# Victorian Water Accounts 2010–2011

**A statement of Victorian water resources**

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# Foreword

The end of Victoria's 13 years of drought and the extremes of weather variability are dramatically highlighted in the *Victorian Water Accounts 2010–2011*.

When the year began, Victoria's water storages were at 36% capacity, holding 3,723,448 ML. At the end of the year, our storages were at 84% capacity and holding 8,800,363 ML.

It was an unforgettable and historic year to see such a turnaround.

But it came at a cost. The deluges that hit the state from September to February produced some significant floods as well as the wettest ever summer.

This dampened the good news in what was an otherwise long-awaited year.

And although rainfall totals for the year were significantly above average in most areas, leading to greater stream flows across Victoria, there were variations in the basins.

Areas to the north of the Great Dividing Range received between 150% and 300% of the long-term average rainfall. In the south, rainfall totals were generally between 100% and 150% of the long-term average; lower totals of between 80% and 100% were recorded across isolated parts of Gippsland.

The increased water availability in so many regions produced many positives for farmers, cities and towns:

- highest levels of season allocations of water in irrigation districts across the State for many years
- significant reduction in the number of towns on water restrictions as well as the severity of restrictions
- reduction in restrictions on diversions from unregulated streams
- increased seasonal allocations of groundwater in several water supply areas
- revocation of qualifications to surface water rights by the end of June 2011.

This dramatic reversal of Victoria's water position makes these accounts a very interesting report.

Moreover, for the first time the accounts contain a new part on distribution systems. In line with national directions in water accounting, water is tracked from where it is extracted from a waterway or aquifer, to where it is delivered to a customer.

Measures of efficiency are given for each distribution system, with notes explaining special factors at work. Over time these will provide an invaluable pointer to where gains might be made, ensuring Victoria makes the most of its precious resources.

**PETER WALSH MLA**
Minister for Water

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# Introduction

## Overview of the *Victorian Water Accounts 2010–2011*

The *Victorian Water Accounts 2010–2011* document the key water resource management issues for Victoria. This report is the eighth in a series that provide 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, environmental releases and initiatives. The *Victorian Water Accounts 2010–2011* are an important contribution towards meeting Victoria's obligations.

The *Victorian Water Accounts 2010–2011* examine the entire state's water allocation and use for the 2010–2011 year at bulk supply level. They consolidate information from all Victorian water businesses,[1] catchment management authorities, the Department of Sustainability and Environment (DSE), the Essential Services Commission (ESC), the Murray-Darling Basin Authority (MDBA), the Victorian Alpine Resorts Commission, power generators and other major users of water. For the first time, information on water in Victoria's water distribution systems is being reported in the Victorian Water Accounts.

The *Victorian Water Accounts 2010–2011* consist of three 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 the government's management of water for the environment.

Part 2 contains the water accounts for each of Victoria's 29 river basins. The accounts include quantitative data on available water and water use as well as concise commentary to give context to the data. The introductory chapter of Part 2 describes the approach taken to compile the basin accounts, as well as key assumptions and any identified limitations of the data.

Part 3 comprises 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 four regions for which Victoria's Sustainable Water Strategies have been developed.

## A change in conditions

In contrast to 2009–2010 (when the drought's grip on the state loosened a little, with slightly higher-than-average statewide rainfall), Victoria experienced rainfall totals significantly above average across most areas in 2010–2011.

The very wet conditions experienced across Victoria during late spring and summer were primarily due to a strong La Niña event in the Pacific Ocean, coupled with warm sea-surface temperatures off the north-west coast of Australia.

From September 2010 to February 2011, Victoria experienced some of the worst floods in its history. Approximately one-third of Victoria experienced some form of flooding or storm damage, with the floods of January 2011 the largest on record for many areas in northern, western and central Victoria.

Above-average rainfall in 2010–2011 meant that streamflows across Victoria were greater than the relatively low volumes observed in 2009–2010. Streamflows were above long-term averages in nearly all basins as a result of the very high rainfall during the period.

## 2010–2011, the year in water

Rainfall was significantly higher-than-average across most of Victoria in 2010–2011. Areas to the north of the Great Dividing Range received between 150% and 300% of the long-term average. Rainfall totals were generally between 100% and 150% of the long-term average in the south, with lower totals of between 80% and 100% recorded across isolated parts of Gippsland.

It was particularly wet during late spring and summer, with the Bureau of Meteorology reporting that the summer of 2010–2011 was the wettest in Victoria since records began.

Significantly above-average rainfall in 2010–2011 ensured streamflows across Victoria were greater than both the relatively low flows observed in 2009–2010 and the low volumes observed during the drought years of 1997 to 2009. The total streamflow volume for Victoria was 175% of the long-term average.

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[1] Water businesses are water corporations established under the *Water Act 1989* and the metropolitan retailers established under the *Corporations Act 2001* that hold water and sewerage licences issued under the *Water Industry Act 1994*.

The wettest river basins, compared to their long-term averages, were the Murray, Wimmera, Moorabool, Werribee, Loddon, Campaspe, Broken, Maribyrnong and Bunyip basins. All these basins experienced streamflows greater than 200% of their long-term averages. The Tambo, Barwon and Thomson basins were the only basins to record inflows less than their long-term averages.

The total volume of water stored in Victoria's major regional reservoirs started the year at 3,723,448 ML (36% of capacity) and ended at 8,800,363 ML (84% of capacity). Levels increased significantly over spring, and continued to rise over summer and autumn as above-average rainfall produced high inflows and suppressed demand for water for irrigation and urban use.

Compared to groundwater level trends in 2009–2010, a larger number of groundwater management units (GMUs) showed an increasing water level trend. This can be attributed to the decrease in demand for groundwater, and increased levels in some unconfined aquifers may be a recharge response to the wetter-than-average conditions in 2010–2011.

## Improved water resource position in Victoria

Victoria's improved water position in 2010–2011 benefited both consumptive and environmental users of water.

From a consumptive use perspective, increased water availability enabled:

- the highest levels of seasonal allocations of water in irrigation districts across the state for many years
- reduced restrictions on diversions from unregulated streams
- increased seasonal allocations of groundwater in several water supply protection areas (WSPAs)
- a significant reduction in the number of towns on water restrictions, and in the severity of restrictions
- the revocation of qualifications to surface water rights by the end of June 2011.

The volume of water taken under bulk entitlements in 2010–2011 was only 37% of the total entitlement volume. It is likely that higher rainfall suppressed demand for water.

Significantly for environmental water, as increased rainfall and runoff increased the volumes in water storages and Victoria's water resource position improved, the temporary qualifications that had been in place in recent years that had reduced EWR were progressively lifted. In July 2010, environmental flows of 22,000 ML were restored to the Yarra and Thomson rivers.

The combination of above-average rainfall and streamflows above the long-term average in most basins shifted the focus of environmental water management from protecting drought refuges to building on and maximising the benefits of the wetter conditions and higher flows.

## Conclusion

Sustainable management of our water resources requires adequate monitoring, accounting and reporting. The *Victorian Water Accounts 2010–2011* provide public accountability for water availability, entitlements and use across Victoria. Importantly, Victoria's efforts in monitoring, reporting and accounting continue to improve.

This report is also available at www.water.vic.gov.au/monitoring/accounts.

# Part 1: Overview of Victorian water resources 2010–11

Part 1 of the *Victorian Water Accounts 2010–2011* provides a statewide overview of Victoria's water resources during the year. It reports on the:

- quantity of water available in terms of rainfall, streamflow, reservoirs and aquifers
- quantity of water allocated for consumption from reservoirs, streams and aquifers under entitlements issued by government, as well as quantities used and recycled
- water available to the environment.

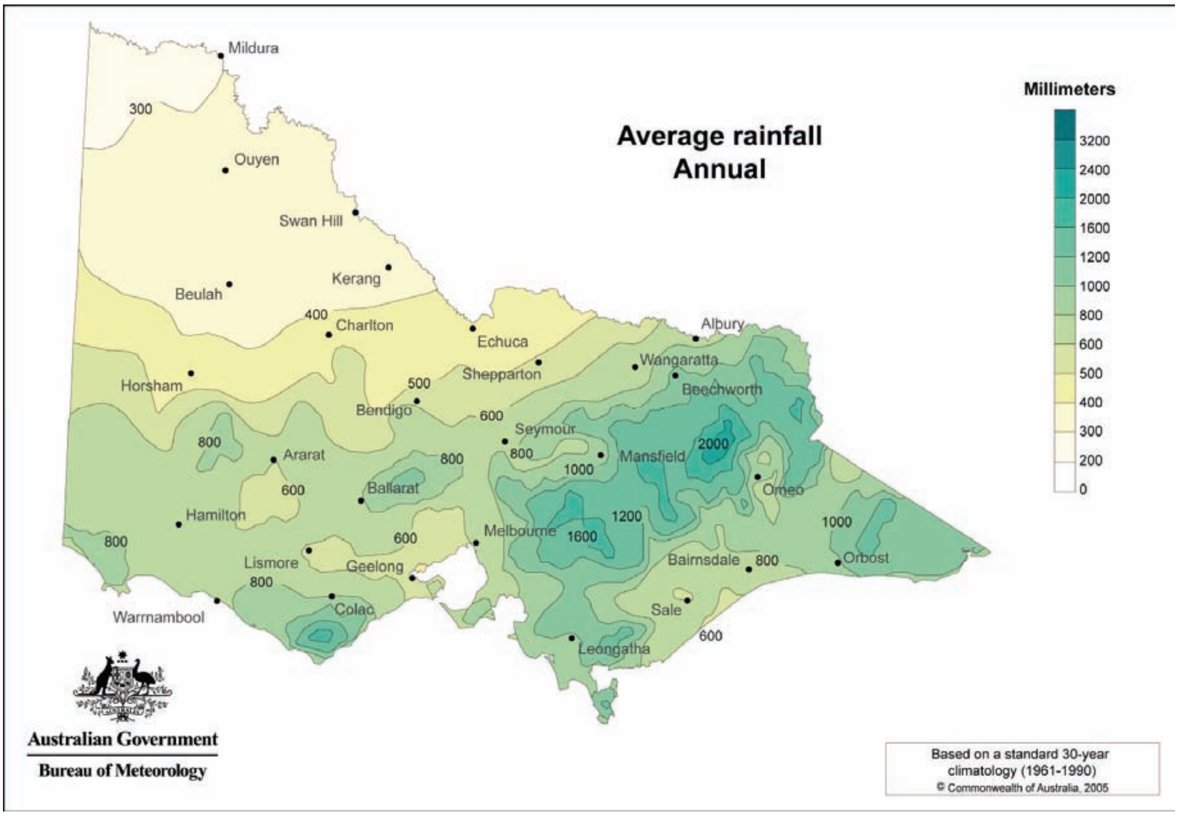
# 1 Water availability

This chapter presents a description and analysis of surface water and groundwater in Victoria in 2010–11. It examines how much surface water was available in Victoria during the year compared to previous years and reports rainfall, streamflow and reservoir levels. It also presents a high-level synopsis of Victoria's groundwater resources in 2010–11, including groundwater levels, entitlement volumes and extractions.

## 1.1 Rainfall

Victoria's rainfall in an average year is shown in Figure 1-1. The average rainfall 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.

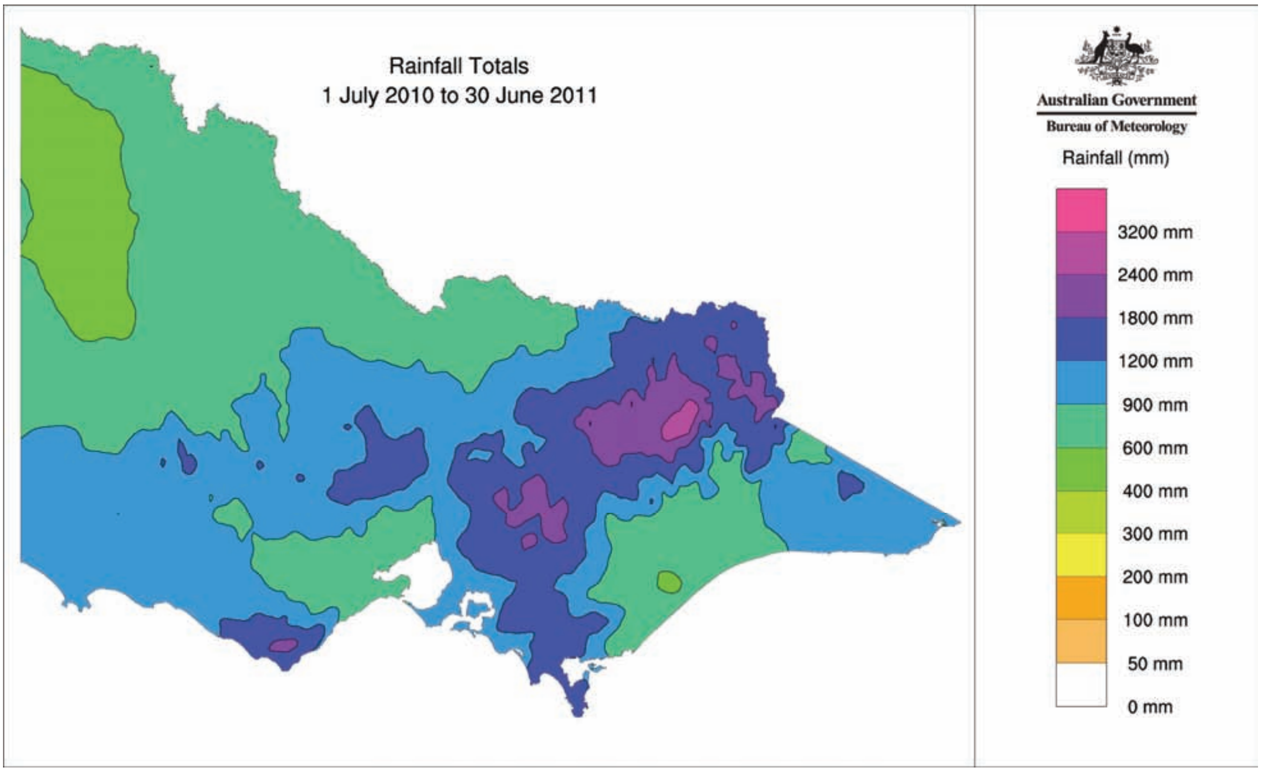
**Figure 1-1 Victorian average annual rainfall, 1961-1990**



