lower at 177,776 ML (45% of capacity) at the end of June 2012 (Figure 6.28-2). Only volumes for major on-stream storages have been included in the water balance. In the Wimmera basin, these storages include Bellfield, Fyans, Lonsdale, Taylors, Toolondo and Wartook reservoirs, and also Batyo Catyo, Dock, Green and Pine lakes (which are no longer part of the Wimmera-Mallee headworks following completion of the Wimmera-Mallee pipeline).

Figure 6.28-2 All major storages and catchment inflows



6.28.3.3 Volume diverted

In the Wimmera basin, surface water is diverted by GWMWater, Central Highlands Water, Coliban Water, Wannon Water and licensed diverters, and also harvested in small catchment dams.

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 (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 Bulk entitlement volumes and diversions

Bulk entitlement[1]	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
GWMWater				
Wimmera and Glenelg Rivers[2][3]	1	125,500	0	36,336
Willaura Elmhurst and Buangor systems[4][5]	1	390	0	271
Coliban Water				
Wimmera and Glenelg[3][6]	1	300	0	148
Central Highlands Water				
Landsborough – Navarre	1	60	0	0
Wannon Water				
Wimmera and Glenelg Rivers[3][6]	1	2,120	0	113
Willaura system[7][8]	1	58	0	18
2011–12 Total		**125,950**	0	**36,607**
2010–11 Total		125,560	0	18,836

Notes:

(1) This table does not include bulk entitlements and environmental entitlements held by the VEWH. Any diversions out of the waterway under VEWH entitlements are discussed below.

(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.

(3) These bulk entitlements are also reported in the Glenelg basin sub-chapter, however are only included in the water balance for the Wimmera basin.

(4) 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 located in the Hopkins basin. Their entitlement volume and diversion volume are reported in Table 6.24-4 and have been omitted here.

(5) GWMWater was granted a bulk entitlement conversion order in May 2012 for the Willaura, Elmhurst and Bunagor supply systems.

(6) These bulk entitlements are not included in the 2011–12 Total in this table as the entitlement volume and volume diverted are already accounted under GWMWater's Wimmera and Glenelg Rivers bulk entitlement.

(7) This bulk entitlement is not included in the 2011–12 Total in this table as the entitlement volume and volume diverted are already accounted under GWMWater's Willaura system bulk entitlement.

(8) Wannon Water was granted a bulk entitlement conversion Order in May 2012 for supply to Glenthompson from the Willaura system.

The Wimmera and Glenelg Rivers Environmental Entitlement 2010 provides the VEWH with up to 1,000 ML 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 2011–12, 22ML 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.

The total volume of water diverted from unregulated streams by licence holders in the Wimmera basin 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 2011–12; the diversion reported is an estimate of licensed domestic and stock use.

Table 6.28-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**2,586**	**466**
2010–11	2,551	0

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

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

6.28.4 Groundwater resources

The Wimmera basin contains part of the West Wimmera GMA. Groundwater resources supply licences, domestic and stock use and four towns in the area.

A summary of the licensed entitlements and use from the West Wimmera GMA is presented in Table 6.28-7. These volumes may include domestic and stock usage where it is part of an existing licence.

Groundwater levels are generally stable in in this area.

Table 6.28-7 Licensed groundwater volumes

WSPA/GMA[1]	GMA/WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
West Wimmera GMA (30%)[3]	All depths	16,105	16,105	4,712	0	4,712	462
Total		**16,105**	**16,105**	**4,712**	**0**	**4,712**	**462**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit.

(3) West Wimmera GMA replaced Balrootan (Nhill) GMA, Goroke GMA and Nhill GMA.

An estimate of domestic and stock groundwater use is provided in Table 6.28-8. A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed volume in Table 6.28-7.

Table 6.28-8 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)
West Wimmera GMA (30%)[1]	199	397
Total	**199**	**397**

Note:
(1) West Wimmera GMA replaced Balrootan (Nhill) GMA, Goroke GMA and Nhill GMA.

Groundwater is used as an urban water supply to the townships of Horsham Mt Zero, Kiata, Landsborough and Nhill. The licensed entitlements and metered use for these groundwater supplies are provided in Table 6.28-9.

Table 6.28-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Horsham Mt Zero	800	133	15
Kiata	40	5	9
Landsborough	150	45	73
Nhill	1,000	386	267
Total	**1,990**	**568**	**363**

6.28.5 Recycled water

GWMWater operates 16 wastewater treatment plants in the Wimmera basin and reuses all wastewater at nine of these plants for purposes including irrigation of pasture, horticulture and vineyards and for urban and industrial uses.

Table 6.28-10 shows the volumes of water recycled in the Wimmera basin in 2011–12.

Table 6.28-10 Volume of recycled water

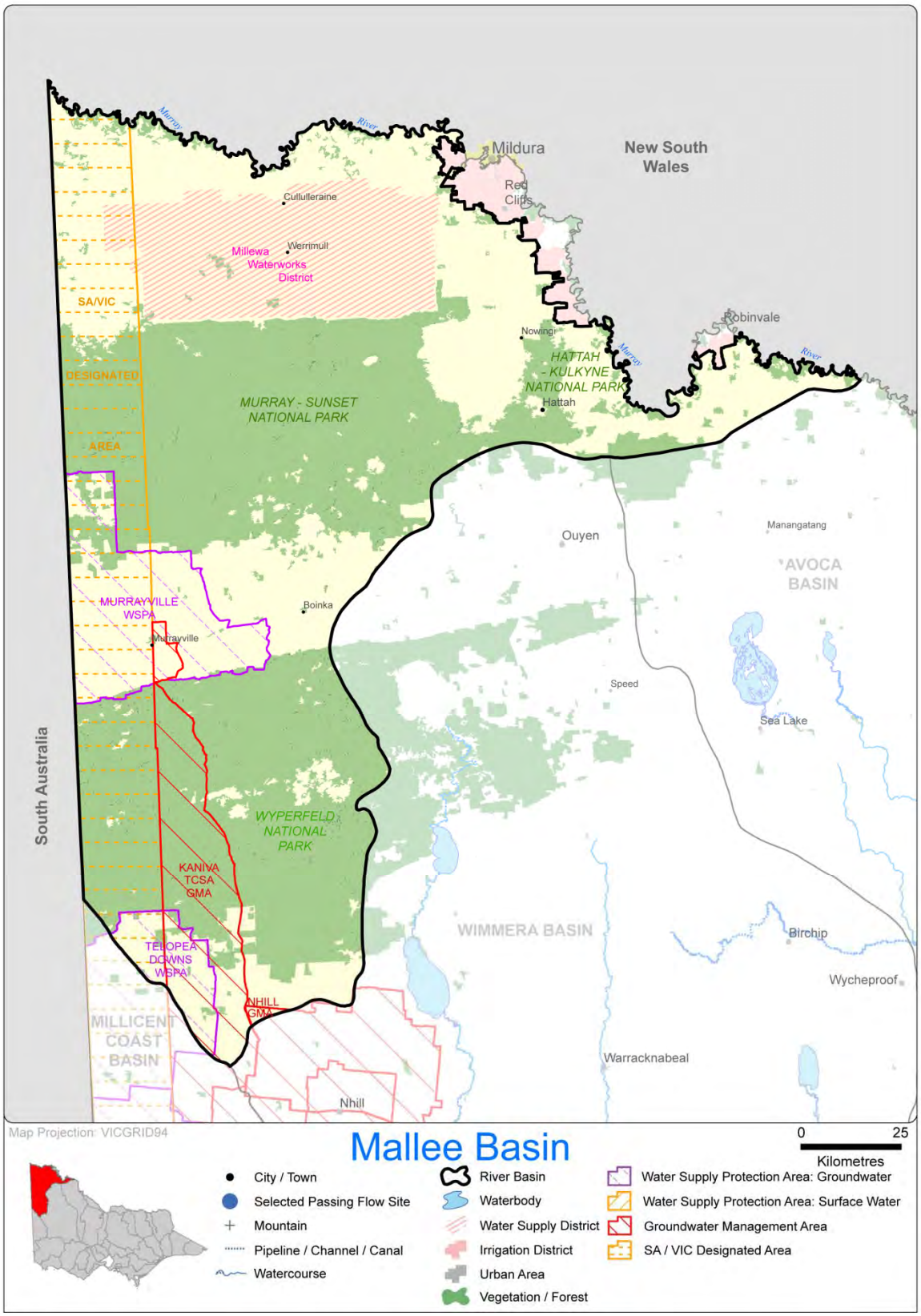
Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process[2])	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other[3] (ML)
				Urban and industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Birchip	34	34	100%	0	34	0	0	0	0
Dimboola	193	0	0%	0	0	0	0	0	193
Donald	113	113	100%	0	113	0	0	0	0
Halls Gap[4]	142	189	133%	6	183	0	0	0	(47)
Hopetoun	0	0	0%	0	0	0	0	0	0
Horsham[4]	467	732	157%	55	677	0	0	0	(265)
Jeparit	0	0	0%	0	0	0	0	0	0
Minyip	10	0	0%	0	0	0	0	0	10
Murtoa	47	47	100%	0	47	0	0	0	0
Natimuk	0	0	0%	0	0	0	0	0	0
Nhill[4]	84	139	164%	0	139	0	0	0	(54)
Ouyen	39	0	0%	0	0	0	0	0	39
Rainbow	0	0	0%	0	0	0	0	0	0
Stawell[4]	302	384	127%	135	250	0	0	0	(83)
Warracknabeal[4]	59	68	117%	63	5	0	0	0	(10)
Wycheproof	19	19	100%	0	19	0	0	0	0
Total 2011–12	**1,507**	**1,724**	**114%**	**259**	**1,465**	**0**	**0**	**0**	**(217)**
Total 2010–11	1,669	1,613	97%	314	1,299	0	0	0	56

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 2011–12, rainfall across the Mallee basin generally ranged between 80% and 100% of the long-term average, with isolated parts in the north receiving up to 125% of the long-term average. Almost all surface water used in the Mallee basin is sourced from other basins. The Mallee basin relies heavily on groundwater. Licensed groundwater use in 2011–12 was more than double the volume used in 2010–11.

In 2011–12, the Mallee basin Environmental Water Reserve comprised water outside the allocation limit for GMAs and WSPAs.

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		Acts as the licensing authority for the Murrayville WSPA and all other groundwater bores in the Mallee basin	Supplies water to Murrayville and Cowangie	
Lower Murray Water	Supplies water to the Millewa Waterworks District, Carwarp and Yelta			
Mallee Catchment Management Authority				Manages waterways in the whole of the Mallee basin

6.29.2 Total water resources in the basin

Table 6.29-2 shows the water resources available and water resource use in the Mallee basin in 2011–12.

Table 6.29-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	-	-
Groundwater	28,517	11,023
Recycled water	-	-

6.29.3 Surface water resources

6.29.3.1 Water balance

A water balance for the Mallee basin has not been presented. All surface water supplies are sourced from outside the basin.

6.29.3.2 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.

6.29.3.3 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.

6.29.3.4 Volume diverted

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.

6.29.4 Groundwater resources

Groundwater is the main water supply in the Mallee basin. The Mallee basin contains the Murrayville WSPA as well as part of the West Wimmera GMA. Groundwater also supplies the towns of Cowangie and Murrayville.

A summary of the licensed entitlements and use from GMUs within the Mallee basin is shown in Table 6.29-3. These volumes may include domestic and stock usage where it is part of an existing licence. Reported groundwater usage in

the Mallee basin increased in 2011–12, compared to 2010–11. Groundwater levels in the Murrayville WSPA and West Wimmera GMA are generally stable and in line with management objectives.

Table 6.29-3 Licensed groundwater volumes

WSPA/GMA[1]	GMA/WSPA aquifer depth limits (m)	Entitlement limit[2] (ML/year)	Licensed entitlement (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2011–12	Total licensed groundwater use (ML) 2010–11
Murrayville WSPA (100%)	70-200	10,883	9,634	4,891	-	4,891	4,059
West Wimmera GMA (34%)[3]	All depths	18,025	18,025	5,273		5,273	314
Total		**28,908**	**27,659**	**10,164**	**-**	**10,164**	**4,372**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage.

(2) Entitlement limit is equal to the PCV. In cases where there is no PCV, or where there is a reduced allocation limit for 2011–12, the entitlement limit is represented by the allocation limit.

(3) West Wimmera GMA replaced Kaniva TSCA GMA and Telopea Downs WSPA.

An estimate of domestic and stock groundwater use is provided in Table 6.29-4. A number of licensed groundwater allocations also incorporate domestic and stock use, and the estimated use for these bores is included in the licensed volume in Table 6.29-3.