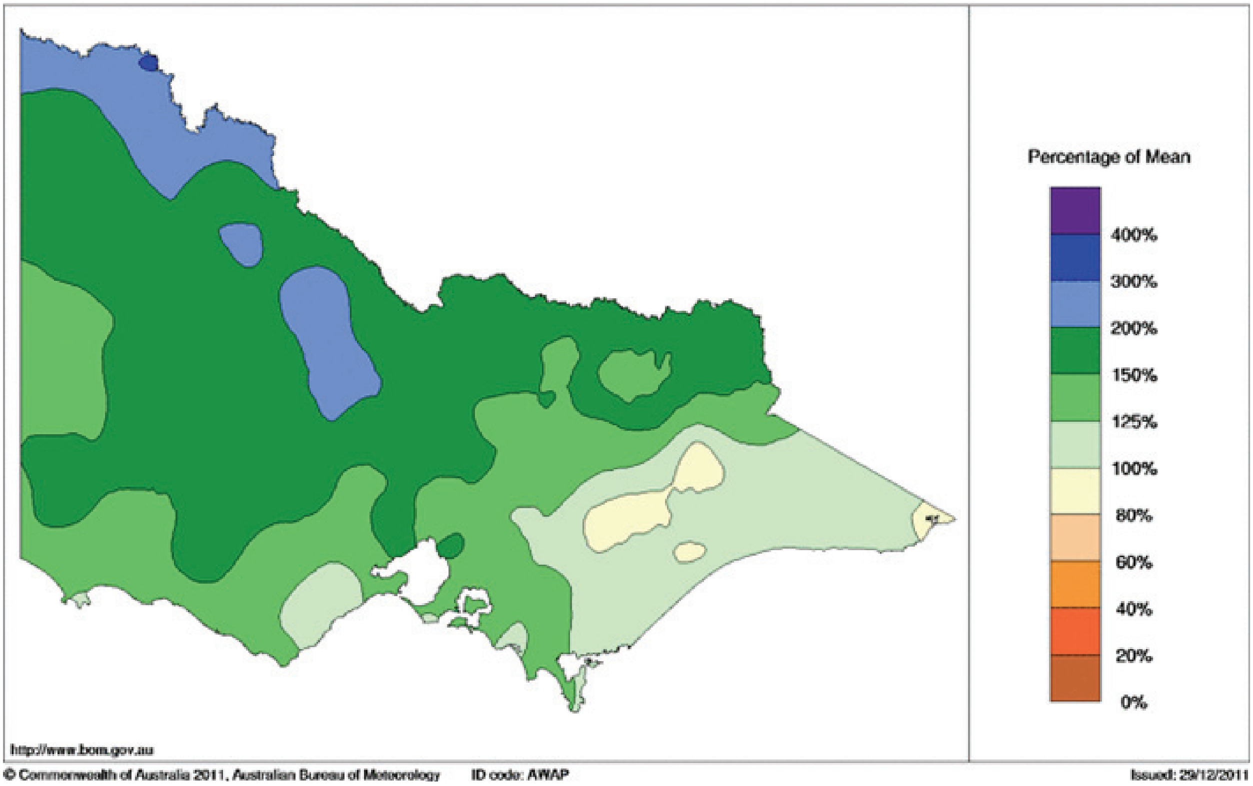

Victoria's rainfall in 2010–11 is shown in Figure 1-2, while Figure 1-3 compares rainfall in 2010–11 to the long-term average.

Rainfall was significantly higher than average across most of Victoria in 2010–11. Areas to the north of the Great Dividing Range received between 150% and 300% of the long-term average. Rainfall totals were generally between 100% and 150% of the long-term average in the south, with lower totals of between 80% and 100% recorded across isolated parts of Gippsland.

### Figure 1-2 Victorian rainfall, 2010–11



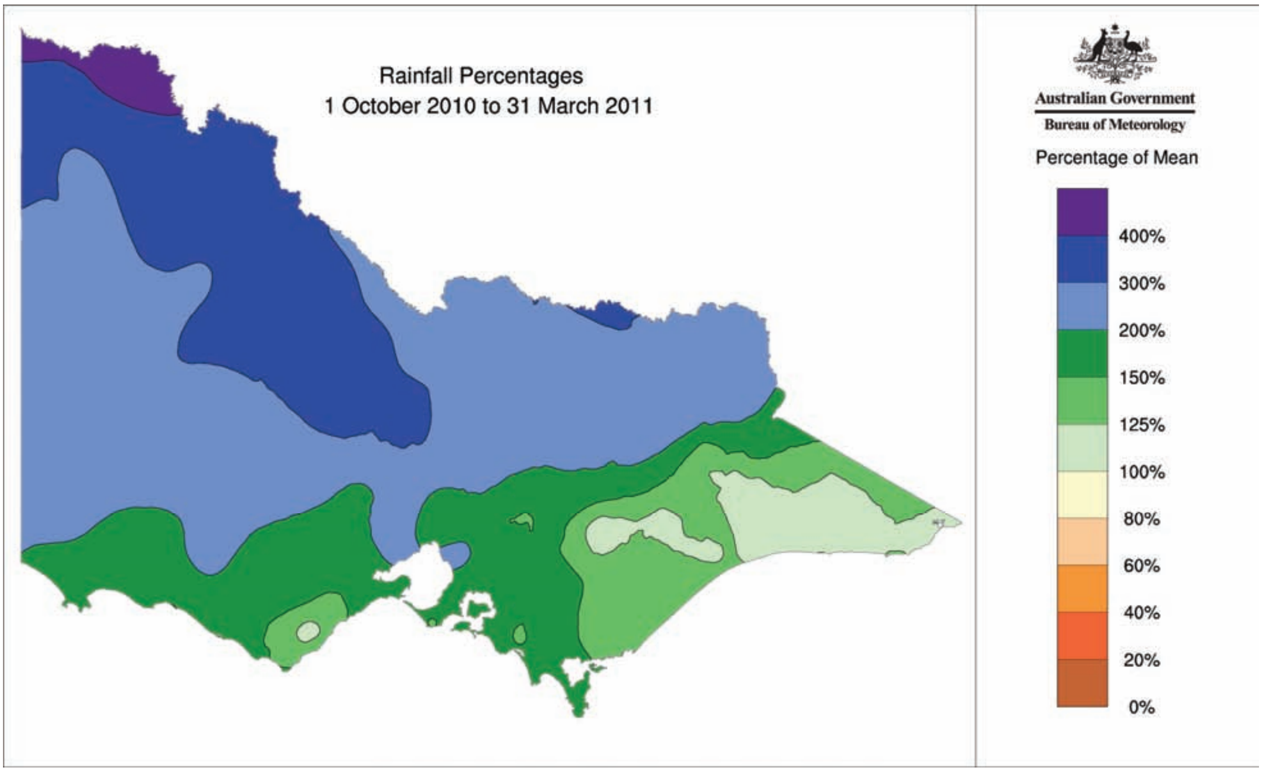

### Figure 1-3 Victorian rainfall, 2010–11, relative to long-term average rainfall




As Figure 1-4 shows, it was very wet across Victoria during late spring and summer in 2010–11, with parts of the state receiving more than three times the long-term average rainfall for this period. From September 2010 to February 2011, Victoria experienced some of the worst floods in the state's history. Victoria recorded its wettest January on record, and the floods in January 2011 were the largest on record for many areas in northern, western and central Victoria. The widespread, above-average rainfall initially triggered flash flooding across western and central Victoria and subsequently floods in northern, western and central Victoria. The Bureau of Meteorology has reported that the summer of 2010-11 was the wettest in Victoria since records began.

In contrast, autumn and early winter again saw below-average rainfall across the north of the state, as illustrated in Figure 1-5.

### Figure 1-4 Victorian rainfall, 1 October 2010 to 31 March 2011




### Figure 1-5 Victorian rainfall, 1 April to 30 June 2011

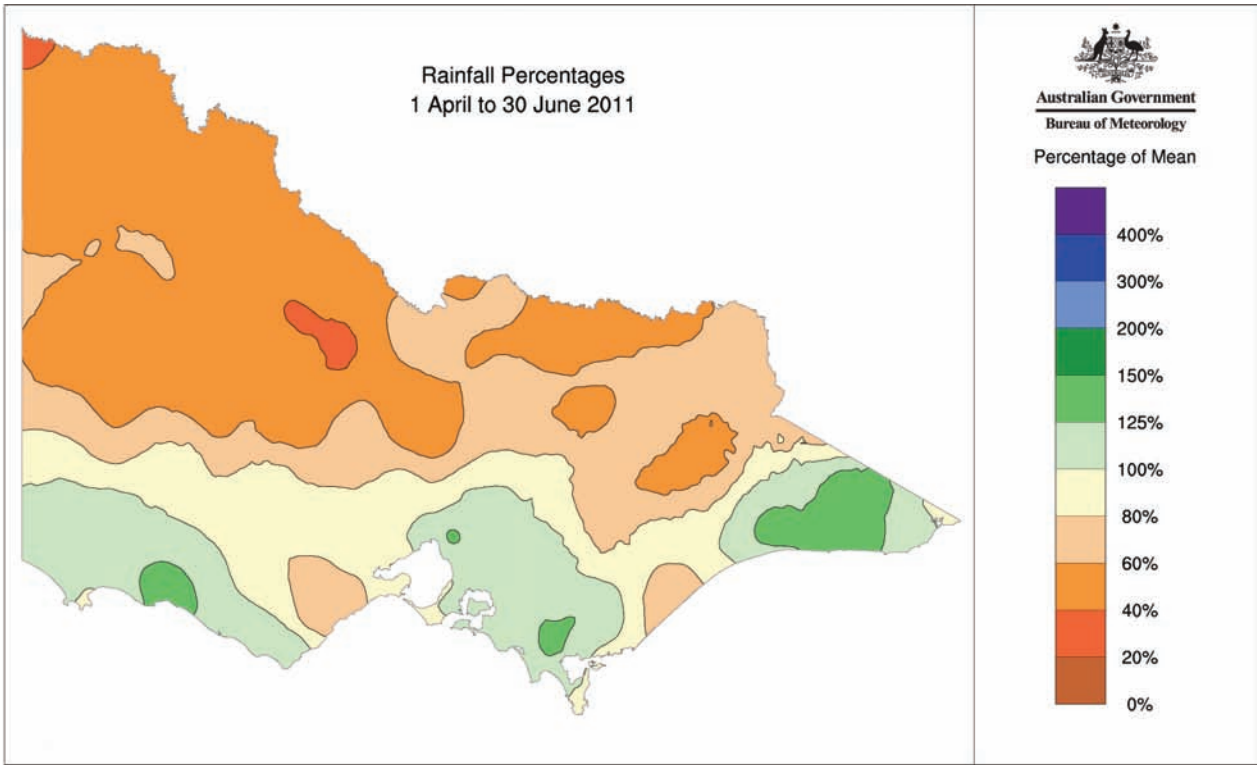



Figure 1-6 provides a national context, showing that the pattern of rainfall experienced across Victoria in 2010–11 is consistent with the rainfall patterns experienced across Australia. Large areas of Australia received rainfall significantly above the long-term average in 2010–11. However, rainfall deficiencies were again observed in the south-west region of Western Australia**.**

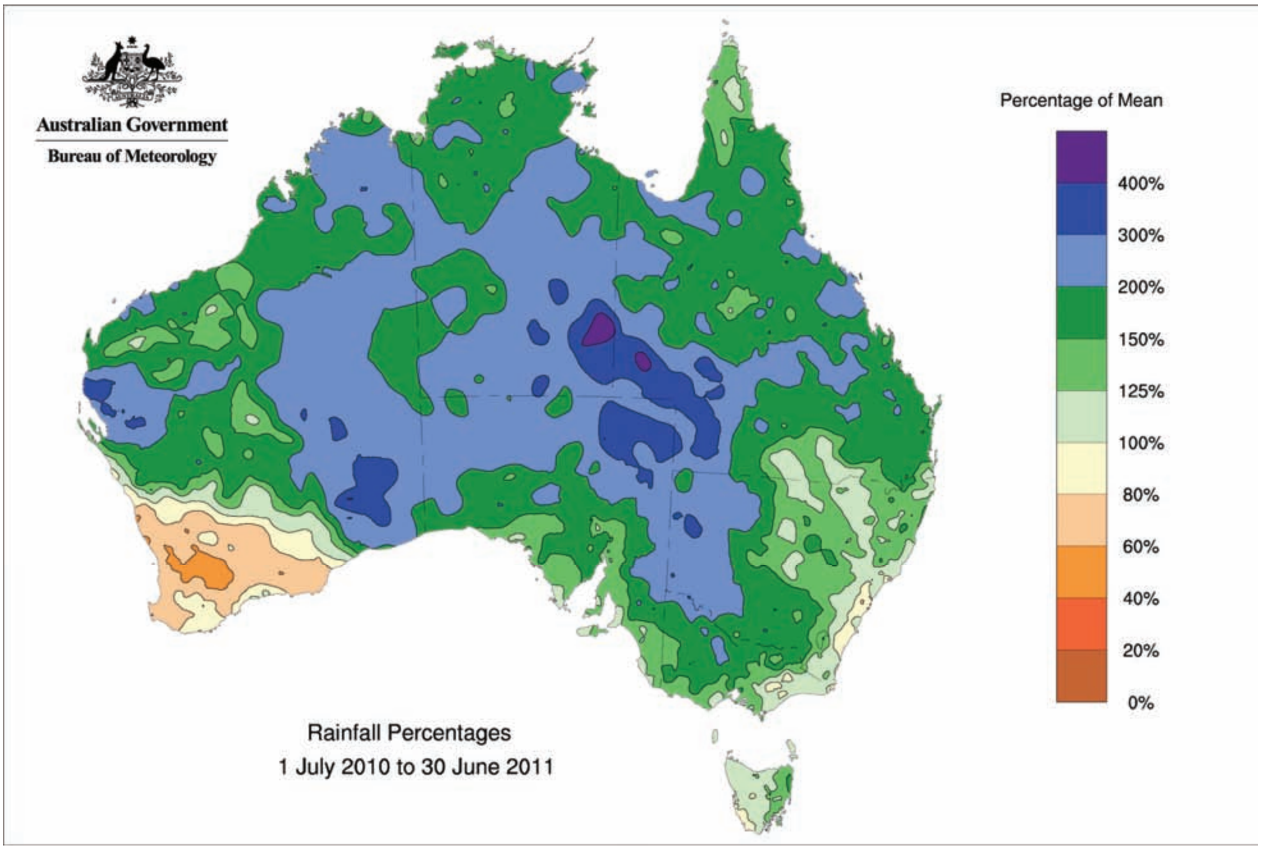
The extremely wet conditions were driven by record warmth in the tropical waters around northern Australia. A strong La Niña event in the Pacific Ocean was coupled with warm sea-surface temperatures off the north-west coast of

Australia (a negative Indian Ocean Dipole event) and these warm conditions in the eastern Indian Ocean created conditions conducive to the formation of north-west cloud bands. Together, these events resulted in tropical moisture being brought very far south, with more frequent low pressure systems as well as much cloudier and more humid conditions than usual, leading to above-average rainfall. In Victoria, this particularly affected regions north of the Great Dividing Range.

The La Niña event was one of the strongest ever observed and was the principal cause of the high rainfall over spring and summer. The last time such a strong La Niña event occurred was in 1973–74.

The La Niña conditions in 2010–11 brought welcome improvements to streamflows and storages across Victoria, as discussed in the following sections.

**Figure 1-6 Australian rainfall, 1 July 2010 to 30 June 2011, percentage of average**




Evapotranspiration (ET) is the sum of transpiration by plants, evaporation from soil and open water surfaces, and evaporation from the wet surfaces of plants soon after rainfall.

In 2010–11, the proportion of rainfall that became ET varied from an average of 47% in the Kiewa Basin to 91% in the Mallee Basin (see Chapter 5 for the method, and Appendix D for more results).

## 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.

The streamflow data presented in Table 1-1 is taken from the water balance for each basin in Part 2 of this report. The table includes a comparison between streamflows in 2010–11, 2009–10 and over the long term.

Above-average rainfall in 2010–11 ensured streamflows across Victoria were greater than the relatively low volumes observed in 2009–10. In fact, streamflows were above long-term averages in nearly all basins given the very high rainfall during this period. Overall, the total streamflow volume for Victoria was 175% of the long-term average.

The highest-yielding river basins, relative to their long-term averages, were the Murray, Broken, Campaspe, Loddon, Wimmera, Bunyip, Maribyrnong, Werribee and Moorabool. All experienced streamflows greater than 200% of the long-term average.

The Tambo basin was the driest in 2010–11. This basin, the Barwon basin and the Thomson basin were the only basins to record inflows of less than 100% of the long-term average.

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

| Basin | Average annual streamflow (ML) [1] | 2010–11 streamflow [2] [3] | | 2009–10 streamflow [2] | |
|---|---|---|---|---|---|
| | | (ML) | (% of average) | (ML) | (% of average) |
| Murray | 7,618,000 | 15,846,500 | 208% | 3,199,100 | 42% |
| Kiewa | 689,000 | 1,164,500 | 169% | 525,400 | 76% |
| Ovens | 1,758,000 | 3,470,000 | 197% | 936,200 | 53% |
| Broken | 308,000 | 686,800 | 223% | 63,200 | 21% |
| Goulburn[4] | 3,363,000 | 5,777,400 | 172% | 1,777,500 | 53% |
| Campaspe | 352,000 | 815,600 | 232% | 77,800 | 22% |
| Loddon | 373,000 | 2,178,600 | 584% | 102,500 | 27% |
| Avoca | 136,200 | 188,200 | 138% | 26,400 | 19% |
| Mallee[5] | 0 | 0 | 0% | 0 | N/A |
| Wimmera | 316,400 | 646,900 | 240% | 76,400 | 24% |
| East Gippsland | 714,000 | 791,600 | 111% | 241,800 | 34% |
| Snowy [6] | 1,022,000 | 1,014,200 | 99% | 380,600 | 37% |
| Tambo | 297,800 | 185,000 | 62% | 80,500 | 27% |
| Mitchell | 884,500 | 969,700 | 110% | 575,100 | 65% |
| Thomson | 1,101,760 | 970,500 | 88% | 652,800 | 59% |
| Latrobe | 847,400 | 1,099,600 | 130% | 522,900 | 62% |
| South Gippsland | 911,500 | 1,568,000 | 172% | 711,400 | 78% |
| Bunyip | 541,000 | 1,185,400 | 219% | 597,100 | 110% |
| Yarra | 1,054,000 | 1,453,600 | 138% | 568,000 | 54% |
| Maribyrnong | 113,000 | 249,400 | 221% | 24,200 | 21% |
| Werribee | 102,000 | 267,000 | 262% | 24,300 | 24% |
| Moorabool | 97,000 | 262,800 | 271% | 40,000 | 41% |
| Barwon | 360,000 | 352,100 | 98% | 147,700 | 41% |
| Corangamite | 316,000 | 518,600 | 164% | 144,100 | 46% |
| Otway Coast | 884,000 | 1,463,700 | 166% | 770,400 | 87% |
| Hopkins | 635,000 | 1,072,400 | 169% | 259,400 | 41% |
| Portland Coast | 361,000 | 522,300 | 145% | 276,500 | 77% |
| Glenelg | 964,000 | 993,800 | 103% | 330,800 | 34% |
| Millicent Coast [7] | 0 | 0 | 0% | 0 | N/A |
| **Total** | **26,119,560** | **45,714,200** | **175%** | **13,132,100**[8] | **51%**[8] |

Notes:

(1) Data is average annual basin inflow under current level of development. Average annual streamflow in the basins within the Murray-Darling catchment is based on estimates provided in previous studies, including the Northern Sustainable Water Strategy (DSE 2010) and the National Land and Water Resources Audit (2001). The average for all other catchments is based on the average annual flow calculations of the Sustainable Diversion Limits Project (Department of Natural Resources and Environment 2002), the Central Region Sustainable Water Strategy (DSE 2006), and the Gippsland Sustainable Water Strategy (DSE 2010).

(2) 'Streamflow' in the above table is defined in the same manner as catchment inflow as shown in each basin water balance: that is, excluding interbasin transfers, irrigation return flows and recycled water.

(3) In 2010–11, the water balances for the Wimmera, Loddon, Avoca, Murray, Barwon and Corangamite basins were revised to provide a more complete representation. The streamflow volumes reported for these basins will not be directly comparable to the 2009–10 figures.

(4) Includes inflows from Broken River.

(5) Streamflow not calculated due to absence of surface water resources other than direct rainfall.

(6) Volumes shown for the Snowy basin exclude catchment inflows from NSW (upstream of Burnt Hut Crossing). Note that the streamflows for 2009–10 differ from the value of 559,000 ML reported in the *Victorian Water Accounts 2009–2010* due to previously including the NSW inflows.

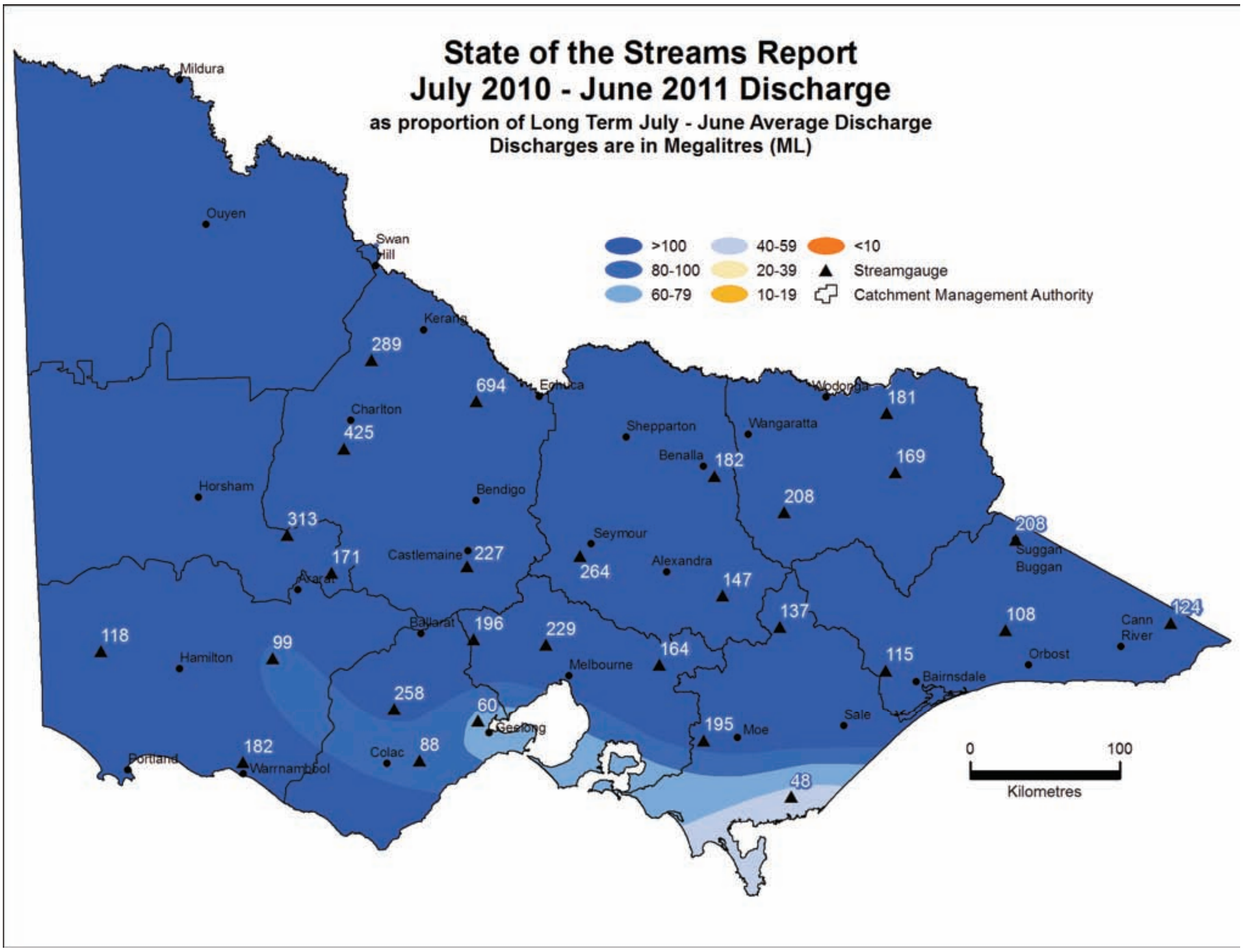
(7) A reliable estimate of streamflows could not be made as there are no streamflow gauges within the basin. Estimated streamflow is assumed to equal the estimated volume of water diverted.

(8) The total 2009–10 streamflow differs from the value of 13,294,100 ML reported in the *Victorian Water Accounts 2009–2010* due to updated data for the Snowy, Thomson, Latrobe, Maribyrnong, Werribee, Moorabool and Barwon basins.

N/A: Not applicable

Figure 1-7 shows an isoline representation of Victorian streamflows in 2010–11 as a percentage of long-term average streamflow (inclusive of 2010–11), based on data from 28 selected streamflow gauges distributed across Victoria. The percentages are not directly comparable to the total river basin flows listed in Table 1-1 because some gauges are located downstream of major storages, and the period of streamflow record differs for each site. However, the overall trend is similar, with above-average streamflow experienced at almost all selected gauges across Victoria in 2010–11. Streamflows at several gauge sites in southern Victorian basins were below the long-term average.

## Figure 1-7 Victorian streamflow, 2010–11, percentage of long-term average flow




The streamflow data presented in Table 1-2 allows a comparison between total streamflow volumes for Victoria in 2010–11 and the volumes recorded each year since 2003–04. Streamflows in 2010–11 were 175% of the long-term average, and more than three times greater than 2009–10. These were the largest flows experienced since the Victorian water accounts commenced in 2003–04.

## Table 1-2 Streamflow compared to long-term average (1)

| Year | Streamflow (ML) | % of average (Average flow is 26,119,560 ML) |
|---|---|---|
| 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 (2) | 8,239,800 | 32% |
| 2009–10 (3) | 13,132,100 | 50% |
| 2010–11 (4) | 45,714,200 | 175% |

Notes:

(1) Long-term average streamflows were updated in 2008–09 based on information from the Northern Sustainable Water Strategy and Gippsland Sustainable Water Strategy. The Victorian long-term average streamflow was revised from 27,602,900 ML to 26,119,600 ML.

(2) The total 2008–09 streamflow differs from the value of 8,244,900 ML reported in the Victorian Water Accounts 2008–2009 due to updated data for the Werribee and Portland Coast basins.

(3) The total 2009–10 streamflow differs from the value of 13,294,100 ML reported in the Victorian Water Accounts 2009–2010 due to updated data for the Snowy, Thomson, Latrobe, Maribyrnong, Werribee, Moorabool and Barwon basins.

(4) The streamflow volumes reported for 2010–11 include improvements to the water balances for the Wimmera, Loddon, Avoca, Murray, Barwon and Corangamite river basins.

### 1.2.1 Long-term streamflow trends

The following graphs depict flows across a selection of 10 Victorian waterways to the end of June 2011. They demonstrate that streamflows were above the long-term average in 2010–11 across all but one of these sites.

Figure 1-8 depicts annual flows in the Goulburn River at Doherty's, which is upstream of Lake Eildon. Over the previous 13 years flows at this location were only 66% of the long-term average. Flows in 2010–11 were much higher than this, at 150% of the long-term average.

**Figure 1-8 Annual streamflow at Goulburn River**

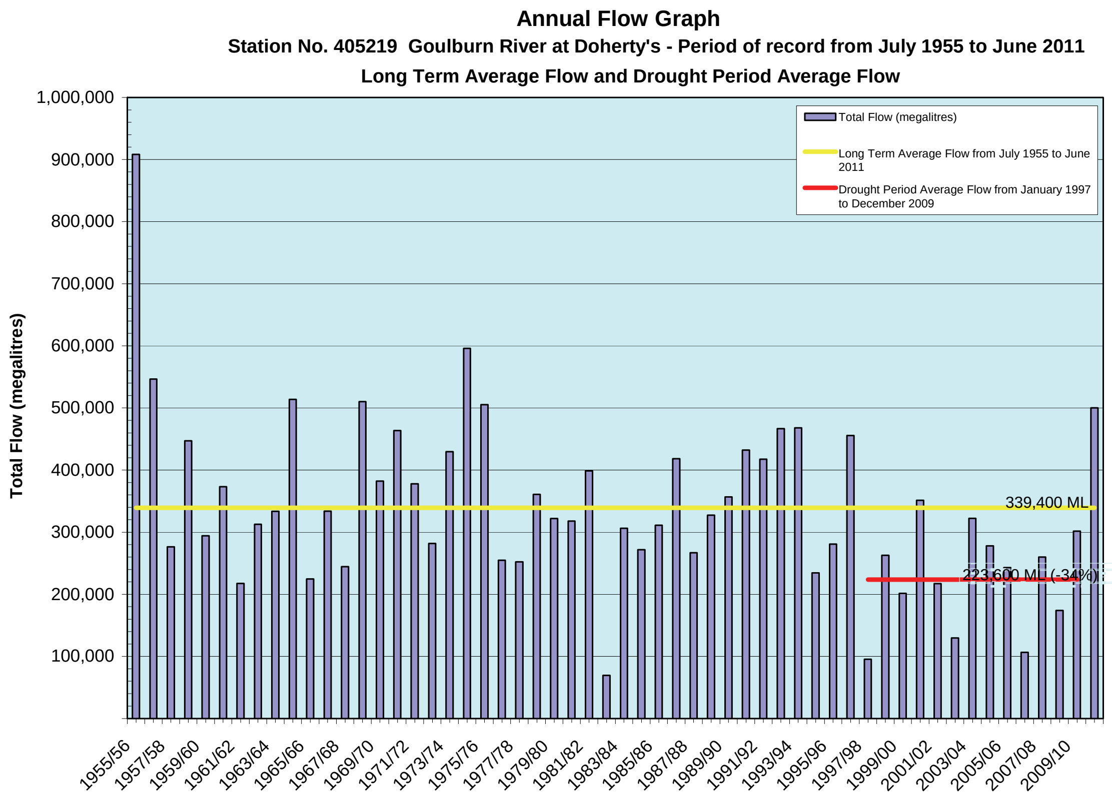



Figure 1-9 depicts annual flows in the Loddon River at Vaughan, which is upstream of Cairn Curran Reservoir. Over the previous 13 years, annual flows here were only 28% of the long-term average. Flows in 2010–11 were some of the highest on record at 230% of the long-term average.