Table 6.29-4 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)
Murrayville WSPA (100%)	207	414
West Wimmera GMA (34%)[1]	222	445
Total	**429**	**859**

Note:

(1) West Wimmera GMA replaced Kaniva TSCA GMA and Telopea Downs WSPA.

In the Mallee basin, groundwater is used as an urban water supply for the townships of Cowangie and Murrayville. The licensed entitlements and metered use for these groundwater supplies are provided in Table 6.29-5.

Table 6.29-5 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Cowangie	40	14	8
Murrayville	475	113	89
Total	**515**	**126**	**97**

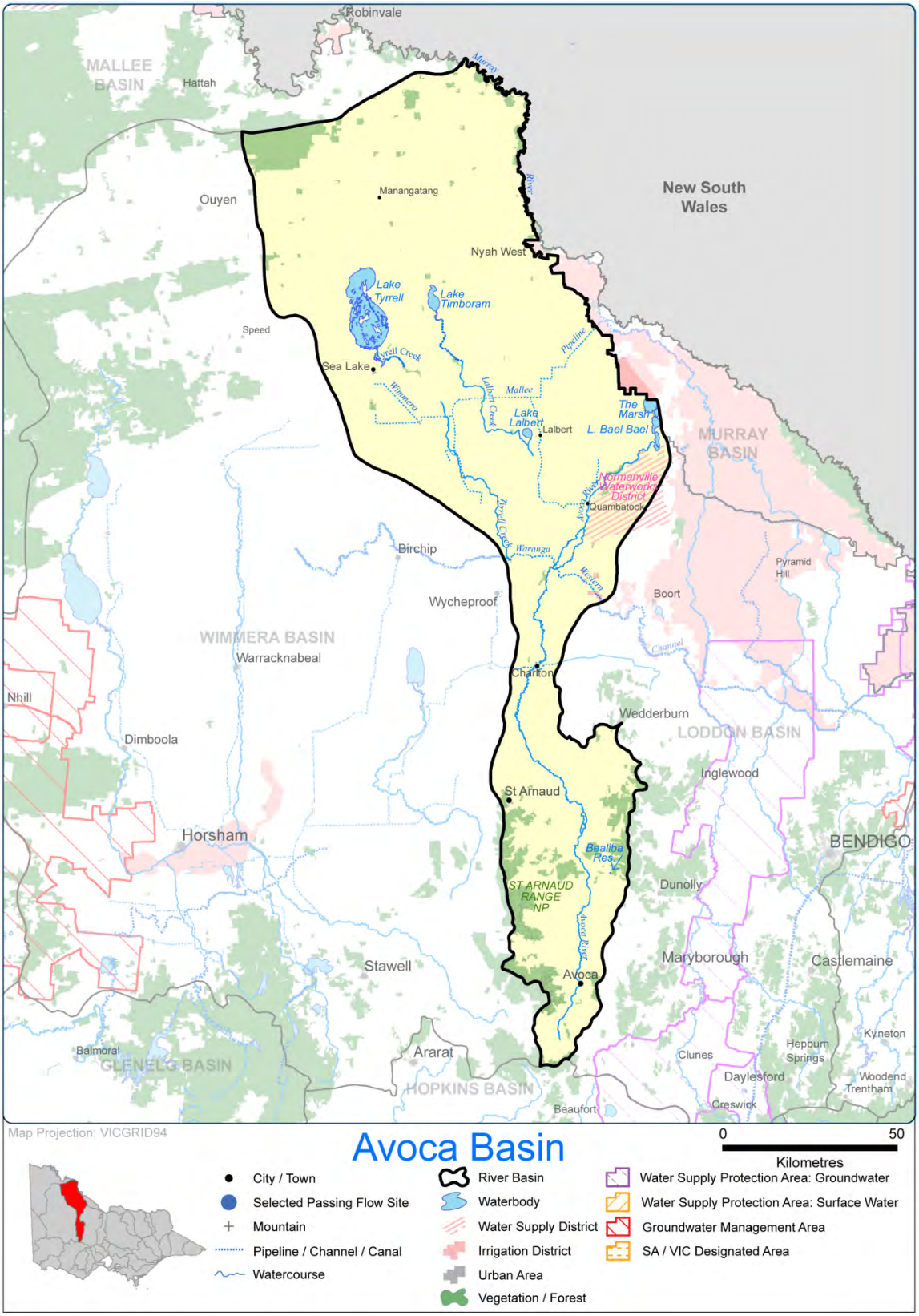
6.29.5 Recycled water

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 2011–12, rainfall across the Avoca basin was generally between 80% and 100% of the long-term average. Catchment inflows were 20% of the long-term average, significantly lower than the previous year, and the associated outflows into the terminal lakes in the north of the basin also decreased in comparison to the previous year.

Most towns in the basin are either supplied by groundwater or by surface water from the Wimmera, Glenelg and Murray basins. Restrictions for towns supplied by surface water were removed in October following significant resource improvements in the source basins. Stage 2 restrictions remained in place all year for Redbank, which is supplied by groundwater. Licensed surface water users were unrestricted during the year.

Surface water use was a similar volume to that used in 2010–11, while groundwater use dropped by around 30%.

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 surface water and groundwater 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 2011–12 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 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Avoca basin are shown in Table 6.30-2. Total surface water availability decreased significantly in 2011–12 compared to previous years, while usage remained the same. The groundwater resource amount in Table 1-2 provides for the towns of Avoca, Redbank, Amphitheatre and Daylesford, and the supply is from groundwater located in unincorporated areas.

Table 6.30-2 Summary of total water resources and water use

Water source	Total water resource (ML)	Total use (ML)
Surface water	26,975	12,846
Groundwater	593	49
Recycled water	159	155

6.30.3 Surface water resources

6.30.3.1 Water balance

A surface water balance for the Avoca basin is shown in Table 6.30-3. 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.

Table 6.30-3 Balance of surface water in the Avoca basin

Water account component	2011–12 (ML)[1]
Major on-stream storage	
Volume in storage at start of year	0
Volume in storage at end of year	0
Change in storage	0
Inflows	
Catchment inflow[2]	26,975
Rainfall on major storages	0
Treated wastewater discharged back to river	0
Total inflows	**26,975**
Outflows	
Diversions	
Urban diversions	116
Licensed diversions from unregulated streams	37
Small catchment dams	12,693
Total diversions	***12,846***
Losses	
Evaporation losses from major storages	0
Losses from small catchment dams	9,772
In-stream infiltration to groundwater, flows to floodplain and evaporation	3,771
Total losses	***13,543***
Water passed at outlet of basin	
Avoca River flow at Sandhill Lake Road (outflow to terminal lakes)	586
Avoca River overflow from the terminal lakes to the Kerang Lakes	0
Total water passed at outlet of basin	***586***
Total outflows	**26,975**

Notes:

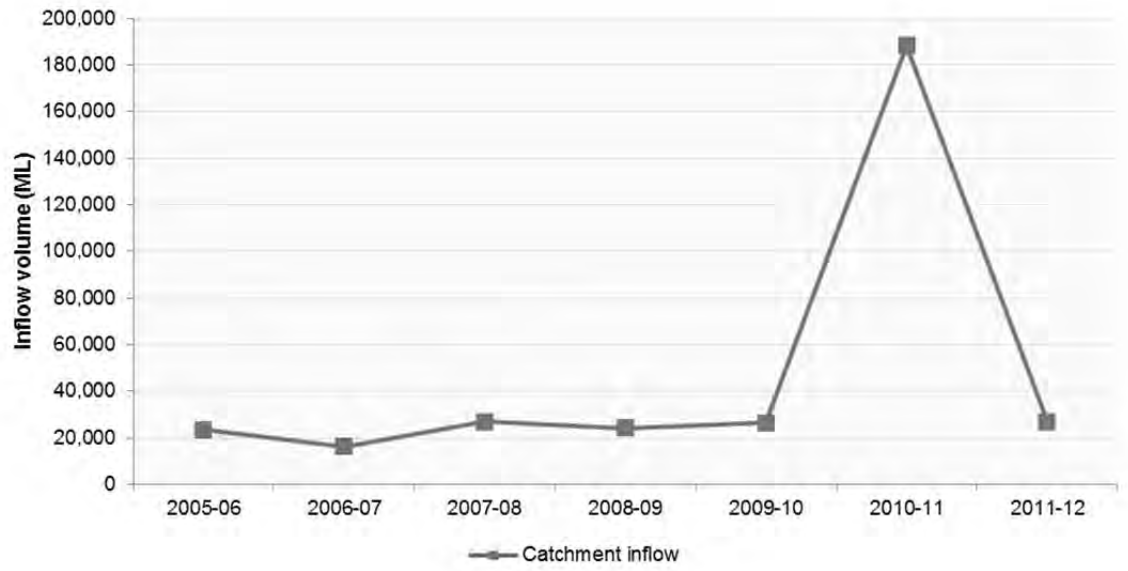
(1) Volumes for 2011–12 are rounded to the nearest 1 ML. Volumes were rounded to the nearest 10 ML or 100 ML in prior editions of the *Victorian Water Accounts*.

(2) 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.

6.30.3.2 Storages and flows

In 2011–12, the catchment inflows were 20% of the long-term average of 136,200 ML. This is significantly lower than 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 586 ML compared to 101,600 ML in 2010–11. There are no major on-stream storages in the Avoca basin.

Figure 6.30-2 Catchment inflows



6.30.3.3 Volume diverted

In the Avoca basin, water is diverted by Central Highlands Water and licensed diverters, and harvested in small catchment dams.

Central Highlands Water diverted more surface water under its bulk entitlements in 2011–12 than 2010–11 (Table 6.30-4).

Table 6.30-4 Bulk entitlement volumes and diversions

Bulk entitlement	Bulk entitlement period (years)	Bulk entitlement volume (ML/year)	Net assignment of allocation (ML)	Volume diverted (ML)
Central Highlands Water				
Amphitheatre	1	25	-	12
Avoca	1	233	-	99
Redbank	1	20	-	6
2011–12 Total		**278**	**-**	**116**
2010–11 Total		278	-	43

Water diverted from unregulated streams by licence holders in the Avoca basin decreased from 2010–11 to 2011–12 (Table 6.30-5). The total volume of licences in the Avoca basin includes licences for irrigation as well as for domestic and stock purposes. There were no diversions for irrigation in 2011–12; the diversion reported is an estimate of licensed domestic and stock use.

Table 6.30-5 Volume of licensed diversions from unregulated streams

Year	Total licensed volume (ML/year)	Total licensed diversions (ML)
2011–12	**3,032**	**37**
2010–11	3,624	100

The estimated volume of water harvested from small catchment dams represents the largest diversion of water in the Avoca basin (Table 6.30-6).

Table 6.30-6 Estimated small catchment dam information

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	10,514	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.

6.30.4 Groundwater resources

There are no GMAs or WSPAs located within the Avoca basin. Groundwater from an unincorporated area is being used to supply urban water for the townships of Amphitheatre, Avoca, Daylesford and Redbank. The licensed entitlements and metered use for these groundwater supplies are provided in Table 6.30-7.

Table 6.30-7 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2011–12 (ML)	Metered use 2010–11 (ML)
Amphitheatre	20	0	0
Avoca	250	49	72
Daylesford	273	0	0
Redbank	50	0	2
Total	**593**	**49**	**74**

6.30.5 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 2011–12 was slightly lower than that produced in 2010–11. The proportion of wastewater recycled in the Avoca basin treatment plants increased to 98% in 2011–12. The recycled water was used for urban, industrial and agricultural purposes.

Table 6.30-8 shows the volumes of water recycled in the Avoca basin in 2011–12.

Table 6.30-8 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	40	40	100%	0	40	0	0	0	0
Charlton	39	0	0%	0	0	0	0	0	39
Sea Lake	10	10	100%	0	10	0	0	0	0
St Arnaud[4]	70	105	150%	46	58	0	0	0	(35)
Total 2011–12	**159**	**155**	**98%**	**46**	**109**	**0**	**0**	**0**	**4**
Total 2010–11	166	88	53%	29	59	0	0	0	78

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 Distribution system water accounts 2011–12

7.1 Overview of methodology

Because distribution systems start where water is taken from a waterway or aquifer, these 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 like Lake Eildon will continue to be covered in the 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 it, is 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.

7.1.1 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, which supplies several retail water corporations. Their distribution systems in turn 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. However, distribution systems are always (with the exception of the Goldfields Superpipe) operated by a single water corporation, and are generally located in one of the four regions (Northern, Gippsland, Central and Western). The sole exception is Southern Rural Water, which operates three irrigation systems: one of these is in the Gippsland Region, and the other two are in the Central Region. Southern Rural Water systems therefore appear in two regions (Central and Gippsland regions).

Most water corporation websites have diagrams or maps of the distribution systems.