## Figure 1-9 Annual streamflow at Loddon River

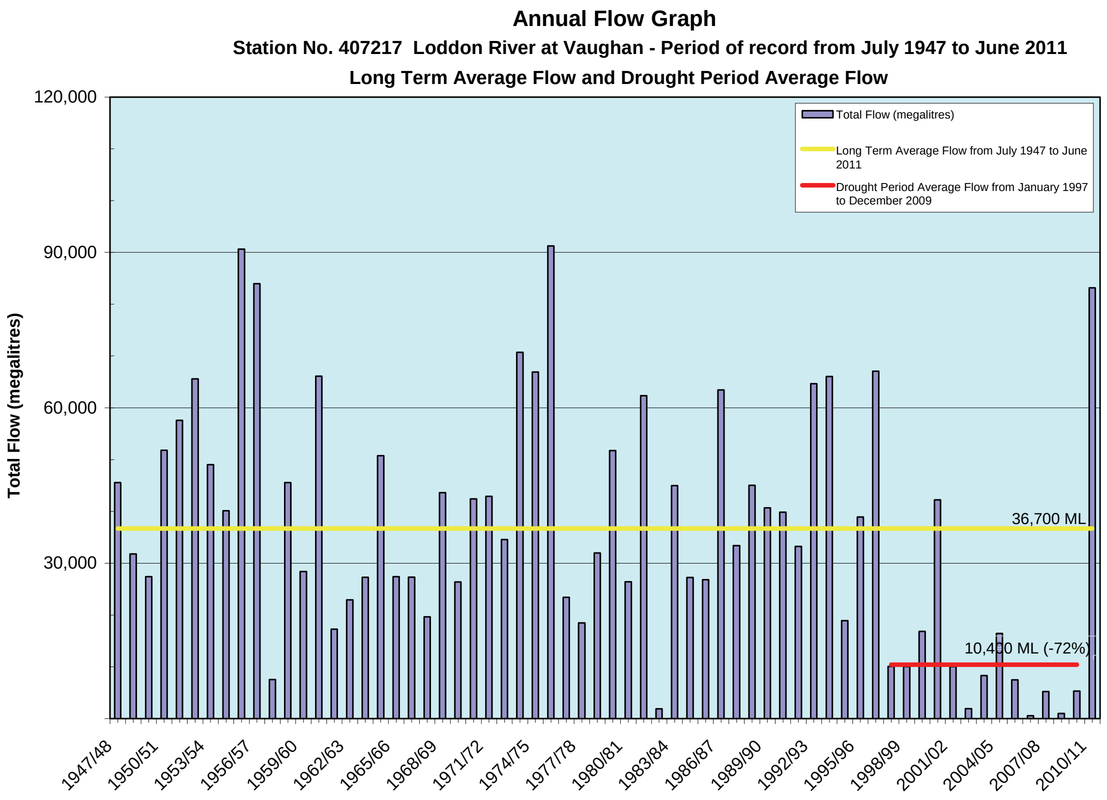



Figure 1-10 depicts annual flows in the Avoca River at Coonooer, which is upstream of Charlton. At 425 % of the long-term average, flow at this location in 2010–11 was close to the highest on record. This is in stark contrast to the previous 13 years, as during this period average annual flows were extremely low at only 12% of the long-term average.

## Figure 1-10 Annual streamflow at Avoca River

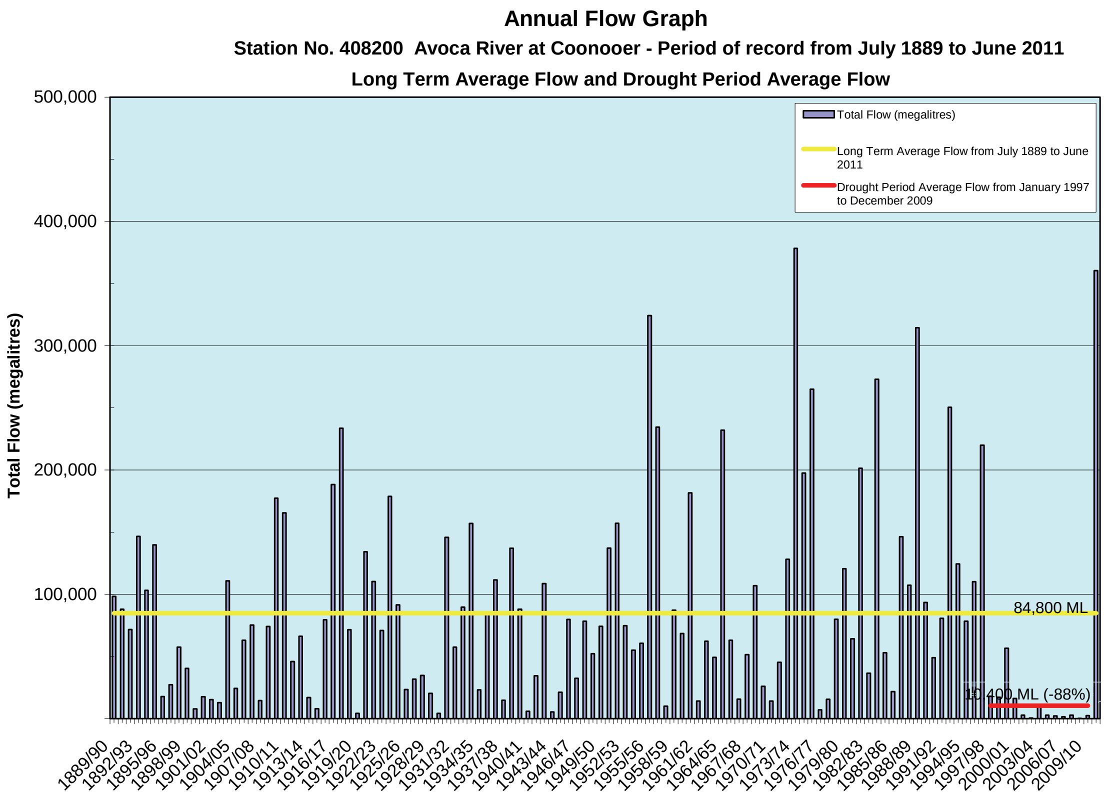


Figure 1-11 depicts annual flows in the Wimmera River at Glynwylln. The Wimmera River at this location also experienced record streamflows in 2010–11. At 310% of the long-term average, flows in 2010–11 were significantly greater than over the past 13 years. Average annual flows over this period were just 16% of the long-term average.

## Figure 1-11 Annual streamflow at Wimmera River

Figure 1-12 depicts annual flows in Snowy Creek at Granite Flat. Flow at this location in 2010–11 was 170% of the long-term average, compared to an average annual flow of 72% of the long-term average during the recent drought.

## Figure 1-12 Annual streamflow at Snowy Creek

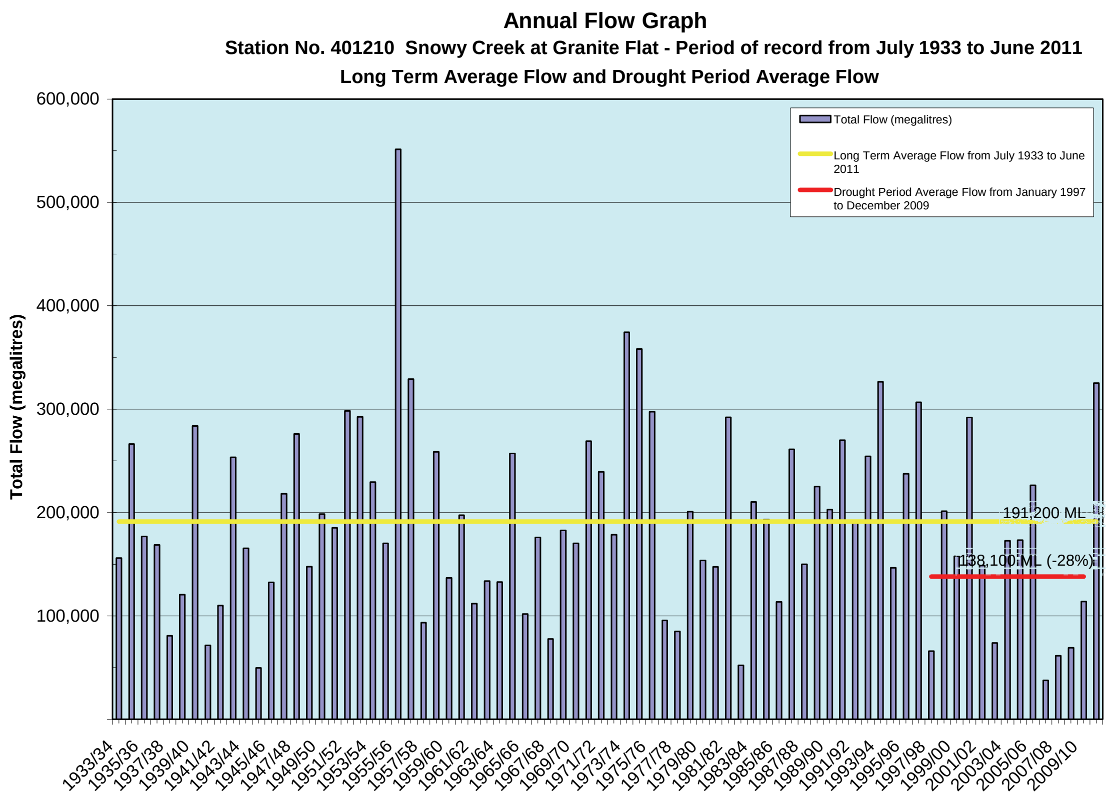



Figure 1-13 depicts annual flows in the Mitchell River at Glenaladale, which is approximately 25 kilometres upstream of Bairnsdale. Flow at this location in 2010–11 was 120% of the long-term average, compared to an average annual flow of 63% of the long-term average during the recent drought.

### Figure 1-13 Annual streamflow at Mitchell River

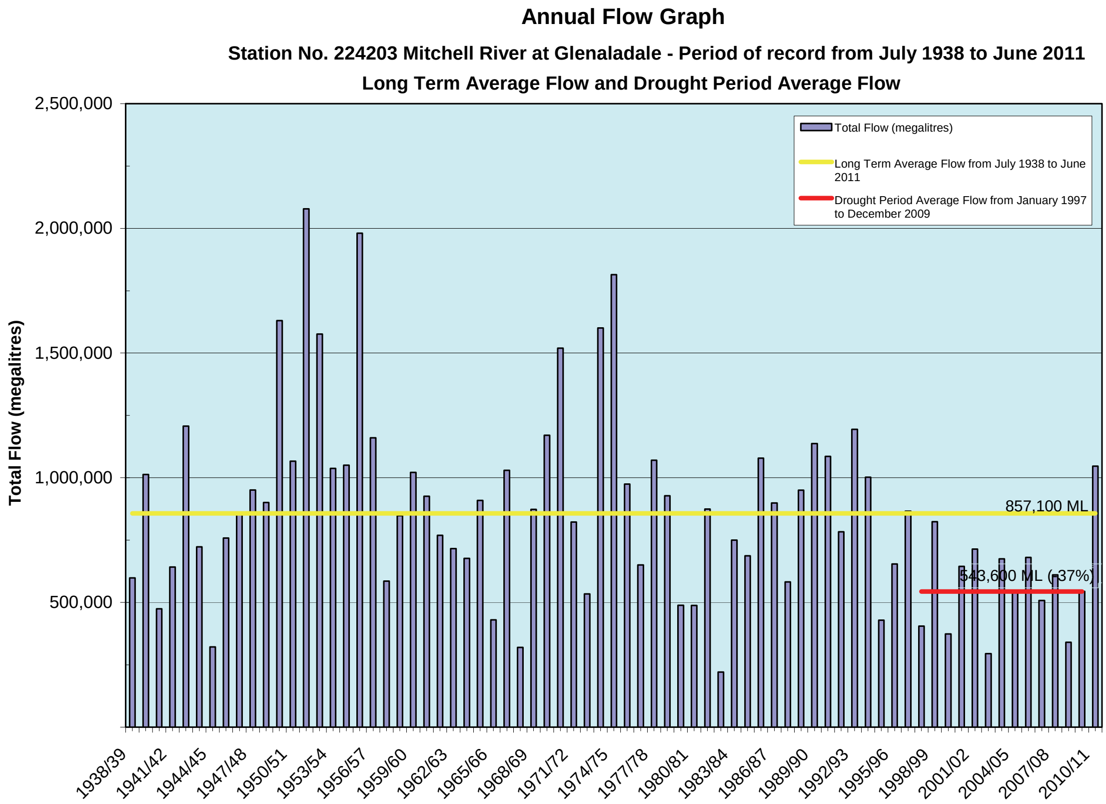



Figure 1-14 depicts annual inflow to Melbourne's harvesting reservoirs in the Yarra and Thomson basins. Inflows in 2010–11 were 121% of the long-term average, compared to 65% of the long-term average during the recent drought.

### Figure 1-14 Annual streamflow at Melbourne's storages

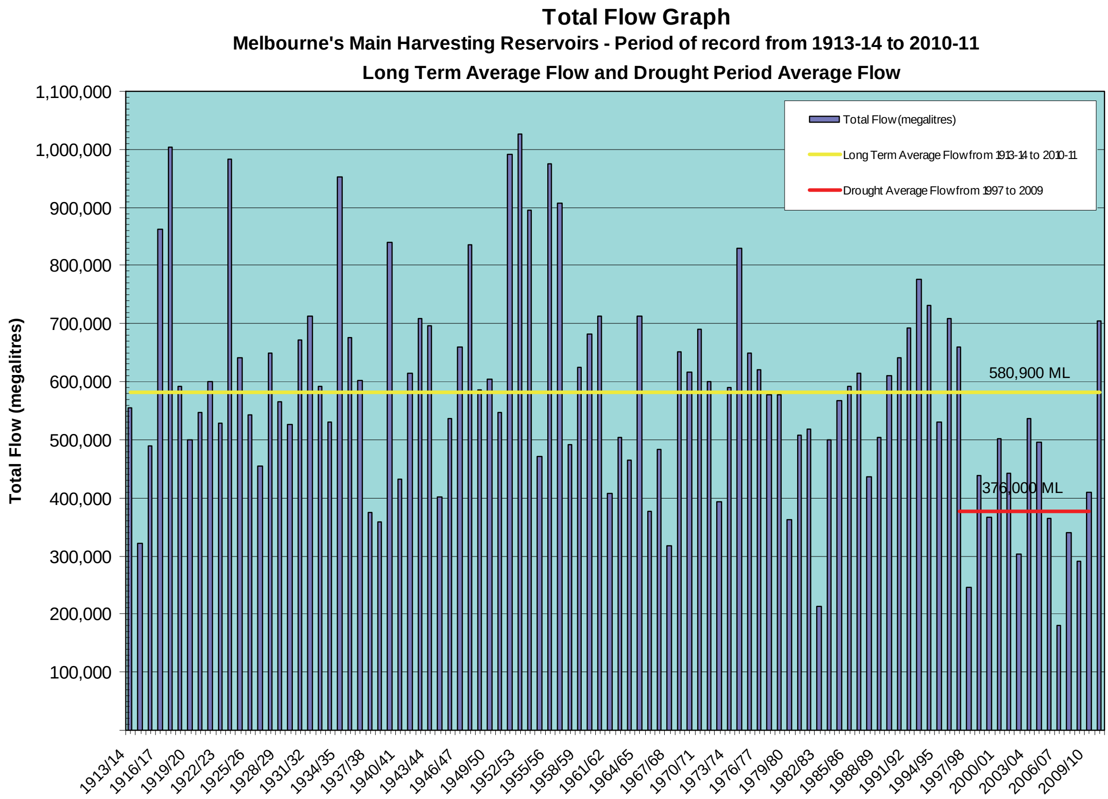


Figure 1-15 depicts annual flows in Deep Creek at Bulla, which were just 24% of the long-term annual average flow during the recent drought. Flows in 2010–11 were over double the annual average and were the highest since 1973–74.