7.1.2 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 stock and domestic 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 offen cannot be separated. For simplicity, reports on these systems consolidate urban and rural components as 'combined distribution systems'.

7.1.3 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 from traditional figures are small.

7.1.4 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 outflow or loss. If that figure is negative, it is an unaccounted inflow.

7.1.5 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.

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 Service 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.

7.1.6 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.

7.2 Northern region

7.2.1 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 7-1 summarises North East Water's urban distribution systems.

Table 7-1 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 Mt Beauty	West Kiewa River	Tawonga South
	Myrtleford	Buffalo Creek	Myrtleford
Broken River	Benalla	Ryan and Whiskey creeks	Benalla
Central	Goorambat	Groundwater	Goorambat
	Springhurst	Diddah Diddah Creek	Springhurst
King and Ovens rivers	Glenrowan	Fifteen Mile Creek	Glenrowan
	Moyhu	Regulated King River	Moyhu
	Oxley	Regulated King River	Oxley
	Whitfield	Musk Gully Creek	Whitfield
	Wangaratta and Glenrowan	Regulated Ovens River, groundwater	Wangaratta
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, 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 7-2 shows North East Water's urban distribution systems' water balances.

Table 7-2 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	2	592	236	145	20	191	592	3	64%
Harrietville town	-	44	21	18	0	6	44	-	86%
Mount Beauty System (Tawonga group)	8	318	148	58	15	99	320	6	64%
Myrtleford town	361	615	256	213	25	110	604	372	78%
Broken River									
Benalla Town	9	1,206	796	306	83	9	1,194	21	92%
Central area									
Goorambat town	-	12	8	1	0	3	12	-	75%
Springhurst town	-	8	5	1	3	0	8	-	64%
Kings and Ovens rivers									
Moyhu town	-	30	21	3	3	4	30	-	78%
Oxley town	-	54	26	1	8	20	54	-	50%
Whitfield town	13	13	8	5	0	2	15	11	87%
Wangaratta group[3]	34	3,452	1,531	1,132	332	457	3,452	35	77%
Mitta Mitta River									
Dartmouth town	-	21	6	5		10	21	-	51%
Eskdale town	-	10	7	2	1	0	10	-	88%
Murray River									
Bellbridge town	1	44	32	2	2	8	44		76%
Tallangatta town	2	148	73	42	5	27	148	2	78%
Rutherglen/Wahgunyah system	7	572	319	147	48	58	572	7	82%
Wodonga system[2]	89	4,793	2,860	1,565	153	219	4,797	86	92%
Yarrawonga system	12	1,121	751	181	45	149	1,125	8	83%
Sub-alpine area									
Beechworth town[4]	817	660	230	102	26	303	661	816	50%
Yackandandah town	24	111	60	33	6	14	112	23	83%
Upper Murray River									
Corryong system	71	216	103	61	0	46	211	76	78%
Walwa town	1	16	7	4	1	4	16	1	68%

Notes:

(1) Where an account does not balance exactly any unaccounted-for flows have been added to distribution system losses.

(2) Springhurst was connected to the Wodonga supply from December 2011 onwards. Data from January 2012 to June 2012 has been included in the Wodonga system.

(3) Wangaratta includes data for Glenrowan. Glenrowan, which was reported separately in 2011 was connected to the Wangaratta supply In May 2011.

(4) For the Beechworth system, the distribution system efficiency includes allowance for evaporation losses from Lake Kerferd (off-stream storage).

7.2.2 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 7-3 summarises Goulburn Valley Water's urban distribution systems.

Table 7-3 Goulburn Valley Water urban distribution systems

Area	System/towns supplied	Source of supply	Treatment plant location/ Comment
Goulburn River	Alexandra	Regulated Goulburn River	Alexandra
	Murchison	Regulated Goulburn River	Murchison
	Nagambie	Regulated Goulburn River	Nagambie
	Seymour system – Seymour, Avanel, Mangalore and Tallarook	Regulated Goulburn River	Seymour
	Shepparton system – Shepparton, Moroopna, 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 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
Lake Eildon	Bonnie Doon	Bran Keet Creek/Lake Eildon	Bonnie Doon
Murray River	Cobram system – Cobram, Strathmerton and Yarroweyah	Murray River	Cobram
	Barmah	Murray River	Barmah
Murray channels	Katamatite and Picola	Murray Valley Irrigation Area	At each town
Groundwater	Katunga		Disinfection only
Broken Creek	Nathalia	Broken Creek	Nathalia
	Numurkah system – Numurkah and Wunghnu	Broken Creek and the Murray 6/6 Channel	Numurkah
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

Table 7-4 shows Goulburn Valley Water's urban distribution systems' water balances.

Table 7-4 Goulburn Valley 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		Passed to other systems[3]	Total outflows		
			To urban residential	To urban other	From treatment plants[1][2]	From distribution systems				
Goulburn River										
Alexandra	-	340	177	69	4	43	47	340	-	86%
Murchison	-	176	83	38	3	22	30	176	-	86%
Nagambie system	-	549	163	356	1	21	8	549	-	96%
Seymour system	-	1,425	777	318	19	165	146	1,425	-	87%
Shepparton system	-	11,054	5,245	3,782	46	878	1,103	11,054	-	92%
Woods Point	-	10	9	1	(1)	1		10	-	100%
Goulburn channels										
Towns supplied from Shepparton Irrigation Area	-	120	62	39	2	11	6	120	-	89%
Towns supplied from Central Goulburn Irrigation Area	623	4,559	1,536	2,344	(16)	549	131	4,544	638	88%
Towns supplied from Rochester Irrigation Area	-	28	13	10	1	3	1	28	-	86%
Lake Eildon										
Eildon and Bonnie Doon	43	205	109	56	4	29	4	202	46	84%
Murray River										
Cobram system	-	2,903	501	1,854	82	7	459	2,903	-	97%
Barmah	-	47	38	3	1	3	2	47	-	91%
Murray channels										
Katamatite and Picola	16	58	36	9	3	2	8	58	16	91%
Supplied from groundwater										
Katunga	-	58	41	14		1	2	58	-	98%
Broken Creek										
Nathalia	-	397	203	82	9	25	78	397	-	91%
Numurkah system	-	885	499	273	12	2	99	885	-	98%
Goulburn River tributaries										
Euroa system	-	572	415	121	(57)	93	0	572	-	94%
Longwood	22	51	25	11	1	14	0	51	22	71%
Mansfield	540	388	286	116	(173)	158	0	387	541	104%
Upper Delatite system	-	52	29	8	1	9	5	52	-	81%
Thornton	-	39	23	14	0	2	0	39	-	95%
Marysville[4] and Buxton	85	184	50	25	3	104	6	188	81	43%
Yea system	-	189	120	48	(6)	27	0	189	-	89%
Pyalong	31	38	26	2	(3)	10	0	35	34	80%
Broadford system	81	485	323	97	7	94	0	521	45	81%
Kilmore system	60	640	528	104	(47)	46	0	631	69	100%

Notes:

(1) Treatment plant losses are used as the balancing item.

(2) 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.

(4) Marysville, due to recovery from bushfire, has higher than usual losses.

7.2.3 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 ten irrigation and six other rural distribution systems, as shown in Table 2-7.

7.2.3.1 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 stock and domestic 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 7-5.

Table 7-5 Waranga Western Channel water balance

Waranga Western Channel	Goulburn segment (ML)	Campaspe segment (ML)	Loddon segment (ML)	Eliminations (ML)	Total (ML)
Volumes in store					
Start volume (1 July 2011)					
Waranga basin (total)	351,374	-	-	-	351,374
Greens Lake (total)	-	22,829	-	-	22,829
End volume (30 June 2012)					
Waranga basin (total)	367,613	-	-	-	367,613
Greens Lake (total)	-	17,329	-	-	17,329
Increase or (decrease) in storages	**16,239**	**(5,500)**	**-**	**-**	**10,739**
Inflows					
From Goulburn River	808,430	-	-	-	808,430
Natural to Waranga	4,273	-	-	-	4,273
Rain on Waranga	28,632	-	-	-	28,632
From WWC Goulburn segment	-	395,717	-	(395,717)	0
From Campaspe East	-	483	-	-	483
From Campaspe West	-	618	-	-	618
From Campaspe pumps	-	0	-	-	0
From Wanalta Creek to WWC	-	73	-	-	73
From Cornella Creek to WWC	-	0	-	-	0
From Lake Cooper to Greens Lake	-	0	-	-	0
Rain on Greens Lake	-	3,514	-	-	3,514
From WWC Campaspe segment	-	-	192,094	(192,094)	0
From Loddon River	-	-	43,883		43,883
Total inflows	**841,335**	**400,405**	**235,977**	**(587,811)**	**889,906**
Outflows					
Passed to other systems					
To Central Goulburn Irrigation Area	362,906	-	-	-	362,906
To Goldfields Superpipe	1,522	-	-	-	1,522
To Campaspe segment	395,717	-	-	(395,717)	0
To Rochester Irrigation Area[1]	-	206,600	-	-	206,600
To Campaspe River (ex-Goulburn River)	-	0	-	-	0
To Campaspe River	-	945	-	-	945
To Campaspe River (via Campaspe Channel)	-	0	-	-	0
To Lake Cooper	-	0	-	-	0
To Loddon segment	-	192,094	-	(192,094)	0
To Pyramid Boort Irrigation Area[2]	-	-	192,112	-	192,112
To Loddon River	-	-	42,844	-	42,844
To Wimmera-Mallee	-	-	15	-	15
WWC to East Loddon waterworks district	-	-	644	-	644
WWC to West Loddon waterworks district	-	-	100	-	100
WWC to Normanville	-	-	262	-	262
WWC to Boort Lakes	-	-	0	-	0

Waranga Western Channel	Goulburn segment (ML)	Campaspe segment (ML)	Loddon segment (ML)	Eliminations (ML)	Total (ML)
Losses					
Evaporation/seepage Waranga	52,459	-	-	-	52,459
Evaporation Greens Lake	-	6,266	-	-	6,266
Total outflows	**812,604**	**405,905**	**235,977**	**(587,811)**	**866,675**
Balancing item (unaccounted outflow)	**12,492**	**0**	**0**	**0**	**12,492**
System efficiency (%)	**94%**	**98%**	**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.

7.2.3.2 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 7-6 shows the water balance for the VMMS.

Table 7-6 Victorian Mid-Murray Storages water balance

Victorian Mid-Murray Storage (VMMS)	Volume (ML)
Volumes in store	
Start volume (1 July 2011)	
Total Kow Swamp, Lake Charm, Kangaroo Lake, Lake Boga	104,959
End volume (30 June 2012)	
Total Kow Swamp, Lake Charm, Kangaroo Lake, Lake Boga	111,943
Change in storages	**6,984**
Inflows	
Rain on all storages	18,731
Murray to Lake Boga	11,249
Torrumbarry Irrigation Area to Lake Boga	3,104
Torrumbarry Irrigation Area to Lake Charm	7,453
Torrumbarry Irrigation Area to VMMS	6,984
Total inflows	**47,521**
Outflows	
Passed to other systems	
Lake Charm to Murray River	710
Lake Boga to Murray River	430
6/7 channel to Murray River	15,659
Kerang Weir to Murray River	0
VMMS to Torrumbarry Irrigation Area	0
Total passed to other systems	***16,799***
Losses	
Evaporation on storages	62,975
Distribution losses[(1)]	11,442
Total losses	***74,417***
Total outflows	**91,216**
Balancing item (unaccounted inflow)	**50,678**
System efficiency (%)	N/A

Notes:
(1) Fixed allowance for distribution system losses
N/A = not applicable.

7.2.3.3 Other distribution systems

Goulburn–Murray Water's other distribution systems are rural, and are summarised in Table 7-7.

Table 7-7 Goulburn–Murray Water rural distribution systems

System	Customers supplied	Source of supply
Irrigation distribution systems		
Shepparton Irrigation Area	Primarily irrigation and domestic and stock (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
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
Rochester Irrigation Area	Primarily irrigation and D&S to irrigators. Also provides bulk supply to four towns in its area	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
Campaspe Irrigation District	Irrigation and D&S to irrigators	Campaspe River at Campaspe Weir
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
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
Woorinen Irrigation Area	Irrigation and D&S to irrigators	Pumped from Murray
Tresco Irrigation Area	Irrigation and D&S to irrigators	Torrumbarry Irrigation Area
Nyah Irrigation District	Irrigation and D&S to irrigators	Pumped from Murray
Other rural distribution systems		
Normanville D&S	Rural D&S. Also provides bulk supply to Quambatook urban	Waranga Western Channel
East Loddon D&S	Rural D&S	Waranga Western Channel
West Loddon D&S	Rural D&S	Waranga Western Channel
Tungamah D&S	Rural D&S	Shepparton Irrigation Area
Upper Broken Creek	Irrigation diversions	Broken River at Caseys Weir
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

Table 7-8 shows Goulburn–Murray Water's rural distribution systems' water balances.