## Figure 1-15 Annual streamflow at Deep Creek

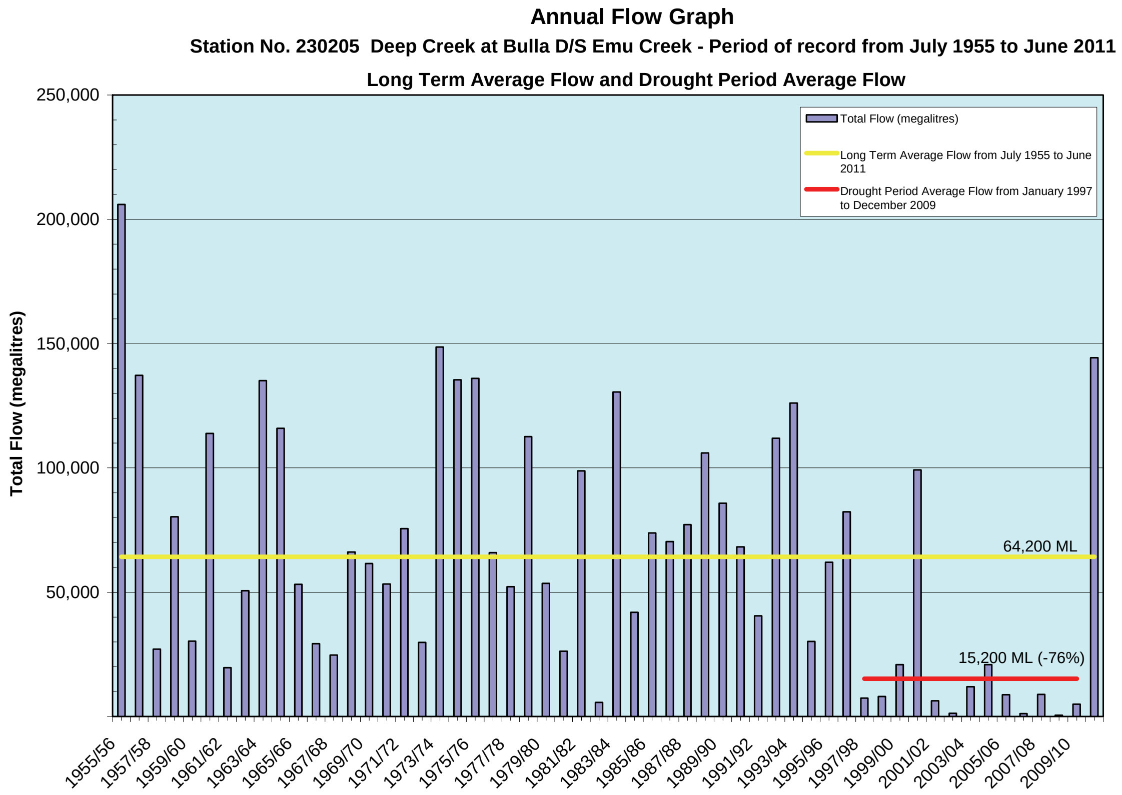



Figure 1-16 depicts annual flows in the Werribee River at Ballan which were just 33% of the long-term annual average flow during the recent drought. Flows in 2010–11 were close to double the annual average and were the highest since 1993–94.

## Figure 1-16 Annual streamflow at Werribee River

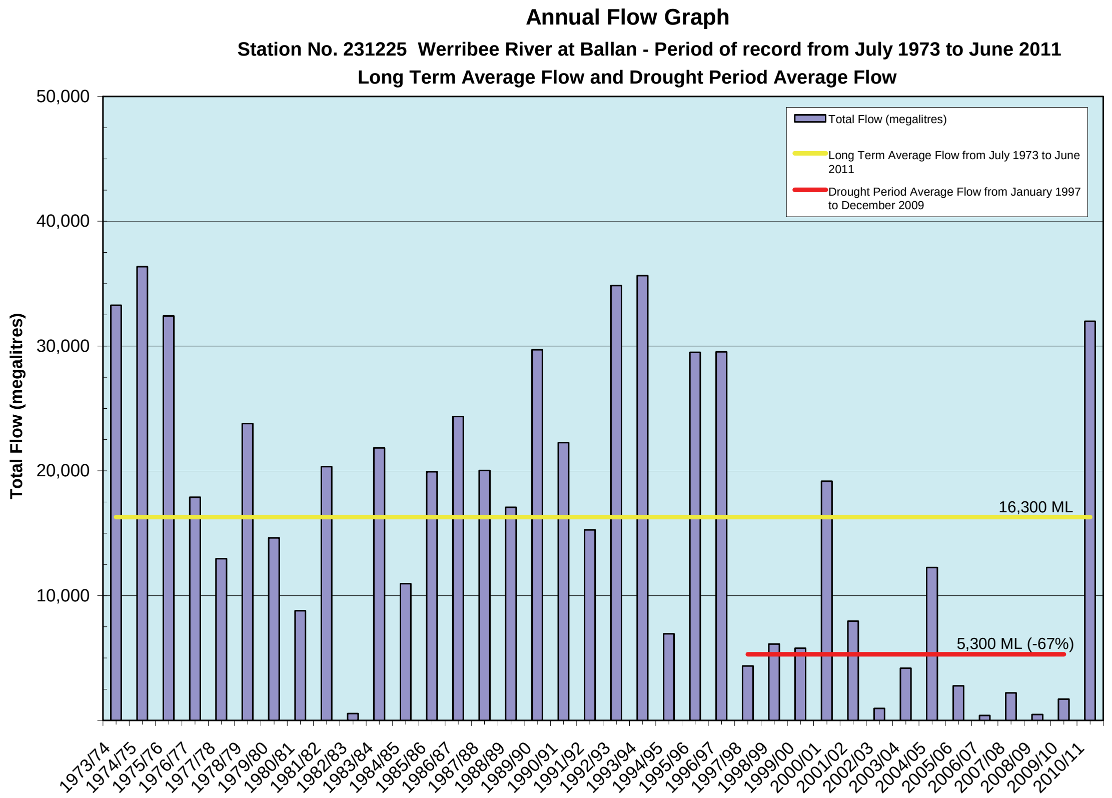
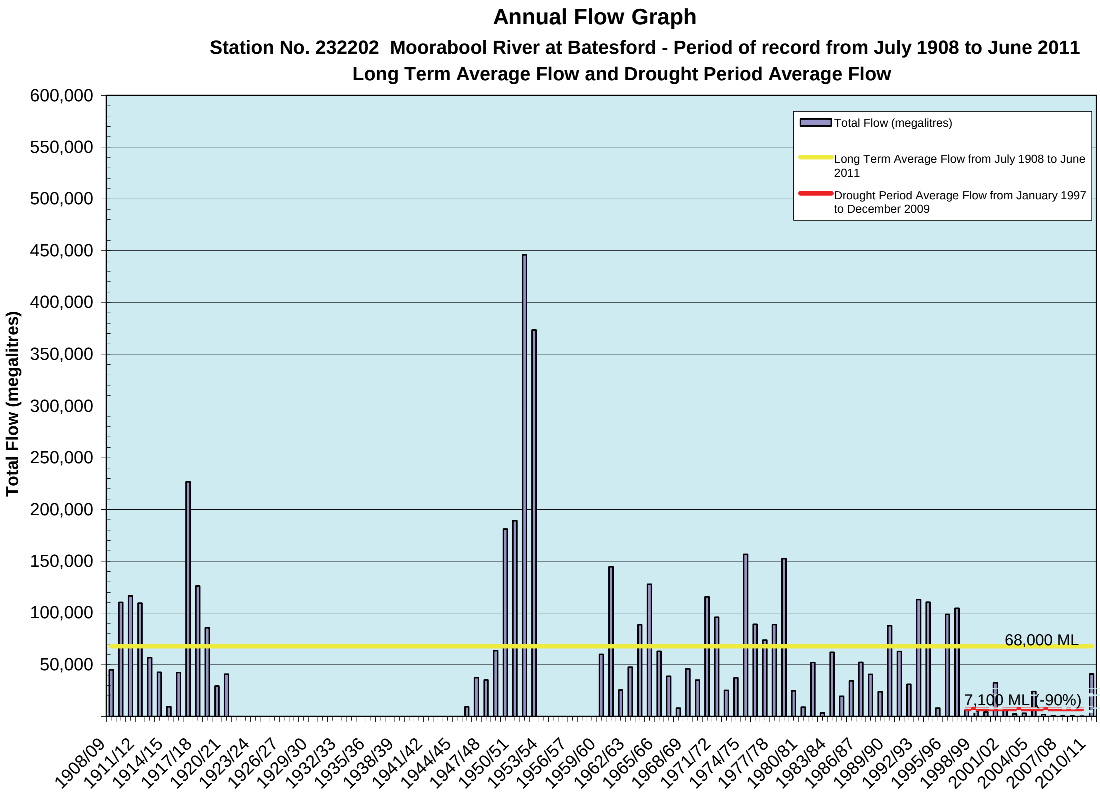


Figure 1-17 depicts annual flows in the Moorabool River at Batesford. At 60% of the long-term average, this was the only location that did not experience above-average flow in 2010–11. However, this was still greater than the annual average flow over the previous 13 years, which was extremely low at only 10% of the long-term average.

### Figure 1-17 Annual streamflow at Moorabool River




Note: Unlike the other figures, this figure shows readings taken downstream from water storages.

### 1.2.2 Blue-green algal blooms

In 2010–11 there were 41 high-alert blue-green algae (BGA) outbreaks.

Cyanobacteria (BGA) are a natural component of most aquatic systems and are found in streams, lakes, estuaries and the sea. The presence of significant numbers of BGA 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 trigger BGA blooms including nutrient loads, low inflows, low storage volumes and higher-than-normal temperatures.

The number of high-alert blooms for both drinking and recreational blooms was high, compared to the last five years. BGA outbreaks generally occur in the summer months as warm temperatures are a factor in their development. The number of reported BGA blooms during the winter of 2010 was unusually high. This has been attributed to high nutrient loads from floods and high turbidity levels.

BGA blooms are monitored regularly by water corporations and local waterway managers. Table 1-3 summarises the significant high-alert BGA blooms recorded in 2010–11. 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.

### Table 1-3 High-alert blue-green algal blooms for 2010–11

| Basin | Location | Major use | Reporting body | Duration | Actions |
|---|---|---|---|---|---|
| Barwon | Blue Waters Lake | R, SW | City of Greater Geelong | January to April 2011 | Media release issued. |
| | McLeods Waterholes | R, SW | City of Greater Geelong | January to March 2011 | Media release issued. |
| Broken | Torgannah Lagoon | S&D, I | Goulburn-Murray Water | December 2010 | Warning signs erected. Stakeholders notified and media release issued. |
| Campaspe | Campaspe River at Goornong | D | Coliban Water | February 2011 | Regular monitoring. Water treatment. |
| | Ironstone Hill | I | Coliban Water | February 2011 | Reservoir not in use. |

| Basin | Location | Major use | Reporting body | Duration | Actions |
|---|---|---|---|---|---|
| | Reservoir | | | | |
| | Lake Eppalock | D, S&D, I, R | Goulburn-Murray Water | January to April 2011 | Warning signs erected. Stakeholders notified and media release issued. Regular monitoring. |
| | Waranga Channel | D, S&D, I, R | Goulburn-Murray Water | June 2011 | Warning signs erected. Regular monitoring. |
| Corangamite | Lake Bullen Merri | R | Corangamite Shire Council | December 2010 | Warning signs erected. Stakeholders notified and media release issued. Regular monitoring. |
| Glenelg | Hamilton Hayes Reservoir | D | Wannon Water | October to November 2010 | Reservoir not in use. |
| Goulburn | Lake Eildon | D, S&D, I, R | Goulburn-Murray Water | January to May 2011 | Warning signs erected. Stakeholders notified and media release issued. Regular monitoring. |
| Goulburn | Dingee Service Basin | S&D | Coliban Water | February to April 2011 | Regular monitoring. |
| Goulburn | Mitiamo Service Basin | S&D | Coliban Water | February 2011 | Service basins taken off-line. Water carting to Mitiamo and Macorna. |
| Goulburn | Macorna Service Basin | S&D | Coliban Water | February 2011March to April 2011 | Service basins taken off-line. Water carting to Mitiamo and Macorna. |
| Hopkins | Brierly Basin | D | Wannon Water | March to April 2011 | Water source taken off-line. |
| Loddon | Bridgewater Service Basin | D | Coliban Water | February 2011 | Regular monitoring. Water treatment. |
| Loddon | Lockington Raw Water Storage | S&D | Coliban Water | February to April 2011 | Regular monitoring. |
| Loddon | Mysia Service Basin | S&D | Coliban Water | October 2010 | Regular monitoring. |
| Loddon | Pyramid Hill Service Basin | D | Coliban Water | February 2011 | Regular monitoring. Water treatment. |
| Loddon | Kangaroo Lake | S&D, I, R | Goulburn-Murray Water | October 2010 | Warning signs erected. Stakeholders notified and media releases issued. Regular monitoring. |
| Loddon | Kow Swamp | S&D, I, R | Goulburn-Murray Water | October to November 2010 | Warning signs erected. Stakeholders notified and media releases issued. Regular monitoring. |
| Loddon | Little Lake Charm | S&D, I, R | Goulburn-Murray Water | October to November 2010 | Warning signs erected. Stakeholders notified and media releases issued. Regular monitoring. |
| Loddon | Loddon River | S&D, I, R | Goulburn-Murray Water | October 2010 | Warning signs erected. Stakeholders notified and media releases issued. Regular monitoring. |
| Loddon | Racecourse Lake | S&D, I, R | Goulburn-Murray Water | October to November 2010 | Warning signs erected. Stakeholders notified and media releases issued. Regular monitoring. |
| Loddon | Reedy Lake | S&D, I, R | Goulburn-Murray Water | October 2010 | Warning signs erected. Stakeholders notified and media releases issued. Regular monitoring. |
| Loddon | Third Lake | S&D, I, R | Goulburn-Murray Water | December 2010 | Warning signs erected. Stakeholders notified and media releases issued. Regular monitoring. |
| Loddon | Torrumbarry Irrigation Area (multiple channels) | S&D, I, | Goulburn-Murray Water | October to November 2010 | Warning signs erected. Stakeholders notified and media releases issued. Regular monitoring. |
| Loddon | Centenary Reservoir | D | Central Highlands Water | February to March 2011 | Reservoirs isolated from supply. Warning signs erected. |
| Loddon | Evansford Reservoir | D | Central Highlands Water | April to June 2011 | Reservoirs isolated from supply. Warning signs erected. |
| Loddon | Talbot Reservoir | D | Central Highlands Water | April to June 2011 | Stakeholders notified. Regular monitoring. |
| Loddon | Kennington | R | City of Greater Bendigo | April to May 2011 | Stakeholders notified. Warning signs erected. |
| Mallee | Lake Mournpall – Hattah Kulkyne NP | R | Parks Victoria | April to June 2011 | Warning signs erected. |
| Mallee | Lake Hattah – Hattah Kulkyne NP | R | Parks Victoria | June 2011 | Warning signs erected. |
| Moorabool | Lal Lal Reservoir | D, S&D | Central Highlands Water | January to March 2011 | Stakeholders notified. Warning signs erected. |

| Basin | Location | Major use | Reporting body | Duration | Actions |
|---|---|---|---|---|---|
| | | | | | Regular monitoring. |
| Ovens | Diddah Diddah Reservoir | D | North East Water | July 2010 | Reservoir not in use. |
| Port Phillip | Quiet Lakes | R | Melbourne Water | June 2011 | Warning signs erected. Regular monitoring. |
| Werribee | Lake Merrimu | D | Southern Rural Water | October 2010 to January 2011 | Stakeholders notified. Warning signs erected. Regular monitoring. |
| | Melton Reservoir | D, S&D | Southern Rural Water | March 2011 | |
| | Pykes Creek Reservoir | D, S&D, I, R | Southern Rural Water | December 2010 to January 2011 | |
| Westernport | Candowie Reservoir | D | Westernport Water | March 2011 | Regular monitoring. Water treatment. |
| Wimmera-Avon | Taylors Lake | D,S&D, R | GWMWater | January 2011 | Stakeholders notified. Warning signs erected. Regular monitoring. |
| | Lake Lonsdale | R | GWMWater | February to March 2011 | |
| Yarra | Yan Yean Reservoir | D | Melbourne Water | December 2010 - June 2011 | Water from Yan Yean Reservoir not supplied to distribution system |

Legend:

| | | | |
|---|---|---|---|
| D | Drinking water | I | Irrigation |
| S&D | Stock and domestic | PR | Passive recreation |
| R | Recreation | SW | Storm water |

## 1.3 Storages

Victoria's major water storages are capable of holding around 12,294,860 ML. Of this, Melbourne's storage capacity is 1,812,175 ML, while the combined capacity of the state's regional storages is 10,482,685 ML.