Table 7-8 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		Losses[1]	Passed to other systems	Total outflows		
			To rural customers	To other					
Irrigation distribution systems									
Shepparton Irrigation Area	-	157,345	103,736	0	12,990	40,619	157,345	-	92%
Central Goulburn Irrigation Area	-	365,494	289,355	0	71,919	4,220	365,494	-	80%
Rochester Irrigation Area	-	205,708	157,021	0	47,168	1,519	205,708	-	77%
Pyramid-Boort Irrigation Area	-	192,094	152,519	0	38,186	1,389	192,094	-	80%
Campaspe Irrigation Area	-	8,917	5,466	0	2,350	1,101	8,917	-	74%
Murray Valley Irrigation Area	-	329,786	210,438	0	92,321	27,027	329,786	-	72%
Torrumbarry Irrigation Area[2]	11,494	588,451	329,952	12,117	144,234	101,753	588,056	11,889	75%
Woorinen Irrigation Area	-	10,931	8,651	0	2,280	0	10,931	-	79%
Tresco Irrigation Area	-	5,744	5,363	0	381	0	5,744	-	93%
Nyah Irrigation Area	-	4,997	4,350	0	647	0	4,997	-	87%
Other rural distribution systems									
Normanville D&S	62	263	149	0	57	57	263	61	78%
East Loddon D&S	-	644	523	0	121	0	644	-	81%
West Loddon D&S	-	100	73	0	27	0	100	-	73%
Tungamah D&S	-	434	207	0	227	0	434	-	48%
Upper Broken Creek[3]	-	3,004	257	0	(22,077)	24,824	3,004	-	N/A
Lower Broken Creek[3]	-	165,199	14,086	0	(958)	152,071	165,199	-	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) Apparent negative losses in creek systems are because of unmeasured inflows.

The Shepparton irrigation area had early take-up of 'modernisation': lined channels, some closure of spur channels, remotely operated weirs and gates, and accurate metering. This is reflected in the system's 92% efficiency.

On the other hand, the Torrumbarry system efficiency is 75%.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.

7.2.4 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
- the Coliban Main Channel.

There are nine urban water supply systems, including the two separate groundwater systems of Elmore and Trentham. There are 11 rural subsystems.

7.2.4.1 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 7-9 shows the superpipe's water balance.

Table 7-9 Goldfields Superpipe water balance

Goldfields Superpipe	Volume (ML)
Volumes in store	
Start volume (1 July 2011)	-
End volume (30 June 2012)	-
Change in storage	**-**
Inflows	
From WWC at Colbinabbin – Coliban Water	1,551
From WWC at Colbinabbin – Central Highlands Water	109
From Lake Eppalock – Coliban Water	379
From Lake Eppalock – Central Highlands Water	0
From Sandhurst	0
Total inflows	**2,039**
Outflows	
To Eppalock – Coliban Water	0
To Eppalock – Central Highlands Water	0
Direct to Coliban Water rural customers	282
To Sandhurst – Coliban Water (1)	(238)
To Sandhurst – Central Highlands Water	0
Transfer to Central Highlands Water at White Swan Reservoir	109
To Heathcote (Caledonia Reservoir)	120
To Emu Valley rural channel subsystem	94
To Axe Creek rural channel subsystem	288
To Spring Gully Reservoir	204
To Specimen Hill rural channel subsystem	1,178
Total outflows	**2,039**
Balancing item (unaccounted 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.

7.2.4.2 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 7-10 shows the water balance for the Coliban Main Channel.

Table 7-10 Coliban Main Channel water balance

Coliban Main Channel	Volume (ML)
Volumes in store	
Start volume (1 July 2011)	-
End volume (30 June 2012)	-
Change in storage	-
Inflows	
From Malmsbury Reservoir	14,193
Total inflows	**14,193**
Outflows	
Deliveries to customers	
Direct deliveries to rural customers off channel	223
Total deliveries to customers	***223***
Passed to other systems	
To Coliban North system at Sandhurst Reservoir	10,180

Coliban Main Channel	Volume (ML)
To Poverty Gully rural subsystem	1,571
To Harcourt rural subsystem	2,376
To Emu Valley rural subsystem	532
To Specimen Hill rural subsystem	180
To Spring Gully rural subsystem	340
Total passed to other systems	15,179
Losses	
System losses (back-calculated) [1]	(1,209)
Total losses	***(1,209)***
Total outflows	**14,193**
System efficiency (%)	**109%**

Note:
(1) System losses (back-calculated) represent unmeasured inflow runoff direct to main channel.

7.2.4.3 Rural distribution systems

Coliban Water's rural distribution system supplies rural licence customers (including stock, domestic and irrigation customers) with entitlements of around 15,700 ML in rural areas extending from Castlemaine to Bendigo, and further north to Raywood. Table 7-11 shows Coliban Water's rural distribution systems' water balances.

Table 7-11 Coliban 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]	Passed to other systems	Total outflows		
			To rural customers	To other					
Ascot	-	736	493	-	243	-	736	-	67%
Axe Creek	-	288	106	-	182	-	288	-	37%
Cockatoo Hill	-	184	65	-	119	-	184	-	35%
Emu Valley	-	626	286	-	340	-	626	-	46%
Harcourt	1,690	2,376	970	-	1,406	-	2,376	1,690	41%
Jackass Flat	-	11	4	-	7	-	11	-	35%
Lockwood	-	745	375	-	370	-	745	-	50%
Poverty Gully[2]	-	1,571	4	-	193	1,374	1,571	-	88%
Specimen Hill[3]	-	1,358	299	-	303	756	1,358	-	78%
Spring Gully Reservoir[4]	1,017	265	0	-	323	736	1,058	224	70%
Spring Gully rural subsystem[5]	-	340	51	-	104	185	340	-	69%

Note:
(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.
(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 2011–12.

7.2.4.4 Urban distribution systems

Table 7-12 summarises Coliban Water's nine urban distribution systems.

Table 7-12 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	Kyneton system – Kyneton, Malmsbury and Tylden	Lauriston Reservoir	Kyneton
	Castlemaine system – Castlemaine, Maldon, Campbells Creek, Chewton, Newstead, Elphinstone, Taradale and Harcourt	Coliban storages (via Coliban Main Channel)	Castlemaine
Elmore Groundwater	Elmore	Lower Campaspe Valley Water Supply Protection Area	Elmore
Goulburn	Towns supplied from Rochester Irrigation Area – Lockington and Rochester	Goulburn system (Lake Eildon & Waranga Basin)	Lockington and Rochester
	Towns supplied from Pyramid-Boort Irrigation Area – Boort, Dingee, Macorna, Mitiamo, Mysia and Pyramid Hill	Goulburn system (Lake Eildon & Waranga Basin)	Boort and Pyramid Hill No treatment at Dingee, Macorna, Mitiamo and Mysia
Loddon	Serpentine	Loddon River – Serpentine Creek and tankered	Serpentine
	Jarklin	Loddon River – Serpentine Creek and tankered	No treatment (not a drinking water supply)
	Bridgewater system – Bridgewater and Inglewood	Loddon River	Bridgewater
	Laanecoorie system – Laanecoorie, Tarnagulla, Bealiba and Dunolly	Loddon River	Laanecoorie
Murray	Cohuna and Cohuna-Mead-Gunbower rural system	Murray River – Gunbower Creek	Cohuna
	Echuca	Murray River	Echuca
	Leitchville	Murray River – Gunbower Creek and Cohuna irrigation channel	Leitchville
	Gunbower	Murray River – Taylors Creek	Gunbower
Trentham Groundwater	Trentham	Spring Water and groundwater from Campaspe basin	Trentham
Wimmera	Wychitella	Wimmera-Mallee Pipeline	No treatment (not a drinking water supply)
	Borung	Wimmera-Mallee Pipeline	No treatment (not a drinking water supply)
	Korong Vale system – Korong Vale and Wedderburn	Wimmera-Mallee Pipeline	Korong Vale

Table 7-13 shows Coliban Water's urban distribution systems' water balances.

Table 7-13 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]		Passed to other systems	Total outflows		
			To urban residential	To urban non-residential	From treatment plants	From dist'n systems				
Campaspe										
Goornong	-	46	26	6	-	15	0	46	-	68%
Coliban Northern										
Bendigo system	2,207	9,972	6,348	2,445	-	2,068	6	10,867	1,312	81%
Heathcote system	84	386	129	61	-	151	0	341	129	56%
Coliban Southern										
Castlemaine system – McKay Reservoir	1,265	1,374	876	709	-	148	0	1,733	906	91%
Kyneton system	-	768	352	284	-	132	0	768	-	83%
Elmore groundwater system										
Elmore	-	122	63	33	-	26	0	122	-	78%
Goulburn system										
Supplied from Rochester Irrigation Area[2]	-	1,216	326	725	-	165	0	1,216	-	86%
Supplied from PH-Boort Irrigation Area[3]	-	298	131	60	-	107	0	298	-	64%
Loddon system										
Bridgewater system	-	239	72	32	-	135	0	239	-	44%
Jarklin	-	3	1	1	-	1	0	3	-	63%
Laanecoorie system	-	103	65	16	-	22	0	103	-	78%
Serpentine	-	23	11	3	-	9	0	23	-	62%
Murray system										
Cohuna	-	698	274	237	-	187	0	698	-	73%
Echuca	-	2,591	1,314	1,132	-	145	0	2,591	-	94%
Leitchville	-	206	25	135	-	46	0	206	-	78%
Gunbower	-	56	30	10	-	16	0	56	-	72%
Trentham groundwater system										
Trentham[4]	39	279	53	12	-	44	127	235	83	81%
Wimmera system										
Wychitella	-	4	1		-	3	0	4	-	36%
Borung	-	1	2		-	(1)	0	1	-	212%
Koorong Vale – Wedderburn	-	143	63	20	-	60	0	143	-	58%

Note:

(1) Distribution system losses are the balancing item in all cases.

(2) Rochester Irrigation Area consists of Lockington town and Rochester town (part).

(3) PH-Boort Irrigation Area consists of Macorna town, Pyramid Hill town, Boort town, Mysia town, Mitiamo town and Dingee town.

(4) Trentham passed to other systems is spill down Trent Creek.

7.2.5 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 7-14 summarises Lower Murray Water's rural distribution systems.

Table 7-14 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
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
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
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
Wargan-Yelta part of the Cardross-Yelta waterworks district	D&S customers	Merbein 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

Table 7-15 shows Lower Murray Water's rural distribution systems' water balances.

Table 7-15 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	Total outflows		
			To irrigation	To other				
Irrigation distribution systems								
First Mildura Irrigation District	-	32,690	27,790	-	4,901	32,690	-	85%
Red Cliffs Irrigation District	-	27,436	24,165	821	2,450	27,436	-	91%
Merbein Irrigation District	-	17,354	15,273	-	2,081	17,354	-	88%
Robinvale Irrigation District	-	17,742	17,583	-	159	17,742	-	99%
Other rural distribution systems								
Cardross part of Cardross-Yelta waterworks district	-	1	1	-	0	1	-	100%
Millewa waterworks district[(1)]	4,491	12,002	709	7,563	3,729	12,002	4,491	69%

Note:

(1) For the Millewa waterworks district, the distribution system efficiency includes allowance for evaporation losses from Lake Cullulleraine (off-stream storage).

Table 7-16 summarises Lower Murray Water's urban distribution systems.

Table 7-16 Lower Murray Water urban distribution systems

System/towns supplied	Source of supply	Treatment plant location/Comment
Millewa urban system – Werrimull, Meringur and Cullulleraine	Millewa waterworks district	Millewa
Mildura urban system – Mildura (including Cardross, Koorlong and Nicholls Point), Merbein and Irymple	Murray River	Mildura
Red Cliffs	Murray River	Red Cliffs
Robinvale	Murray River	Robinvale
Piangil	Murray River	Piangil
Swan Hill urban system – Swan Hill, Lake Boga, Nyah, Nyah West, Woorinen South and Wakool Shire (NSW)	Murray River	Swan Hill
Kerang	Murray River, Loddon River, Torrumbarry Irrigation Area	Kerang
Koondrook	Murray River	Koondrook
Murrabit	Murray River	Murrabit
Mystic Park	Victorian Mid-Murray Storage (Lake Kangaroo)	Raw water supply only (no treatment plant)

Table 7-17 shows Lower Murray Water's urban distribution systems' water balances.

Table 7-17 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[1]		Total outflows		
			To urban residential	To urban non-residential	From treatment plants	From distribution systems			
Millewa system	1	25	29	-	-	(4)	25	1	N/A
Mildura system	48	10,468	7,201	2,348	-	919	10,468	48	91%
Red Cliffs	7	1,066	501	459	-	106	1,066	7	90%
Robinvale	5	491	308	119	-	64	491	5	87%
Piangil	1	92	38	39	-	15	92	1	84%
Swan Hill system	14	3,420	2,134	782	-	504	3,420	14	85%
Kerang	6	990	643	167	-	180	990	6	82%
Koondrook	3	204	125	21	-	58	204	3	72%
Murrabit	2	30	13	5	-	12	30	2	60%
Mystic Park		10	4	1	-	5	10	0	50%

Note:

(1) Distribution system losses are used as the balancing item.

7.3 Gippsland region

7.3.1 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 7-18 summarises East Gippsland Water's urban distribution systems.

Table 7-18 East Gippsland Water urban distribution systems

System/towns supplied	Source of supply	Treatment plant location
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
Orbost system – Orbost, Newmerella and Marlo	Rocky and Brodribb rivers	Orbost
Mallacoota	Betka River and groundwater	Mallacoota
Omeo	Butchers Creek	Omeo
Swifts Creek	Tambo River	Swifts Creek
Bemm River	Bemm River	Bemm River
Cann River	Cann River	Cann River
Buchan	Buchan River	Buchan
Dinner Plain	Groundwater	Dinner Plain

Table 7-19 shows East Gippsland Water's urban distribution systems' water balances.

Table 7-19 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		Total outflows		
			To urban residential	To urban other	From treatment plants	From distribution systems[1]			
Mitchell system	1,205	4,105	2,231	1,169	-	1,093	4,493	817	76%
Orbost system	31	694	215	347	-	126	688	37	82%
Mallacoota	60	173	83	45	-	50	178	55	72%
Omeo	16	48	24	17	-	10	50	13	80%
Swifts Creek	3	23	13	8	-	2	24	2	92%
Bemm River	5	24	10	19	-	(5)	23	5	124%
Cann River	1	34	15	13	-	4	33	3	87%
Buchan	1	22	9	6	-	8	22	0	66%
Dinner Plain	1	42	21	10	-	11	42	1	74%

Notes:
(1) Distribution system losses are used as the balancing item.

7.3.2 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 7-20 summarises Gippsland Water's urban distribution systems.

Table 7-20 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
Sale	Sale and Wurruk	Groundwater	Sale
Moondarra Reservoir	Moondarra system – Boolarra, Churchill, Cowwarr, Glengarry, Hazelwood North, Jumbuck, Morwell, Rosedale, Toongabbie, Traralgon, Tyers and Yinnar	Moondarra Reservoir	Morwell, Traralgon and Tyers
Moe	Moe system – Moe, Newborough, Yallourn North, Trafalgar, Darnum and Yarragon	Narracan Creek and Tanjil River	Moe
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 7-21 shows Gippsland Water's urban distribution systems' water balances.

Table 7-21 Gippsland Water urban 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 system efficiency (%)
			Deliveries		Losses		Total outflows			
			To urban residential	To urban other[1]	From treatment plant	From distribution systems[2]				
Macalister/ Thomson area	32	1,489	720	451	174	144	1,489	1	32	79%
Sale system	16	1,748	1,070	506	145	27	1,748	(1)	16	90%
Moondara Reservoir system	802	48,924	4,160	44,258	358	147	48,923	79	724	99%
Moe system	52	3,867	1,579	1,561	238	488	3,866	0	53	81%
Warragul/Drouin system	93	2,809	1,668	710	246	186	2,810	25	67	85%
Willow Grove	-	44	31	1	2	10	44	0	-	73%
Neerim South/Noojee	3	209	144	28	6	31	209	0	3	82%
Boolara	3	84	36	3	15	30	84	0	2	46%
Erica/Rawson	39	96	37	20	16	23	96	13	26	59%
Mirboo North	2	175	103	30	2	40	175	0	2	76%
Thorpdale	2	15	8	2	4	1	15	0	2	67%
Seaspray [3]	2	32	20	3	0	9	32	(1)	3	72%

Notes:

(1) Urban other includes non-residential use and includes major industry users in some systems.

(2) Distribution system losses are used as a 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) Water was carted from Sale due to major failure at the water treatment plant. Inflows have been assumed to equal outflows.

The Boolarra system (with the least efficiency of 46%) was interconnected to the Moondarra system in July 2012, reducing future losses for this system.

Systems with the lowest efficiencies (of less than 70%, including Boolarra, Erica/Rawson and Thorpdale) are also Gippsland Water's smallest systems by volume supplied. The combined volume supplied to these systems totalled 105 ML, which is small compared to the 57,149 ML total supplied to all systems. An overall efficiency was calculated at 96% for all systems combined.

7.3.3 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, from the Great Divide to the coast, and from the South Australian border to the New South Wales border (except for water supplies by Wannon Water to its rural customers). 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 7-22 shows the water balance for the Macalister Irrigation District.

Table 7-22 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]	Total outflows		
			To irrigation[1]	To other				
Macalister Irrigation District	-	125,157	77,635	-	47,522	125,157	-	62%

Notes:

(1) Deliveries to irrigation include supply to domestic and stock customers.

(2) Losses include 25,786 ML of outfalls, the remainder is back-calculated to represent losses.

7.3.4 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 7-23 summarises South Gippsland Water's urban distribution systems.

Table 7-23 South Gippsland Water urban distribution systems

System/towns supplied	Source of supply	Treatment plant location
Yarram system – Devon North, Alberton, Yarram and Port Albert	Tarra River	Devon North
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

Table 7-24 shows South Gippsland Water's urban distribution systems' water balances.

Table 7-24 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]		Total outflows			
			To urban residential	To urban other	From treatment plant	From distribution systems				
Yarram system	-	461	149	191	-	94	434	27	-	78%
Dumbalk	-	23	8	4	-	7	19	4	-	63%
Fish Creek	123	101	12	70	-	5	87	14	123	94%
Foster	238	168	68	66	-	23	157	11	238	85%
Korrumburra	592	1,250	217	339	-	138	694	556	592	80%
Leongatha	1,910	1,646	334	1,174	-	46	1,554	92	1,910	97%
Loch system	219	201	67	88	-	32	187	14	219	83%
Meeniyan	-	49	29	11	-	1	41	8	-	98%
Toora system	58	531	61	281	-	123	465	66	58	74%
Wonthaggi system	4,200	1,805	868	685	-	165	1,718	87	4,200	90%

Note:

(1) Distribution system losses include treatment plant losses.

(2) A separate balancing item has been included as the unaccounted-for flows in these systems have not been able to be attributed to any particular line item in the accounts.

7.4 Central region

7.4.1 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 numbers swelling to about 60,000 in peak holiday periods.

Table 7-25 summarises Westernport Water's distribution system's water balances.

Table 7-25 Westernport Water distribution system's water balance

Westernport Water	Volume (ML)
Volumes in store	
Start volume in store (1 July 2011)	-
End volume in store (30 June 2012)	-
Change in storages	**-**
Inflows	
From Candowie Reservoir	1,821
From Bass River	0
Total inflows	**1,821**
Outflows	
Deliveries	
Residential customers	967
Non-residential customers	571
Owners corporations	61
Westernport Water operations	0
Total deliveries	***1,599***
Losses	
Treatment plant	54
Distribution system	168
Total losses	***222***
Total outflows	**1,821**
System efficiency (%)	**88%**

7.4.2 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 7-26 summarises Melbourne Water's distribution system's water balance.

Table 7-26 Melbourne Water distribution system's water balance

Melbourne Water	Volume (ML)
Volumes in store	
Start volume (1 July 2011)	
Silvan Reservoir	34,538
Cardinia Reservoir	204,353
Sugarloaf Reservoir	95,583
Greenvale Reservoir	20,720
Total start volume	***355,194***
End volume (30 June 2012)	
Silvan Reservoir	36,311
Cardinia Reservoir	217,739
Sugarloaf Reservoir	93,866
Greenvale Reservoir	20,956
Total end volume	***368,872***
Increase in storages(1)	**13,678**
Inflows	
From Yarra basin to Silvan(2)	242,619
From Yarra basin to Cardinia(3)	0
From Yarra basin to Sugarloaf	100,691
From Goulburn River to Sugarloaf	0
From Yan Yean to Greenvale	0
From Tarago Reservoir	6,548
Rainfall on four main storages	21,924
Total inflows	**371,782**
Outflows	
Passed to other systems	
To South East Water	129,908
To Yarra Valley Water	133,918
To City West Water	96,338
To Western Water	5,108
To Gippsland Water	287
To Cardinia Creek from Cardinia	1,830
To Stonyford Creek from Silvan	732
Total passed to other systems	**368,121**
Losses(4)	
Evaporation from four main storages	15,771
System losses	2,501
Total losses	**18,272**
Total outflows	**386,393**
Balancing item (unaccounted-for inflow)	28,289
System efficiency (%)	**95%**

Notes:
(1) Storage figures do not include service reservoirs and tanks.
(2) Inflows from Yarra basin to Silvan include a transfer of 1,062 ML from Thomson to Yarra basin.
(3) Inflows from Yarra basin to Cardinia were all transferred from Silvan.
(4) System losses exclude aqueduct losses of 2,135 ML upstream of the common distribution system.

Factors contributing to the unaccounted 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.

7.4.3 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 7-27 shows South East Water's urban distribution system's water balance.

Table 7-27 South East Water urban distribution system's water balance

South East Water	Volume (ML)
Volumes in store	
Start volume (1 July 2011)	
Service basins	515
End volume (30 June 2012)	
Service basins	515
Change in storage	0
Inflows	
From Melbourne Water	129,917
Recycled – imported	955
Recycled – from local treatment plant	2,157
Total inflows	**133,029**
Outflows	
Deliveries	
To residential customers	85,463
To non-residential customers	27,693
To authorised non-metered	3,329
Recycled water used	3,112
Total deliveries	***119,597***
Losses	
System losses(1)	13,432
Total losses	***13,432***
Total outflows	**133,029**
System efficiency	**90%**

Note:
(1) The balancing item in this account is system losses (back-calculated from total inflows).

7.4.4 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 7-28 shows Yarra Valley Water's urban distribution system's water balance.

Table 7-28 Yarra Valley Water urban distribution system's water balance

Yarra Valley Water	Volume (ML)
Volumes in store	
Start volume (1 July 2011)	-
End volume (30 June 2012)	-
Change in storage	-
Inflows	
From Melbourne Water	133,918
Recycled – from local treatment plant	143
Total inflows	**134,061**
Outflows	
Deliveries	
To residential customers	94,598
To non-residential customers	25,353
Recycled water used	142
Total deliveries	***120,093***
Losses	
System losses(1)	13,968
Total losses	***13,698***
Total outflows	**134,061**
System efficiency	**90%**

Note:
(1) System losses include both real losses of 9,407 ML (from leakage, bursts and background leakage) and apparent losses of 4,561 ML (which may include metering errors).

7.4.5 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 7-29 shows City West Water's urban distribution system's water balance.

Table 7-29 City West Water urban distribution system's water balance

City West Water	Volume (ML)
Volumes in store	
Start volume (1 July 2011)	-
End volume (30 June 2012)	-
Change in storage	-
Inflows	
From Melbourne Water	96,317
Recycled – imported[(1)]	152
Total inflows	**96,469**
Outflows	
Deliveries	
To residential customers	48,807
To non-residential customers	38,563
Recycled water used	1,262
Total deliveries	***88,632***
Losses	
System losses[(2)]	7,837
Total losses	***7,837***
Total outflows	**96,469**
System efficiency	**92%**

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).

7.4.6 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 Mryniong. 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 7-30 summarises Western Water's urban distribution systems.

Table 7-30 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 Mryniong (*Mryniong 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, Mryniong
Woodend	Woodend	Campaspe Reservoir and Campaspe River tributaries, Mount Macedon storages and tributaries *(indirectly supplemented from integrated system in times of drought)*	Woodend
Lancefield	Lancefield	Garden Hut Reservoir and groundwater	Lancefield

Table 7-31 shows Western Water's urban distribution systems' water balances.

Table 7-31 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		Total outflows			
			To urban residential	To urban other	From treatment plants	From distribution systems				
Main integrated system	979	11,511	10,056	-	-	851	10,907	940	643	92%
Woodend	361	347	379	-	-	32	411	(59)	356	92%
Lancefield	110	168	153	-	-	13	166	3	109	92%

Note:

(1) A separate balancing item has been included as the unaccounted-for flows in these systems have not been able to be attributed to any particular line item in the accounts.

7.4.7 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 7-32 summarises Barwon Water's urban distribution systems.