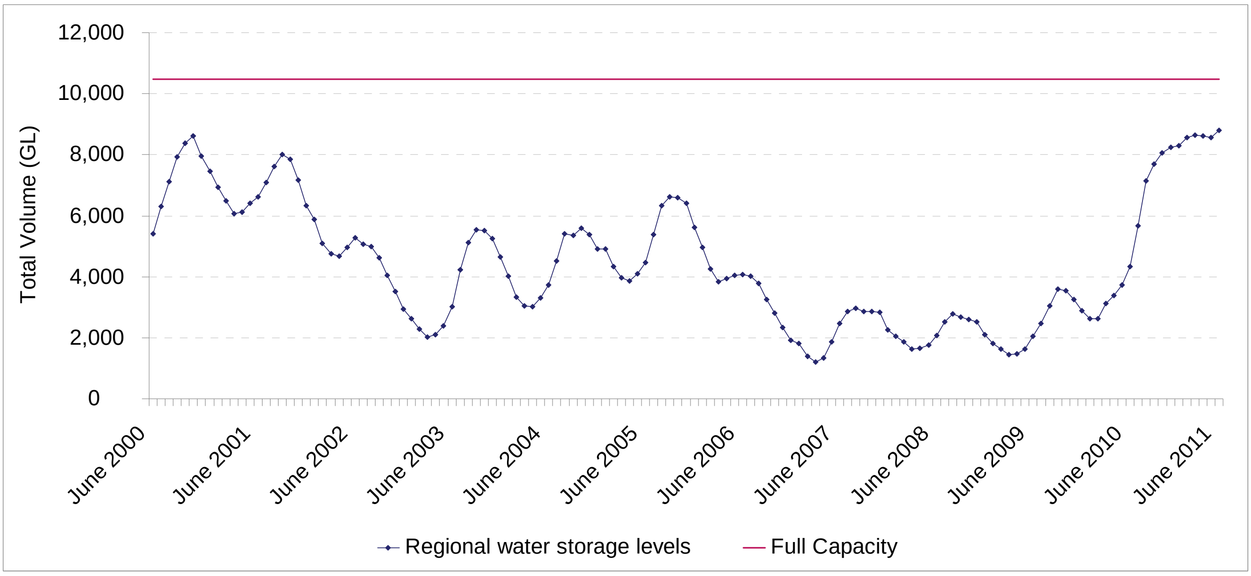
Victoria's storage capacity well exceeds annual use in any one year. For example, Melbourne's total water consumption in 2010–11 was around 306,890 ML, which is about 17% of the volume it can hold in its storages. This large storage capacity is necessary to manage the yearly streamflow fluctuations in Victoria's rivers in order to provide continuous and reliable water supplies.

As shown in Figure 1-18, the total volume of water stored in Victoria's major regional reservoirs started the year at 3,723,448 ML (36% of capacity) and ended at 8,800,363 ML (84% of capacity). Levels increased significantly over spring, and continued to rise over summer and autumn as above-average rainfall produced high inflows and suppressed demand for water for irrigation and urban use.

Storage levels across the north and west of the state showed the most improvement over the year. At the beginning of 2010–11 storages were only 10% full or less in the Campaspe, Loddon, Maribyrnong, Wimmera and Werribee basins, and storages for Ballarat, Bendigo and Geelong were around 30% full. Many of these storages recovered to over 90% of capacity by the end of 2010–11.

Information on storage levels in individual basins is set out in Appendix B and in the basin water accounts. A subset of these storages was used to provide the information in this section.

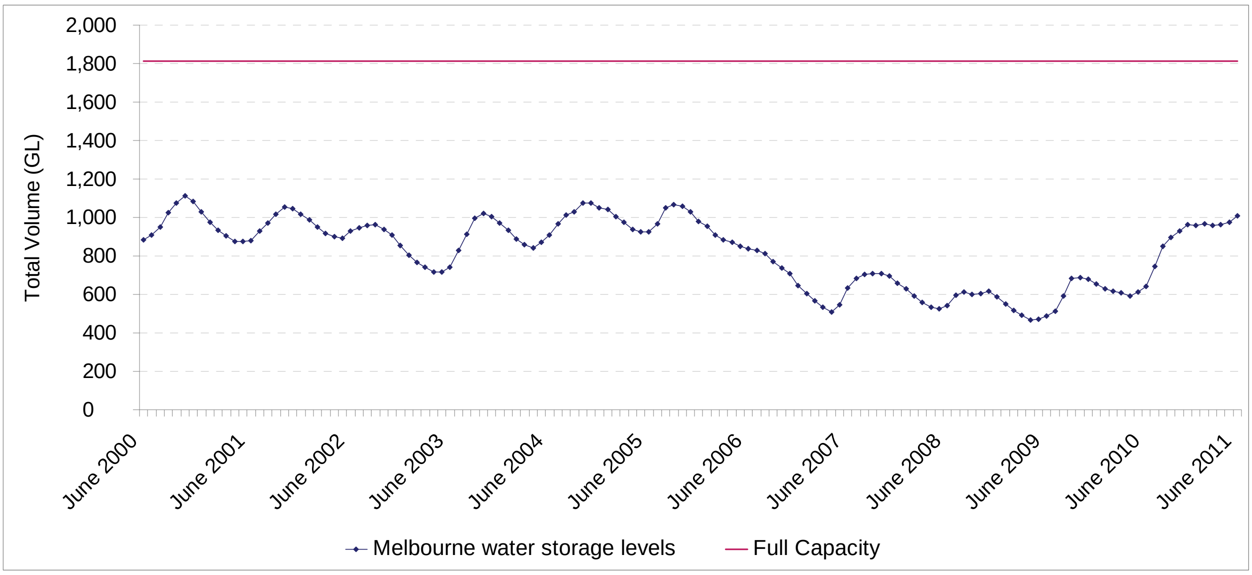
### Figure 1-18 Volume in major regional corporation storages, 1 July 2000 to 30 June 2011




Note: The regional capacity figure is lower than reported in 2009–10, due to the revision of the capacities of Dartmouth and Hume reservoirs, and several Wimmera-Mallee system storages being discontinued following the completion of the Wimmera-Mallee pipeline.

Melbourne's water storages started the year at 611,414 ML (34% of total storage capacity of 1,812,175 ML) and recovered to 1,006,944 ML (56% of total storage capacity) at June 30 2011. It was the second consecutive year since 2004–05 that storage levels ended the year higher than they started.

### Figure 1-19 Volume in Melbourne Water Corporation storages, 1 July 2000 to 30 June 2011



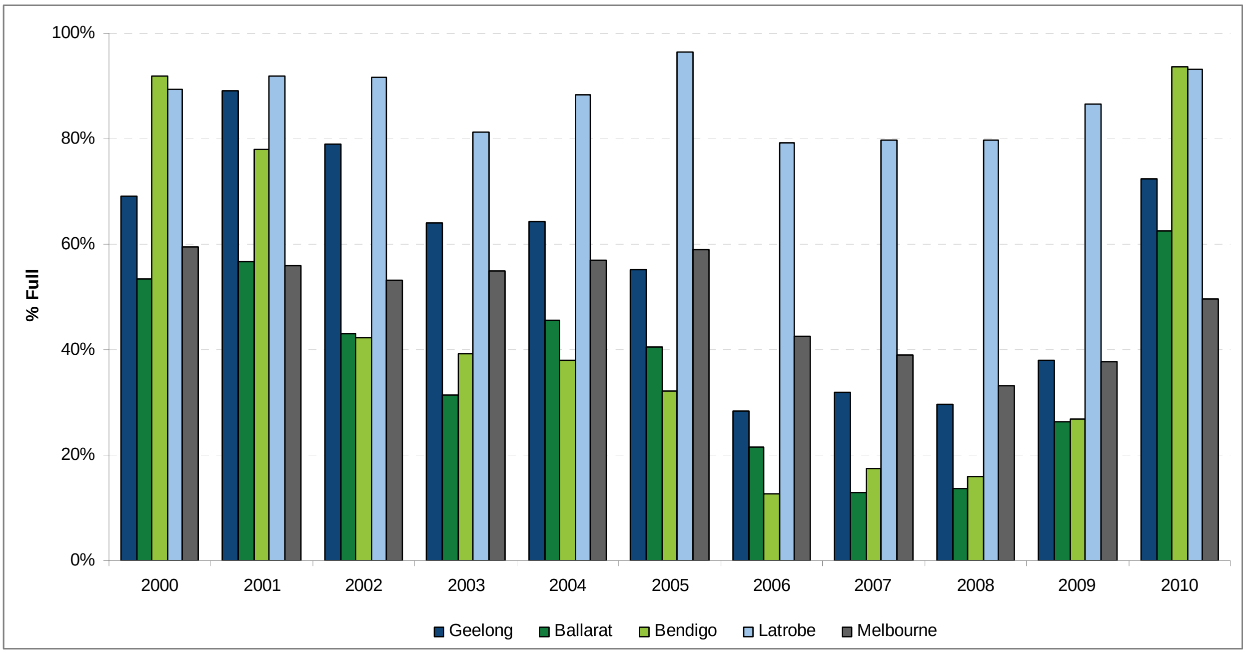

Note: The total capacity of Melbourne's storages is slightly greater than reported in 2009–10 due to changes in the rounding of individual storage volumes.

The total volume of water stored in Victoria's major reservoirs in October provides a good indication of water availability in a year because this is when levels are usually at their maximum.

Figure 1-20 presents October storage levels, as a percentage of storage capacity, from 1997 to 2010 for Melbourne and selected major regional centres.

It shows that October storage levels generally declined from 2000 to 2006, as inflows were not sufficient for systems to recover. A significant drop in levels occurred between 2005 and 2006, when winter and spring rainfall was extremely low. By October 2009 storage levels had recovered slightly, but most remained below 40% of capacity. Storage volumes increased significantly over the past year. Melbourne and Latrobe storages were at their highest October level since 2005. October storage levels for Ballarat, Bendigo and Geelong were the highest for up to a decade.

**Figure 1-20 Water in reservoirs for major urban centres, end of October 2000–2010, percentage of total storage capacity**




## 1.4 Groundwater

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, or 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.

At present, there are 64 GMUs in Victoria, of which 23 are WSPAs, 38 are GMAs and three are UAs. The Upper Loddon and Spring Hill WSPA have been replaced by the Loddon Highlands WSPA and the Campaspe Deep Lead WSPA and Southern Campaspe Plains GMA have been replaced by the Lower Campaspe Valley WSPA. In addition, the Mid-Loddon WSPA is now managed as the Mid-Loddon GMA.

As of June 2011, there were nine approved groundwater management plans. Groundwater management plans for Koo Wee Rup WSPA, Warrion WSPA and Yarram WSPA were approved by the Minister in 2010–11. Good progress is being made preparing the plan for the Upper Ovens WSPA which will be the first plan applying similar management rules to both groundwater and surface water, and is scheduled for completion in early 2012. GWMWater completed the West Wimmera Groundwater Management Strategy in June 2011. The strategy provides clear direction about future groundwater management in the Apsley, Neuarpur, Telopea Downs and Kaniva WSPAs and Balrootan GMA, Goroke, Nhill, Kaniva TCSA (tertiary confined sand aquifer), and Little Desert GMAs.

Two management plans were revoked in July 2010: Campaspe Deep Lead Groundwater Management Plan and Spring Hill Groundwater Management Plan. Management plans are being prepared for the replacement WSPAs. Consultative committees to draft these plans have been appointed by the Minister. The plans are scheduled to be completed in 2012.

In addition, a groundwater sharing agreement is in place between South Australia and Victoria where aquifers straddle the state borders. The agreement was entered into in 1985 as groundwater is the only reliable water source in the region and there is increasing demand for its use. The designated area is a 40-kilometre-wide strip centred on the border and extending its full length. This area is managed under the *Groundwater (Border Agreement) Act 1985*.

The location of aquifers is unrelated to surface water basins, with some aquifers extending beneath several. Nevertheless, for the purpose of the basin accounts, groundwater use has been apportioned according to the surface area by basin. See Chapter 5 for an explanation of the method used.

Groundwater occurrence varies in size and volume throughout Victoria. It lies beneath all parts of the state but is not always useable. Its potential for use is generally dependent on its salinity and how much water can be extracted (aquifer yield).

While groundwater can be a reliable source of water, its overuse can result in failure of supply. Groundwater has a value both when it is extracted for a range of uses including irrigation, commercial, urban or stock watering, and a value when left in situ where it may support groundwater-dependent ecosystems including contributing to base flow in streams and wetlands or supporting a variety of terrestrial flora.

Victoria monitors approximately 2,500 bores to understand groundwater level trends on a quarterly basis. Additionally, rural water corporations conduct monthly infill monitoring of approximately 500 bores. In recent dry years, groundwater has become a key water resource for towns, agriculture and industry. The need for greater security for this resource has increased the need for the state to upgrade its monitoring network.

Improving the understanding of the extent, availability and quality of the state's groundwater resources is one of the primary objectives of the State Observation Bore Network (SOBN) Refurbishment Project. Through this project, 100 new state observation bores were constructed in 2010–11 in key GMAs. A further 19 failed bores have been decommissioned and removed from the network, protecting the integrity of the groundwater resource and the surrounding environment.