Table 7-32 Barwon Water urban distribution systems

Area	System/towns supplied	Source of supply	Treatment plant location / Comment
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, Queenscliffe, 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
Colac (Colac and Gellibrand systems)	Colac urban, and rural areas and towns including Gellibrand, Pirron Yallock, Irrewarra, Corangulac, Alvie, Beeac and Cressy	Olangolah and West Gellibrand reservoirs, which are fed by streams in the Otway Ranges	Colac
Aireys Inlet	Aireys Inlet and Fairhaven	Painkalac Reservoir on the Painkalac Creek	Aireys Inlet
Lorne	Lorne township	Allen Reservoir on the St George River, just west of Lorne	Lorne
Apollo Bay	Apollo Bay, Marengo and Skenes Creek	Diversion weir on the West Barham River in the Otway Ranges	Treatment plant near Marengo

Table 7-33 shows Barwon Water's urban distribution systems' water balances.

Table 7-33 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		Total outflows			
			To urban residential	To urban other	From treatment plants	From distribution systems				
Geelong/Bellarine	36,853	30,856	17,491	8,363	0	3,810	29,664	2,270	35,775	87%
Colac (incl. Gellibrand)	540	3,594	1,595	1,285	0	91	2,971	599	564	97%
Aireys Inlet	2	178	125	11	26	17	178	0	2	76%
Lorne	6	382	213	89	30	36	368	14	6	82%
Apollo Bay	111	413	172	106	15	94	388	11	126	72%

Note:

(1) A separate balancing item has been included as the unaccounted-for flows in these systems have not been able to be attributed to any particular line item in the accounts.

7.4.8 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 7-34 summarises Central Highlands Water's urban distribution systems.

Table 7-34 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 – 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

Area	System/towns supplied	Source of supply	Treatment plant location/ Comment
	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 7-35 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. In addition, White Swan Reservoir is treated in the basin chapters of the accounts as an on-stream storage and is also not covered here. The headworks system, that is the channels connecting Moorabool Reservoir to White Swan, are also not covered in this account.

Table 7-35 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 other	From treatment plants	From distribution systems[2]				
Greater Ballarat	-	10,418	6,444	2,748	0	1,226	10,418	0	-	88%
Maryborough and district	-	1,221	725	212	0	284	1,221	0	-	77%
Amphitheatre	-	12	10	1	0	1	12	0	-	92%
Avoca	-	148	72	21	0	9	102	47	-	91%
Beaufort and Raglan	-	152	91	28	0	31	150	2	-	79%
Blackwood and Barrys Reef	-	50	21	3	0	2	27	23	-	89%
Clunes	-	173	113	34	2	24	173	0	-	85%
Daylesford system	-	581	299	127	0	150	575	6	-	74%
Dean	-	15	4	1	0	10	15	0	-	33%
Forest Hill system	-	133	91	10	0	31	131	2	-	77%
Landsborough[3] and Navarre	-	45	11	8	8	18	45	0	-	42%
Learmonth	-	50	23	15	0	3	40	9	-	95%
Lexton	-	20	11	1	1	7	20	0	-	60%
Redbank	-	6	5	0	0	1	6	0	-	83%
Waubra	-	28	14	1	0	3	19	9	-	79%

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.

7.4.9 Southern Rural Water (Werribee and Bacchus Marsh systems)

Southern Rural Water operates the Werribee and Bacchus Marsh irrigation districts. Both are in the Werribee basin and are supplied from the Werribee River and its tributaries. Werribee is also supplied with recycled water from Melbourne Water's Western Treatment Plant.

Table 7-36 shows Southern Rural Water's Werribee and Bacchus Marsh irrigation districts' water balances.

Table 7-36 Southern Rural Water Werribee and Bacchus Marsh irrigation districts' 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 irrigation	To other				
Werribee Irrigation District	-	12,902	8,094	-	4,808	12,902	-	63%
Bacchus Marsh Irrigation District	-	3,037	1,952	-	1,085	3,037	-	64%

Notes:

(1) Losses include outfalls of 253 ML from Werribee and 77 ML from Bacchus Marsh, and are the balancing item.

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7.5 Western region

7.5.1 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 7-37 summarises Wannon Water's combined distribution systems.

Table 7-37 Wannon Water combined distribution systems

Area	System/towns supplied	Source of supply	Treatment plant location
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
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
Grampians	Hamilton, Cavendish, Dunkeld and Tarrington	Victoria Ranges catchment (small streams and groundwater flow extracted from bores) and Rocklands Reservoir	Hamilton, Cavendish and Dunkeld
Balmoral	Balmoral	Rocklands Reservoir	Balmoral
Port Campbell Limestone aquifer	Casterton, Coleraine, Sandford, Merino and Warrnambool	Groundwater flow extracted at Tullich borefield and at Albert Park, Warrnambool	Casterton
Newer Volcanic aquifer	Darlington, Caramut, Penshurst, Macarthur and Mortlake	Groundwater flow extracted at bores in localities serviced	Darlington, Caramut, Penshurst and Macarthur
Glenthompson	Glenthompson	Local surface water catchments into Glenthompson and Railway reservoirs, bulk supply from GWMWater	Glenthompson
Konongwootong	Rural customers only	Local surface water catchment into Konongwootong Reservoir	N/A

N/A: Not applicable.

Total inflows, reticulation losses and storage levels are accounted for at the system level. Values for these items are not available for individual towns.

Table 7-38 shows Wannon Water's combined distribution systems' water balances. Total inflows, reticulation losses and storage levels are accounted for at the system level. Values for these items are not available for individual towns.

Table 7-38 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		Total outflows			
			To urban residential	To urban other	To rural customers	To other [4]	Treatment plant losses	Reticulation system losses [1]				
Otway System												
Allansford			51	41	18							
Camperdown			236	111	594		236					
Cobden			115	347	124		158					
Koroit			95	69	2							
Lismore and Derrinallum			44	16	55							
Mortlake			76	43	4							
Noorat and Glenormiston			27	40	57							
North Otway pipeline				12	1,360							
Purnim					15							
Simpson			12	55	14		30					
Terang			146	54	8		35					

Area/system	Start volume in store (ML)	Total Inflows (ML)	Outflows (ML)							Balancing item (ML)	End volume in store (ML)	Distribution efficiency (%)
			Deliveries				Losses		Total outflows			
			To urban residential	To urban other	To rural customers	To other [4]	Treatment plant losses	Reticulation system losses[1]				
Warrnambool			2,106	1,380	23		30					
Total[5]	**1,974**	**10,477**	**2,909**	**2,168**	**2,272**	**61**	**489**	**1,739**	**9,638**	**818**	**1,995**	**77%**
Dilwyn Aquifer												
Portland			735	711	1			480				
Heywood			93	29	3			39				
Dartmoor			12	2				3				
Port Fairy			258	325	0			44				
Port Campbell			25	31	-			9				
Peterborough			20	8	5			1				
Timboon			57	42	79			32				
Total	**30**	**3,052**	**1,199**	**1,147**	**88**		**-**	**606**	**3,040**	**12**	**30**	**80%**
Grampians (excl. Balmoral)												
Cavendish			8	2	1			3				
Hamilton[2]			700	228	53		110	198				
Dunkeld			50	16	11			3				
Tarrington			21	2	5			12				
Total[3]	**2,477**	**1,555**	**778**	**248**	**69**	**7**	**110**	**695**	**1,907**	**(142)**	**2,267**	**58%**
Balmoral	**-**	**46**	**14**	**9**	**14**	**-**	**3**	**9**	**48**	**(3)**	**-**	**76%**
Port Campbell limestone aquifer												
Tullich pipeline		464	0	0	2							
Casterton			113	51	8		35	21.8				
Coleraine			60	22	9			17.8				
Sandford			8	2	8			3.2				
Merino			17	5	16			4.8				
Total	**-**	**464**	**198**	**80**	**43**	**1**	**35**	**48**	**404**	**60**	**-**	**80%**
Newer Volcanic aquifer												
Caramut		26	8	3	6		0	9				
Penshurst		109	39	11	0		37	21				
Macarthur		34	14	4	1		0	-3				
Darlington		2	2	0	0		9	0				
Total	**-**	**172**	**63**	**18**	**8**	**-**	**47**	**27**	**163**	**8**	**-**	**55%**
Glenthompson	**110**	**39**	**8**	**6**	**18**	**-**	**2**	**6**	**39**	**29**	**81**	**81%**
Konongwootong[6]	**1,061**	**311**			**46**		**-**	**535**	**581**	**96**	**695**	**8%**

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) Total reticulation system losses for the Grampians system includes evaporation loss from storages.

(4) Deliveries to other represents metered hydrant usage.

(5) Total inflows to the Otway system include groundwater transferred from the Port Campbell and Newer Volcanic aquifers.

(6) The low efficiency in the Konongwootong system is due to a significant volume of evaporation included in the reticulation loss column. Without taking into consideration the effects of Konongwootong Reservoir the efficiency for the system is 45%.

7.5.2 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 covers 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 7-39 summarises GWMWater's combined distribution systems.

Table 7-39 Grampians Wimmera Mallee Water combined distribution systems

Area	System/towns supplied	Source of supply	Treatment plant location/ Comment
Wimmera Mallee Pipeline Supply System 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
Northern Mallee Pipeline	Supplies rural customers around Ouyen and urban customers in Chilingollah, 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 Chilingollah, Chinkapook, Nandaly, Patchewollock, Speed, Tempy and Waitchie

GWMWater also operates some 18 purely urban distribution systems, summarised in Table 7-40.

Table 7-40 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
Stawell system	Stawell, Great Western	Fyans Creek and Lake Fyans	Stawell and Great Western
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
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
Loddon Basin	Quambatook	Normanville D&S system	Chlorinated
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 7-41 shows GWMWater's combined distribution systems' water balances.

Table 7-41 Grampians Wimmera Mallee Water combined 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 other	To rural customers	From treatment plants	From distribution systems (1)				
Wimmera Mallee Pipeline Supply Systems 1 and 7	-	807	236	94	460	-	16	807	0	-	98%
Wimmera Mallee Pipeline Supply System 2	-	1,014	465	125	395	-	30	1,014	0	-	97%
Wimmera Mallee Pipeline Supply System 3	-	279	166	39	64	-	10	279	0	-	96%
Wimmera Mallee Pipeline Supply System 4	-	1,264	531	335	355	-	43	1,264	0	-	97%
Wimmera Mallee Pipeline Supply System 5(2)	-	1,831	169	58	1,164	-	11	1,402	429	-	99%
Wimmera Mallee Pipeline Supply System 6(2)	-	313	0	0	50	-	16	66	248	-	76%
Northern Mallee Pipeline	106	2,131	295	155	1,659	-	23	2,131	0	106	99%

Notes:

(1) Distribution system losses are used as a 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.

(2) The high unaccounted-for outflows in these systems are likely explained by metering issues and high evaporation in supply system 6.

Table 7-42 shows GWMWater's urban distribution systems' water balances.

Table 7-42 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 dist'n systems				
Surface water systems										
Ararat system	319	1,232	958	0	-	125	1,083	222	246	88%
Stawell system[2]	345	1,255	1,193	0	-	92	1,285	29	286	93%
Horsham system[3]	177	2,662	1,557	386	-	587	2,529	132	177	77%
East Grampians system (Willuara)	103	220	108	82	-	11	201	36	86	95%
Quambatook	-	73	29	15	-	4	48	25	-	92%
Elmhurst	31	35	13	3	-	2	17	23	25	90%
Buangor	22	0	9	1	-	1	11	2	10	95%
Groundwater systems										
Apsley	0	26	20	6	-		26	-	0	98%
Cowangie	0	14	6	2	-	6	14	-	0	56%
Goroke	0	54	31	7	-	15	54	-	0	72%
Edenhope	6	148	80	18	-	56	154	-	0	64%
Harrow	-	136	22	5	-	110	136	-	-	19%
Kaniva	0	191	122	62	-	7	191	-	0	96%
Kiata	0	5	2		-	3	5	-	0	48%
Lillimur	0	8	7	0	-	2	8	-	0	82%
Miram	0	2	2	0	-		2	-	0	87%
Murrayville	0	113	64	36	-	13	113	-	0	89%
Nhill	1	386	261	100	-	25	386	-	1	94%
Serviceton	0	9	6	1	-	2	9	-	0	76%
Streatham & Westmere	9	5	6	5	-	(4)	7	-	7	N/A

Notes:

(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.

(2) Inflows are the balancing item in the Stawell system.

(3) For the Horsham system, the distribution system efficiency includes an allowance for evaporation loss from storages.