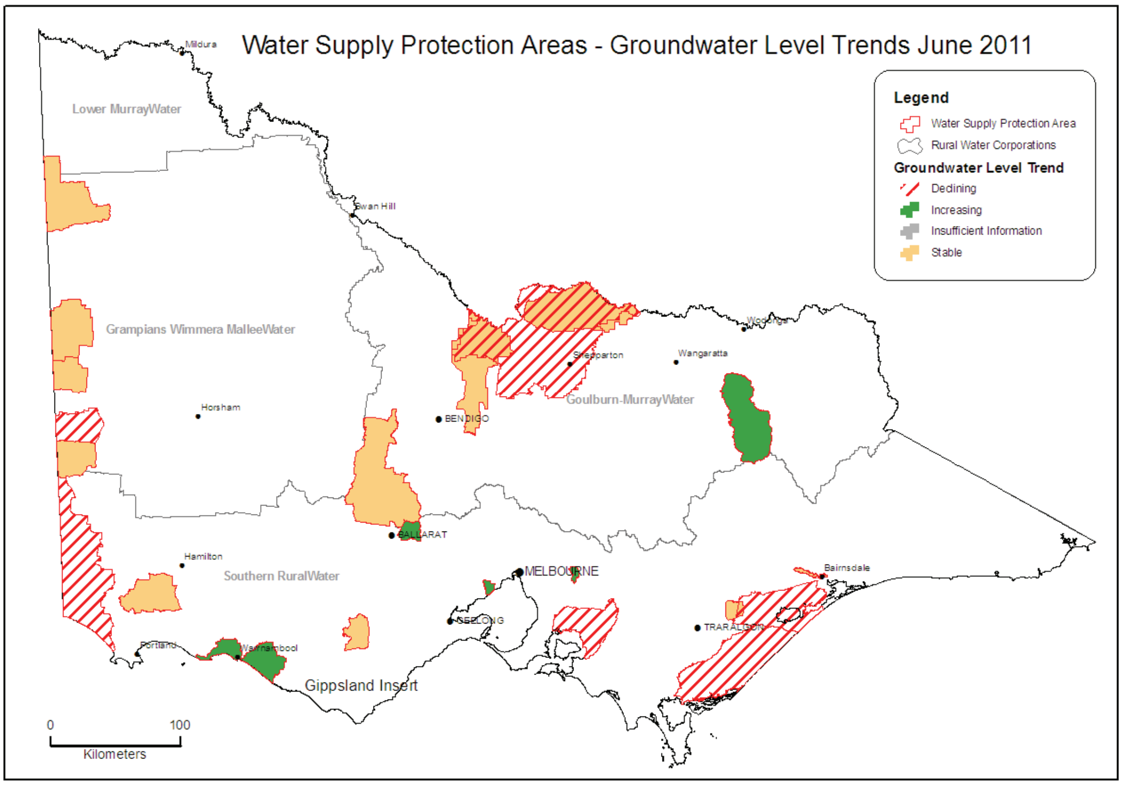
Compared to groundwater level trends in 2009–10, a larger number of management units are now showing an increasing water level trend. This can be attributed to the decrease in demand for groundwater, as evidenced by the reduced groundwater extraction figures and increased availability of surface water resources which have more suitable water quality parameters for irrigation than groundwater. In addition, the increasing water levels in some unconfined aquifers may be a recharge response to the recent wetter-than-average conditions.

Water level trends using the past five or more years of data gathered from the SOBN are presented in .

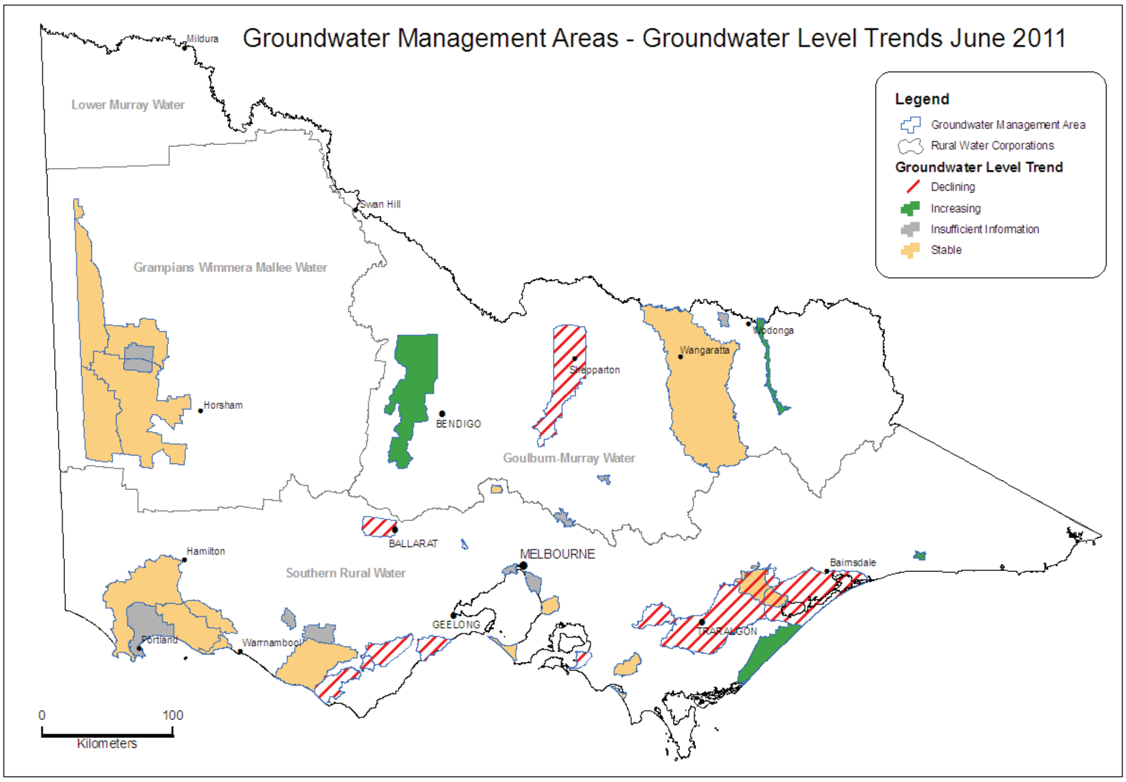
Figure 1-21, Figure 1-22 and Table 1-4.

Water metering is fundamental to responsible management of Victoria's water resources. All new groundwater licences must be metered. To improve water-use compliance and accounting for existing licensed groundwater use, a statewide metering program was implemented in 2004. Under the program, DSE provided a subsidy to install meters on licensed groundwater sites that take 20 ML per year. This program installed 1,565 meters. Many permissible consumptive volumes (PCVs) were exceeded during the 2010–11 year due to the issue of entitlements under the Dairy Shed Water Licence Transition Program. The program was developed to ensure water used in the dairy shed — such as water for washing yards, milking equipment, platforms and other plant — is fully licensed and accounted for. The program included an amnesty period which ended on 23 April 2010 when around 1800 licences were applied for to use water in the dairy shed without penalty. PCVs will be amended to include this entitlement amount.

## Figure 1-21 Groundwater trends in WSPAs



## Figure 1-22 Groundwater trends in GMAs




## Table 1-4 Groundwater level trends in WSPAs

| | SOBN coverage | Groundwater-level trend 2010–11 | Groundwater-level trend 2009–10 | Management activities |
|---|---|---|---|---|
| **Goulburn Murray Water** | | | | |
| Lower Campaspe Valley | Adequate | Stable | Declining | MP*, R[2], A* |
| Katunga | Adequate | Stable | Declining | MP, R[1] |
| Loddon Highlands | Adequate | Stable | Declining | MP*, R[3], A |
| Shepparton Irrigation Region | Adequate | Declining | Declining | MP |
| Upper Ovens | Adequate | Increasing | Stable | MP* |
| **Grampians Wimmera Mallee Water[(1)]** | | | | |
| Apsley | Adequate | Stable | Declining | A |
| Kaniva | Adequate | Stable | Stable | |
| Murrayville | Adequate | Stable | Stable | MP |
| Neuarpur | Adequate | Declining | Declining | MP |
| Telopea Downs | Adequate | Stable | Stable | |
| **Southern Rural Water** | | | | |
| Bungaree | Adequate | Increasing | Declining | |
| Condah | Adequate | Stable | Stable | A |
| Denison | Inadequate | Stable | Stable | |
| Deutgam | Adequate | Increasing | Declining | R[4] |
| Glenelg | Limited | Declining | Declining | |
| Koo Wee Rup | Adequate | Declining | Declining | MP |
| Nullawarre | Adequate | Increasing | Stable | MP, A |
| Sale | Adequate | Declining | Declining | A |
| Wandin Yallock | Adequate | Increasing | Declining | |
| Warrion | Adequate | Stable | Declining | MP |
| Wy Yung | Excessive | Stable | Stable | |
| Yangery | Adequate | Increasing | Stable | MP, A |
| Yarram | Limited | Declining | Declining | MP |

Management activities key:

| | | | |
|---|---|---|---|
| MP | Management plan | MP* | Management plan being prepared |
| LMR | Local management rules in development | R | Restrictions on use |
| A* | Resource appraisal commenced | A | Resource appraisal completed |

Current restrictions on groundwater use:

R1 Katunga WSPA: 70% allocation in all zones as at 30 July 2010.

R2 Lower Campaspe Valley: 75% allocation in zone 1028 and 100% allocation for all remaining zones as at 15 June 2010.

R3 Loddon Highlands: a seasonal allocation of 100% was announced for all zones except zone 1003. In accordance with the Loddon Highlands WSPA Interim Management Rules, a water shortage was declared for Forest Hill Zone 1003 for the 2010–11 irrigation season and an allocation of 80% will apply.

R4 Deutgam: there was a partial lifting of the ban on the use of groundwater in the Deutgam WSPA. Licence holders will now be able to use 75% of their licensed allocation, and all bores can be used for stock and domestic purposes as at 16 March 2011 and remains in place until 30 June 2011.

Notes:

(1) The West Wimmera resource appraisal and subsequent management plan will cover the areas of Apsley WSPA, Kaniva WSPA, Neuarpur WSPA, Telopea Downs WSPA, Balrootan GMA, Little Desert GMA and Nhill GMA.

(2) The Mid-Loddon WSPA was abolished and is now managed as a GMA.

(3) The Campaspe Deep Lead WSPA was replaced by the Lower Campaspe Valley WSPA.

(4) The Spring Hill and Upper Loddon WSPAs have been replaced by the Loddon Highlands WSPA.

## 1.5 Conclusion

Rainfall was significantly higher than average across most of Victoria in 2010–11. Above-average rainfall in 2010–11 ensured streamflows across Victoria were greater than the relatively low volumes observed in 2009–10. On a state basis, the total streamflow volume for Victoria was 175% of the long-term average. This was significantly greater than 2009–10 streamflow.

Storage levels in Victoria’s major regional reservoirs increased in 2010–11 compared to the previous year to hold 84% of capacity. These levels increased significantly over spring, and continued to rise over summer and autumn as above-average rainfall produced high inflows and suppressed demand for water for irrigation and urban use.

During the 2010–11 period, Melbourne’s storages increased their storage volume from 34% to 56% of capacity.

Streamflows, relative to long-term averages, were highest in the Murray, Wimmera, Moorabool, Werribee, Loddon, Campaspe, Broken, Maribyrnong and Bunyip basins. Streamflows were lowest in the Tambo, Barwon and Thomson basins.

The wetter-than-average conditions also affected some groundwater resources, with 10 GMUs showing a short-term trend of increasing water levels. This can be attributed to reduced demand for groundwater and increased recharge of some groundwater resources. It is important to note that not all groundwater resources were affected by the recent conditions and that increased groundwater levels are not necessarily beneficial in all areas (for example, salinity affected areas).

# 2 Management of Victoria's water resources

## 2.1 Victoria's water allocation framework

Victoria's water allocation framework provides the basis for managing Victoria's water resources.

Victoria's water entitlement system comprises well-defined rights to water, and markets have been established to reallocate water between uses.

The government retains the overall right to the use, flow and control of all Victoria's surface water and groundwater resources. The Minister for Water is responsible for issuing entitlements in accordance with the *Water Act 1989*.

A water entitlement is the amount of water authorised to be stored, taken and used by a person under specific conditions. In declared water systems, there are associated entitlements that set conditions for delivery and use.

### 2.1.1 Bulk entitlements

A bulk entitlement is a right to use and supply water which may be granted to water corporations, the Minister for Environment and other specified bodies (for example, electricity companies).

Bulk entitlements are issued with a range of conditions and obligations set out under Part 4 of the *Water Act 1989*. Bulk entitlements can be held for water in a waterway, water in storage, works of a water corporation, and groundwater. To date, bulk entitlements have generally covered surface water systems: however, the first groundwater-specific bulk entitlement was issued on 1 July 2009 in the Anglesea groundwater bulk entitlement.

A bulk entitlement is usually specified in one of two ways.

- **Source bulk entitlement** is an entitlement to harvest water directly from a water source and which typically describes the different sharing arrangements at that source. Source entitlements can cover multiple storages operated in an integrated way within a river basin.
- **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 corporation.

### 2.1.2 Environmental entitlements

An environmental entitlement is a right to water granted to the Minister for Environment for the purpose of maintaining an EWR or improving the environmental values and health of the water ecosystems and other uses that depend on environmental condition.

Environmental entitlements are issued by the Minister for Water under section 48B of the *Water Act 198*9. Before the Act was amended to provide for environmental entitlements, some bulk entitlements were issued to the Minister for Environment for environmental water in systems.

Environmental entitlements form part of the EWR. They enable active management of water by providing water in storage that can be released to meet specific environmental needs such as fish spawning triggers or maintaining critical habitat during drought.

The objective of the EWR is to preserve the environmental values and health of water ecosystems, including their biodiversity, ecological functioning and quality of water, and other uses that depend on environmental condition. It is the responsibility of the holder of an environmental entitlement to manage it accordingly.

Further details regarding water set aside for the environment are provided in Chapter 4.

### 2.1.3 Water shares

The reform of Victorian entitlements in declared water systems meets the National Water Initiative requirement that access to water be specified separately to land.

Traditional water rights and take-and-use licences in declared water systems have been unbundled into three entitlements.

- **Water share:** a legally recognised, secure share of the water available to be taken from a defined water system. A water share is specified as a maximum volume of seasonal allocation that may be made against that share.
- **Delivery share**: the right to have water delivered by a water corporation and a share of the available flow in a delivery system. A share is specified in terms of unit volume per unit of time of the total amount of water that can be drawn from a water system at a certain point.
- **Water-use licences:** the right to use water on a specific piece of land, or water-use registration; an authorisation to use water for purposes other than irrigation.

Entitlements in declared systems in Victoria are automatically recorded in the Water Register, the public register of all water-related entitlements in Victoria.

Water shares are classed according to their reliability, which is defined by the frequency with which full seasonal allocations are expected to be available.

### 2.1.4 Water licences and section 8 rights

A water licence is a licence to take and use water. A water licence can be held by any individual, business or corporation and allows water to be taken from a range of surface water and groundwater sources. Small-catchment dams used for other than domestic and stock purposes also require a licence.

In addition to the entitlements that are formally issued, the *Water Act 1989* enables individuals to take water for domestic and stock purposes from a range of surface water and groundwater sources without a licence. These domestic and stock rights are defined in section 8 of the *Water Act 1989* and are not formally issued.

The *Water Act 1989* also legally recognises the amount of water set aside to meet environmental benefits through the EWR. More details are provided in Chapter 4.

## 2.2 Responding to water availability

The amount of water available for consumptive and environmental purposes and use will vary from year to year. The allocation framework includes mechanisms to manage seasonal variability and respond to water shortage. These include urban water restrictions, seasonal allocations and rosters, restrictions and bans on users in unregulated catchments.

A number of water corporations and businesses undertook water carting and water system upgrades to augment their water supplies in 2010–2011.

The Water Act provides that the Minister for Water may qualify rights to water to maintain essential supplies to towns and rural communities. These powers are specified in s33AAA.

These mechanisms/measures are discussed in this chapter.

### 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 guidelines provide for four stages of restrictions: however, water businesses may grant exemptions from water restrictions.

The scale has four key stages of restrictions (plus intermediate Stage 3a), 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.