Appendix A: Storage levels

Basin	Reservoir	On stream or off-stream?	Storage capacity (ML)	% full at 1 July 2011	% full at 30 June 2012
Murray	Lake Victoria (Victoria's share only)	on-stream	338,500	71%	71%
	Menindee Lakes (Victoria's share only)[(1)]	on-stream	785,000	94%	92%
	Lake Hume (Victoria's share only)	on-stream	1,502,579	92%	95%
	Lake Dartmouth (Victoria's share only)	on-stream	1,928,116	68%	88%
	Lake Cullulleraine	on-stream	5,270	83%	83%
Kiewa	Rocky Valley	on-stream	28,294	64%	71%
	Lake Guy	on-stream	1,416	65%	18%
	Clover Pondage	off-stream	255	85%	53%
	Pretty Valley Basin	off-stream	500	100%	100%
Ovens	Lake William Hovell	on-stream	13,710	101%	101%
	Lake Buffalo	on-stream	23,900	58%	61%
Broken	Lake Nillahcootie	on-stream	40,400	101%	101%
	Loombah-McCall Say	on-stream	1,747	100%	83%
Goulburn	Lake Eildon	on-stream	3,334,158	87%	90%
	Goulburn Weir	on-stream	25,500	98%	99%
	Sunday Creek Reservoir	on-stream	1,700	97%	97%
	Greens' Lake	off-stream	32,440	70%	53%
	Waranga Basin	off-stream	432,362	81%	85%
Campaspe	Upper Coliban Reservoir	on-stream	37,770	100%	100%
	Lauriston Reservoir	on-stream	19,790	100%	77%
	Malmsbury Reservoir	on-stream	12,034	84%	46%
	Lake Eppalock	on-stream	304,651	97%	89%
	Campaspe Weir	off-stream	2,624	102%	101%
Loddon	Newlyn Reservoir	on-stream	3,012	101%	84%
	Tullaroop Reservoir	on-stream	72,950	96%	85%
	Cairn Curran Reservoir	on-stream	147,130	89%	89%
	Laanecoorie Reservoir	on-stream	7,940	77%	37%
	Hepburn Lagoon	on-stream	2,457	97%	70%
	Evansford Reservoir	off-stream	1,346	99%	93%
	Sandhurst Reservoir	off-stream	2,590	82%	51%
	Spring Gully Reservoir	off-stream	1,680	59%	13%
East Gippsland	None	-	-	-	-
Snowy	None	-	-	-	-
Tambo	None	-	-	-	-
Mitchell	None	-	-	-	-
Thomson	Lake Glenmaggie	on-stream	177,640	82%	89%
	Thomson Reservoir	on-stream	1,068,000	41%	64%
Latrobe	Blue Rock	on-stream	208,188	99%	101%
	Lake Narracan	on-stream	7,230	76%	41%
	Moondarra Reservoir	on-stream	30,300	100%	100%
South Gippsland	Lance Creek Reservoir	on-stream	4,200	102%	100%
	Hyland Reservoir	on-stream	671	100%	100%
	Western Reservoir	on-stream	1,137	100%	100%
	Candowie Reservoir	on-stream	2,263	100%	100%
Bunyip	Tarago Reservoir	on-stream	37,580	64%	60%
Yarra	Upper Yarra Reservoir	on-stream	200,579	69%	72%
	O'Shannassy Reservoir	on-stream	3,123	104%	103%
	Maroondah Reservoir	on-stream	22,179	101%	101%

Basin	Reservoir	On stream or off-stream?	Storage capacity (ML)	% full at 1 July 2011	% full at 30 June 2012
	Yan Yean Reservoir	on-stream	30,266	90%	91%
	Cardinia Reservoir	off-stream	286,911	71%	76%
	Greenvale Reservoir	off-stream	26,839	77%	78%
	Silvan Reservoir	off-stream	40,445	85%	90%
	Sugarloaf Reservoir	off-stream	96,253	99%	98%
Maribyrnong	Rosslynne Reservoir	on-stream	25,368	66%	72%
Werribee	Melton Reservoir	on-stream	14,364	95%	97%
	Merrimu Reservoir	on-stream	32,516	85%	77%
	Pykes Creek Reservoir	on-stream	22,119	100%	97%
	Djerriwarrh Reservoir	on-stream	983	94%	98%
Moorabool	Korweinguboora Reservoir	on-stream	2,091	73%	100%
	Bostock Reservoir	on-stream	7,455	99%	100%
	Lal Lal Reservoir	on-stream	59,549	92%	91%
	Wilsons Reservoir	on-stream	1,010	37%	42%
	Moorabool Reservoir	on-stream	6,192	91%	95%
	Upper Stony Creek Reservoir	off-stream	9,494	83%	58%
Barwon	West Barwon Dam	on-stream	21,504	57%	100%
	White Swan Reservoir	on-stream	14,107	95%	73%
	Gong Gong Reservoir	on-stream	1,902	2%	44%
	Wurdee Boluc Reservoir	off-stream	40,431	69%	72%
Corangamite	None	-	-	-	-
Otway Coast	West Gellibrand Reservoir	on-stream	1,856	100%	100%
Hopkins	None	-	-	-	-
Portland Coast	None	-	-	-	-
Glenelg	Rocklands Reservoir	on-stream	348,500	38%	31%
	Moora Moora Reservoir	on-stream	6,300	88%	49%
	Konongwootong Reservoir	on-stream	1,920	54%	36%
	Hamilton System Reservoirs	on-stream	2,716	88%	80%
Millicent Coast	None	-	-	-	-
Wimmera	Taylors Lake	on-stream	33,700	82%	40%
	Lake Lonsdale	on-stream	65,480	74%	43%
	Wartook Reservoir	on-stream	29,360	74%	70%
	Lake Bellfield	on-stream	78,560	78%	85%
	Fyans Lake	on-stream	18,460	72%	68%
	Batyo Lake	on-stream	2,250	82%	21%
	Dock Lake	on-stream	4,420	0%	0%
	Green Lake	on-stream	5,350	83%	67%
	Pine Lake	on-stream	62,000	17%	13%
	Toolondo Reservoir	on-stream	92,430	0%	26%
Mallee	None	-	-	-	-
Avoca	None	-	-	-	-

Appendix B: Groundwater entitlement and use

GMU	PCV	Allocation limit at 30/06/12 (ML)	Licensed volumes (as at 30/06/12)					Domestic and stock		Total use (licensed + domestic and stock)
			Licensed entitlements (ML)	No. of licences	No. of metered bores	Metered volume (ML)	Estimated non-metered use (ML)[1]	No. of domestic and stock bores[2]	Estimated use (ML)[3]	
Goulburn–Murray Water										
WSPA (approved plan)										
Shepparton WSPA	-	204,859	204,859	1,185	849	25,119	0	1,873	3,746	28,865
Katunga WSPA	59,780	42,405	60,579	251	143	18,809	0	763	1,526	20,335
Upper Ovens WSPA	4,010	4,010	3,643	108	70	277	0	315	630	907
WSPA (draft plan)										
Loddon Highlands WSPA	20,521	20,521	20,194	187	211	4,098	0	825	1,650	5,748
Lower Campaspe Valley WSPA	56,381	44,453	56,074	147	131	17,404	0	493	986	18,390
GMA										
Alexandra GMA	1,937	1,937	1,714	10	9	127	0	18	36	163
Barnawartha GMA	2,100	2,100	645	6	2	0	0	29	58	58
Kinglake GMA	2,015	2,015	1,851	61	36	150	0	255	510	660
Lower Ovens GMA	25,200	25,200	20,156	278	168	2,681	0	2,011	4,022	6,703
Mid-Goulburn GMA	14,900	14,900	12,506	66	50	2,180	0	181	362	2,542
Mid-Loddon GMA	37,200	37,200	34,036	103	102	11,128	0	382	764	11,892
Mullindolingong GMA[7]	6,980	6,980	1,730	44	15	15		56	112	127
Unincorporated areas										
Goulburn–Murray unincorporated areas	-	-	32,899	647	621	0	13,160	5,188	10,376	23,536
GWMWater										
WSPA (approved plan)										
Murrayville WSPA	10,883	10,883	9,634	32	46	4,891	0	207	414	5,305
West Wimmera GMA[4]	-	53,327	53,327	173	230	15,601	0	658	1,316	16,917
Unincorporated areas										
GWMWater unincorporated areas	-	-	28,995	46	756	0	3,900	379	758	4,658
Southern Rural Water										
WSPA (approved plan)										
Koo-Wee-Rup WSPA	12,915	12,915	12,336	383	251	1,924	0	1,251	1,877	3,801
Nullawarre WSPA	21,280	21,280	22,741	234	165	10,630	0	940	1,410	12,040
Warrion WSPA	13,836	13,836	14,086	142	131	3,497	0	352	528	4,025
Yangery WSPA	14,103	14,103	14,351	157	179	3,006	0	871	1,307	4,313
Yarram WSPA	25,317	25,317	25,695	92	83	6,740	0	320	480	7,220
WSPA (draft plan)										
Bungaree WSPA	5,321	5,321	5,318	104	143	1,973	0	249	374	2,346
Condah WSPA	7,437	7,437	7,535	41	41	2,358	0	442	663	3,021
Denison WSPA	17,743	17,743	18,501	127	101	2,571	421	232	348	3,340
Deutgam WSPA	5,100	5,100	5,082	148	193	979	0	196	294	1,273
Glenelg WSPA	32,660	32,660	32,659	84	98	7,004	0	1,180	1,770	8,774
Sale WSPA	21,212	21,212	21,238	113	114	6,324	0	750	1,125	7,449
Wandin Yallock WSPA	2,924	2,924	2,933	188	208	285	0	84	126	411
Wy Yung WSPA[7]	7,463	7,463	7,462	60	70	347	0	39	59	406

GMU	PCV	Allocation limit at 30/06/12 (ML)	Licensed volumes (as at 30/06/12)					Domestic and stock		Total use (licensed + domestic and stock)
			Licensed entitlements (ML)	No. of licences	No. of metered bores	Metered volume (ML)	Estimated non-metered use (ML)[1]	No. of domestic and stock bores[2]	Estimated use (ML)[3]	
GMA										
Colongulac GMA	4,695	4,695	4,187	69	22	1,060	0	129	194	1,254
Cardigan GMA	3,967	3,967	3,887	25	23	294	0	98	147	441
Corinella GMA	2,550	2,550	662	14	9	20	0	86	129	149
Cut Paw Paw GMA	3,650	3,650	515	5	4	84	0	39	59	143
Frankston GMA	3,200	3,200	1,685	30	26	119	0	134	201	320
Gellibrand GMA	-	0	0	0	0	0	0	2	3	3
Gerangamete GMA[5]	20,000	20,000	20,000	1	6	0	0	11	17	17
Giffard GMA	5,670	5,670	5,689	17	17	845	0	92	138	983
Glenormiston GMA	2,565	2,565	2,691	41	14	1,261	0	84	126	1,387
Hawkesdale GMA	16,161	16,161	12,455	118	65	5,630	0	1,171	1,757	7,387
Heywood GMA	8,500	8,500	6,920	90	54	1,749	0	1,251	1,877	3,626
Jan Juc GMA[6]	11,250	11,250	11,250	3	7	7,806	0	4	6	7,812
Lancefield GMA	1,485	1,485	1,378	14	20	106	0	72	108	214
Leongatha GMA	6,500	6,500	1,841	34	14	72	0	89	134	206
Merrimu GMA	451	451	440	14	19	145	0	17	26	171
Moe GMA	8,200	8,200	3,993	97	29	330	0	183	275	605
Moorabbin GMA	2,700	2,700	2,617	58	68	873	0	379	569	1,442
Nepean GMA	6,013	6,013	6,110	73	77	3,152	0	2,249	2,249	5,401
Newlingrook GMA	1,977	1,977	1,958	6	5	24	0	4	6	30
Orbost GMA	1,201	1,201	1,217	4	4	0	0	22	33	33
Paaratte GMA	4,606	4,606	3,212	6	1	322	0	293	440	762
Portland GMA	7,795	7,795	7,794	8	7	2,639	0	3	5	2,644
Rosedale GMA	22,313	22,313	22,372	64	51	7,739	0	286	429	8,168
Stratford GMA	27,645	27,645	27,645	8	7	26,042	0	2	3	26,045
Tarwin GMA	1,300	1,300	38	3	1	15	0	693	1,040	1,055
Wa De Lock GMA[7]	30,172	30,172	29,141	253	139	3,240	527	446	669	4,436
Unincorporated areas										
Sourthern Rural Water unincorporated areas	-	-	71,363	1,547	740		25,332	7,359	11,039	36,371
Total	**633,784**	**862,667**	**983,839**	**7,819**	**6,645**	**213,685**	**43,340**	**35,737**	**59,298**	**316,322**

Notes:

(1) In non-metered areas, the water authorities' estimates have been adopted. Use in unincorporated areas has been estimated based on 35% of entitlement for Southern Rural Water, 40% of entitlement for Goulburn–Murray Water and 13% for GWMWater.

(2) The number of domestic and stock bores includes all bores from the groundwater management system that are less than 30 years old. It has been cross-checked with the Victorian Water Register to ensure bores are not double counted. 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.

(3) 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.

(4) West Wimmera GMA replaced Neuarpur WSPA, Apsley WSPA, Kaniva WSPA, Telopea Downs WSPA, Balrootan (Nhill) GMA, Goroke GMA, Little Desert GMA and Nhill GMA. The PCV for West Wimmera GMA has not yet been declared.

(5) Barwon Water's groundwater licence 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.

(6) The Jan Juc bulk entitlement 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 includes 4,250 ML and the 5-year bulk entitlement of 35,000 ML. 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 in any five-year period.

(7) Mullindolingong GMA, Wy Yung WSPA and Wa De Lock GMA PCVs consist of the sum of the PCV for all zones within the GMU.

Appendix C: Evapotranspiration estimates

This section summarises modelled state-wide estimates of evapotranspiration using the methodology discussed in Appendix A.

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.

Figure D-3 and Figure D-4 divide Victoria's river basins into four geographical areas. 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).

In 2011–12, average evapotranspiration across Victoria as a whole was estimated to be 547 mm, which is very close to the long-term average from 1961 to 1990. However, the estimates by basin showed some variation.

In eastern Victoria, evapotranspiration was generally slightly above average, whereas in western Victoria it was slightly below average (Figure D-3). The differences between the eastern and western basins reflect the rainfall over the year, where eastern basins generally received above-average rainfall and western basins below-average rainfall.

In northern and western Victoria, evapotranspiration was considerably lower in 2011–12 than in 2010–11 due to the lower rainfall for 2011–12, and partly because the heavy summer rainfall of 2010–11 was not repeated.

In Figure D-3, evapotranspiration is expressed as millimetres per unit area to allow easy comparison between catchments of different sizes, and also to enable comparisons with rainfall. Considering evapotranspiration as a proportion of rainfall can highlight differences between years in the relationship between rainfall and water resources across the landscape. As a proportion of rainfall, evapotranspiration in 2011–12 generally reflected the long-term average, with the Corangamite basin showing the highest ratio for both 2011–12 and the long-term average, at 98% and 82% respectively.

Figure D-3 Modelled evapotranspiration per unit area (mm) in 2011–12

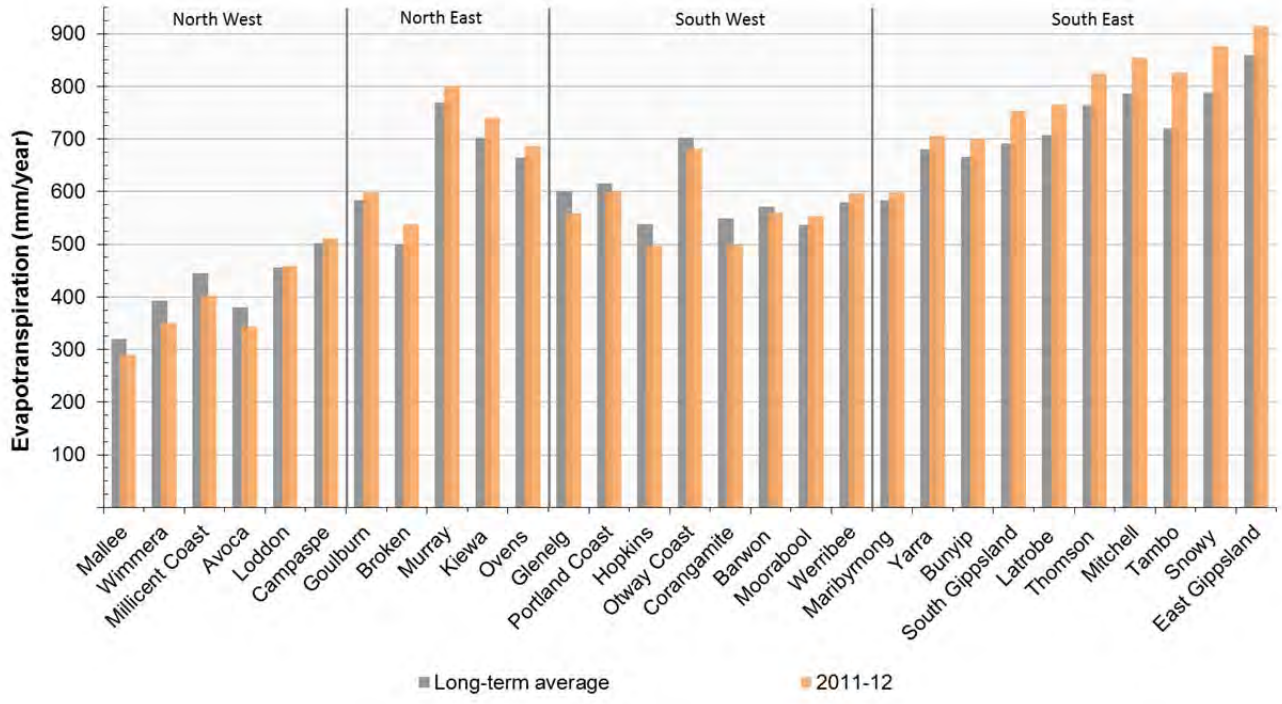
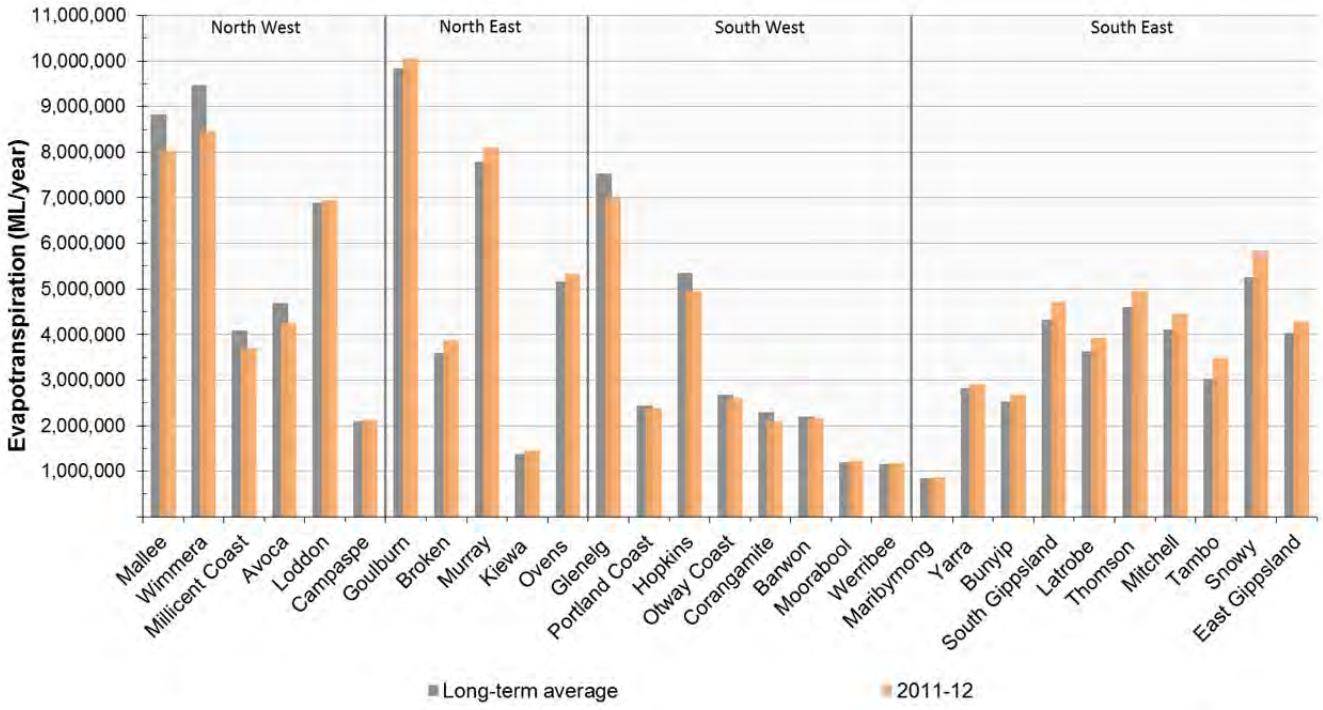


Figure D-4 Modelled evapotranspiration per basin (ML) in 2011–12



North-east Victoria (Goulburn to Upper Murray basins)

Higher than average rainfall over eastern Victoria in 2011–12 resulted in estimates of evapotranspiration that were slightly above average for the north-eastern basins.The estimated evapotranspiration ranged from 538 mm in the Broken Basin to 800 mm in the Upper Murray Basin, and comparisons with the long-term average ranged from 2% above average in the Goulburn basin to 8% above average in the Broken basin.

In 2011–12, evapotranspiration as a proportion of rainfall in the north-eastern basins ranged from average to 6% below average. The Broken basin was estimated to have the highest evapotranspiration as a proportion of the year's rainfall (74%, compared to the long-term average of 80%), and the lowest was in the Kiewa Basin (53% compared to the long-term average of 57%).

As evapotranspiration in the north-east was a slightly lower than average as a proportion of rainfall, slightly more rainfall remained for streamflow and groundwater recharge. The Kiewa basin was estimated as having the highest proportion of the year's rainfall remaining as streamflow or groundwater recharge (47%, compared to the long-term average of 43%) and the Broken Basin had the least (26%, compared to the long-term average of 20%).

South-east Victoria (East Gippsland to Yarra basins)

Higher than average rainfall over eastern Victoria resulted in estimates of evapotranspiration that were generally slightly above average for the south-eastern basins. In 2011–12, the estimated evapotranspiration ranged from 701 mm in the Bunyip Basin to 941 mm in the East Gippsland basin, and comparisons with the long-term average ranged from 4% above average in the Yarra Basin to 15% above average in the Tambo Basin.

In 2011–12, evapotranspiration as a proportion of rainfall was between 4% and 16% above the average for the south-eastern basins. The East Gippsland basin was estimated as having the highest evapotranspiration as a proportion of rainfall (70% compared to the average of 77%), and the lowest was in the Yarra Basin (61%, compared to the average of 66%).

South-west Victoria (Maribyrnong to Glenelg basins)

Lower than average rainfall over western Victoria resulted in estimates of evapotranspiration that were generally slightly below average for the south-western basins. In 2011–12, the estimated evapotranspiration ranged from 497 mm in the Hopkins Basin to 680 mm in the Otway Coast basin, and comparisons with the long-term average ranged from 9% below average in the Corangamite basin to 3% above average in the Moorabool basin.

Corangamite basin had the highest evapotranspiration as a proportion of rainfall in 2011–12, (98% compared to the long-term average of 82%) and the Otway Coast basin the lowest (72% compared with the long-term average of 69%).

North-west Victoria (Mallee to Campaspe River basins)

Lower than average rainfall over western Victoria resulted in estimates of evapotranspiration that were generally slightly below average for the north-western basins. In 2011–12, the estimated evapotranspiration ranged from

291 mm in the Mallee Basin to 512 mm in the Campaspe Basin, and comparisons with the long-term average ranged from 10% below average in the Millicent Coast and Avoca basins to 2% above average in the Campaspe basin.

In 2011–12, evapotranspiration as a proportion of rainfall ranged from average to 6% above average for the north-western basins. The Mallee basin was estimated as having the highest evapotranspiration as a proportion of rainfall (103%, comared to the average of 102%) and the lowest was in the Campaspe basin (76%, compared to the average of 77%).

Abbreviations

AWRC	Australian Water Resources Council
CMA	Catchment management authority
DEPI	Department of Environment and Primary Industries
ESC	Essential Services Commission
GL	Gigalitre
GMA	Groundwater management area
GMU	Groundwater management unit
MDBA	Murray-Darling Basin Authority
ML	Megalitre
PCV	Permissible consumptive volume
REALM	Resource allocation model
TCSA	Tertiary confined sand aquifer
UA	Unincorporated area
VEWH	Victorian Environmental Water Holder
WSPA	Water supply protection area

Glossary of terms

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.

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 River Murray 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 run-off from rainfall goes into one river system.

Catchment management authorities (CMAs): Statutory bodies established under the *Catchment and Land Protection Act 1994*. CMAs have responsibilities under both the Catchment and Land Protection Act and the *Water Act 1989* for river health; regional and catchment planning and coordination; and waterway, floodplain, salinity and water quality management.

Declared systems: A water system that has been declared in accordance with section 6A of the Water Act 1989. Water rights and take and use licences in declared water systems have been converted into unbundled entitlements.

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 vapor.

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 River Murray, 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.

Spill: An uncontrolled flow of water past a reservoir or a weir.

Stream: A body of water flowing in bed, river or brook.

Streamflow 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.