The number of towns on water restrictions significantly reduced in 2010–11. At 1 July 2010, 243 towns were on some form of water restrictions, with 30 towns on Stage 4 restrictions. By 30 June 2011, that number had decreased to 36, with only 1 town on Stage 4 restrictions. Under the guidelines, Stage 4 restrictions prohibit a range of activities including:

- the watering of any public, residential or commercial garden or lawn
- the watering of sports grounds
- cleaning of vehicles with water with the exception of windows, mirrors and lights
- cleaning of building facades or windows with water
- filling any new pond, lake or swimming pool.
- While some water corporations continued to implement exemptions to Stage 4, the majority of towns were subject to stage 1 to 3 restrictions in 2010–11.

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.

Figure 2-1 summarises the number of towns on restrictions over 2009–10 and 2010–11, and the severity of those restrictions. Figure 2-2 shows the change in severity of restrictions for the major population centres over 2010–11.

Significant reductions occurred throughout 2010–11 to both the number of towns and the severity of restrictions. Pronounced reductions occurred in September and October 2010 following good inflows to storages over winter and early spring. At this time, Stage 3 restrictions for the greater Bendigo, Ballarat, Geelong and Melbourne areas were eased to less-severe levels and restrictions were removed for over 50 towns supplied from the Wimmera-Mallee pipeline (including Horsham). Other significant reductions occurred in January 2011, when restrictions for greater Bendigo and Ballarat were lifted, and in March 2011, when restrictions for greater Geelong and the Bellarine Peninsula were also removed.

At the end of June 2011, approximately 480 towns were not on water restrictions but were subject to Permanent Water Saving Rules.

Water consumption decreased marginally compared to 2009–10. Despite this, urban water businesses reported that domestic metered water use was 4.19%, or 13,470 ML, lower in 2010–11 compared to 2009–10.

**Figure 2-1 Number of Victorian towns on restrictions, July 2009 to June 2011**

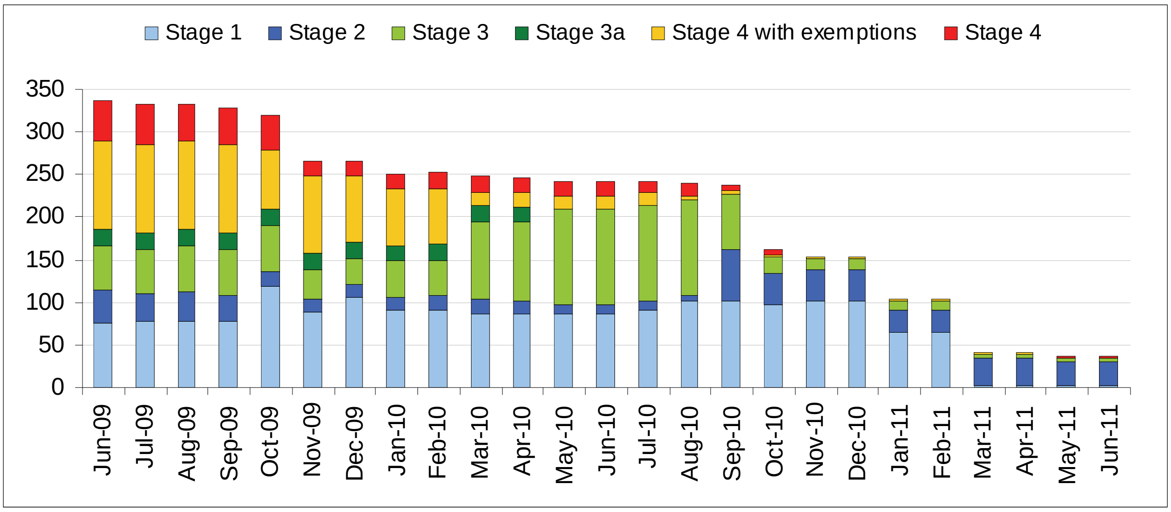
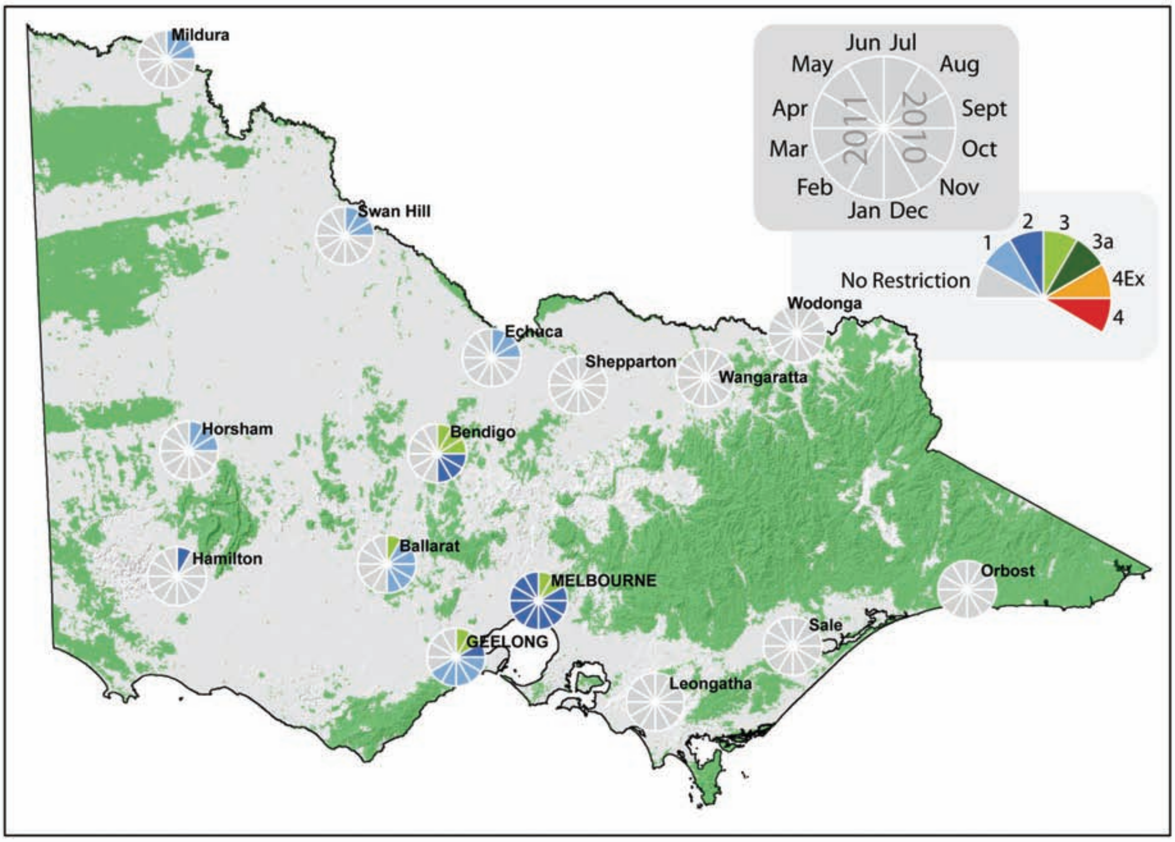



**Figure 2-2 Changes in restrictions levels for major towns, 2010–11**




### 2.2.2 Seasonal allocation of water in irrigation districts

The amount of water made available to irrigators in regulated systems each year is determined by seasonal water allocations. The seasonal allocation differs from urban restrictions in that every year each irrigator is allocated a share of the available resource which will vary from year to year. An irrigator's seasonal allocation can be used at any time throughout the irrigation season.

Seasonal allocations in declared water systems are expressed as a percentage of high-reliability and low-reliability water shares. Water entitlements in the regulated systems of northern Victoria were converted to high- and low-reliability water shares when unbundled on 1 July 2008. Unbundling extended to the Werribee–Bacchus Marsh and Thomson–Macalister water systems on 1 July 2009.

Initial allocations are made early in the irrigation season, 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.

The 2010–11 seasonal allocations for Victoria's irrigation districts are shown in Table 2-1. Allocations across the State reached the highest levels for many years.

For the first time in almost a decade, all the northern Victorian irrigation districts reached 100% allocation for high-reliability entitlements, Low-reliability allocations also reached 100% in the Broken, Bullarook and Campaspe systems, but remained at 0% in the Murray and Goulburn systems.

In southern Victoria, allocations reached 100% for both high- and low-reliability entitlements for the first time since 2007–08 in the Macalister irrigation district. Allocations in the Werribee and Bacchus Marsh irrigation districts reached 100% for high-reliability water shares and 55% for low-reliability water shares after successive years of very low allocations.

### Table 2-1 Seasonal irrigation water allocations

| Irrigation system | | Initial allocation August 2010 (% of entitlement) | Mid-season allocation February 2011 (% of entitlement) | Final allocation 2010–11 May 2011 (% of entitlement) | 2009–10 final allocation (% of entitlement) |
|---|---|---|---|---|---|
| Murray (% HRWS)(1) | | 23 | 100 | 100 | 100 |
| Goulburn (% HRWS)(1) | | 26 | 100 | 100 | 71 |
| Broken (% HRWS)(1) | | 21 | 100 | 100 | 17 |
| Broken (% LRWS)(1) | | 0 | 100 | 100 | 0 |
| Campaspe (% HRWS) (1) | | 21 | 100 | 100 | 0 |
| Campaspe (% LRWS) (1) | | 0 | 100 | 100 | 0 |
| Loddon (% HRWS) (1) | | 26 | 100 | 100 | 3 |
| Bullarook (% HRWS) (1) | | 100 | 100 | 100 | 19 |
| Bullarook (% LRWS) (1) | | 0 | 100 | 100 | 0 |
| Wimmera (% entitlement volume)(2) | | 36 | 100 | 100 | 0 |
| Thomson–Macalister (% HRWS)(3) | | 90 | 100 | 100 | 100 |
| Thomson–Macalister (% LRWS) (3) | | 0 | 10 | 100 | 45 |
| Werribee and Bacchus Marsh (% HRWS) (3) | | 16 | 100 | 100 | 14 |
| Werribee and Bacchus Marsh (% LRWS) (3) | | 0 | 45 | 55 | 0 |
| Maribyrnong (% licence volume)(4) | Southern Rural Water | 0 | 50 | 100 | 0 |
| | Melbourne Water | 0 | Continue to access unregulated flows | Continue to access unregulated flows | 0 |

Irrigation system key:

HRWS – high-reliability water share

LRWS – low-reliability water share

Notes:

(1) Data for the initial allocation is reported for 16 August 2010, mid-season allocation is reported for 15 February 2011, and final allocation is reported for 1 April 2011.

(2) Data for the initial allocation is reported for 1 September 2010, mid-season allocation is reported for 2 February 2011 and final allocation is reported for 1 June 2011.

(3) Data for the initial allocation is reported for 19 August 2010, mid-season allocation is reported for 8 February 2011, and final allocation is reported for 19 April 2011.

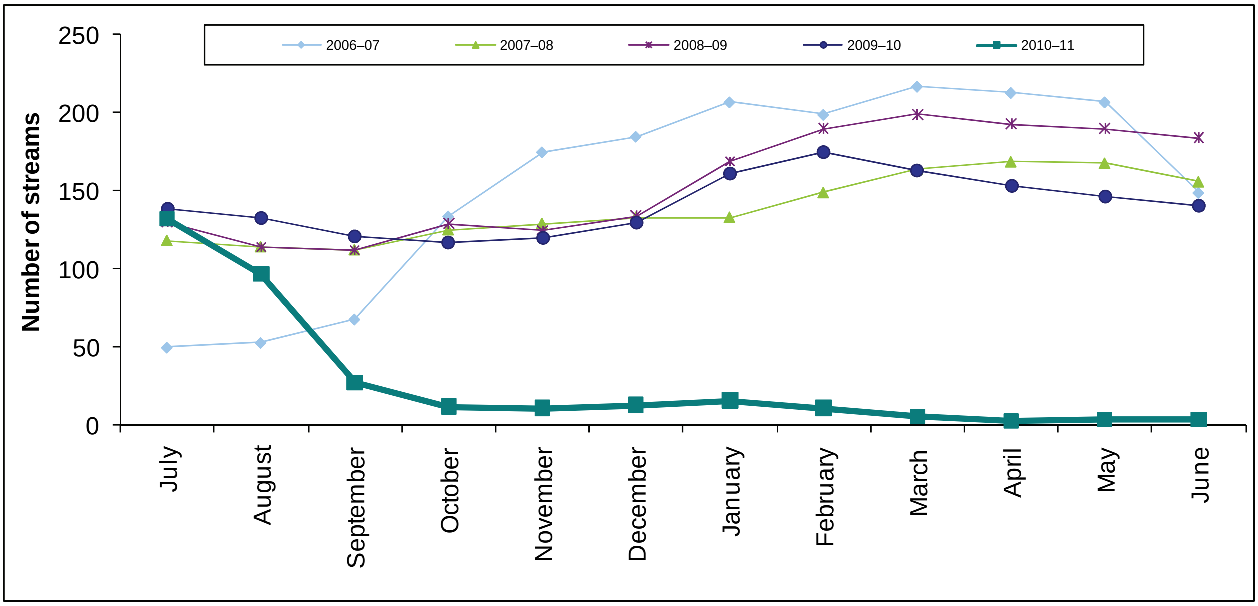
(4) Data for the initial allocation is reported for August 2010, mid-season allocation is reported for February 2011, and final allocation is reported for June 2011.

### 2.2.3 Restrictions on diversions from unregulated streams

When streamflow in an unregulated stream drops below a specified threshold, water corporations have the power to impose restrictions, rosters and bans on the water taken from streams by licensed diverters. Rosters and restrictions set out the order in which licence holders are allowed to take water and the quantity allowed to be taken (for example, 75% of licensed volume). When water is particularly scarce, bans are imposed on diversions from waterways.

Restrictions on diversions from unregulated streams typically fluctuate 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 lifted over the winter and spring seasons. However, as shown in Figure 2-3, restrictions on diversions in 2010–11 did not follow this trend. Instead, restrictions were at their most severe in winter at the beginning of 2010–11, after successive years of dry conditions. With above-average spring and summer rainfall, the number of streams subject to restrictions had dropped to 27 by the end of September 2010 and continued to decrease to the end of June 2011, when only four unregulated streams remained on restrictions.

### Figure 2-3 Number of Victorian unregulated streams on restrictions, 2006-07 to 2010-11




## 2.2.4 Seasonal allocations of groundwater in water supply protection areas

Seasonal allocations are announced in accordance with the groundwater management plans developed for some WSPAs. 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 2010–11, seasonal allocations applied for the following management areas:

- Katunga WSPA (70% allocation)
- Lower Campaspe Valley WSPA (75% allocation)
- Loddon Highlands WSPA (80% allocation)
- Deutgam WSPA (total use ban from 1 July 2010 which moved to a 75% allocation by the end of 2010–11).

## 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 2-2 summarises the towns that received carted water in 2010–11. In contrast to recent years in which water carting was required to address water scarcity, it was necessary to cart water to many towns in 2010–11 due to poor water quality that resulted from major flooding in spring and summer.

### Table 2-2 Towns receiving carted water 2010–11

| Basin | Water corporation | Town(s) receiving water | Source of water | Period |
|---|---|---|---|---|
| Ovens | North East Water | Bundalong | Yarrawonga | 7 to 22 September, 15 to 23 December, 27 January, 16 to 17 February, 11 May to end year |
| | | Mohu | Wangaratta | 5 November to 12 January |
| | | Oxley | | 11 to 12 January |
| | | Springhurst | | 1 July to 7 September |
| Loddon | Coliban Water | Mitiamo and Macorna | Bendigo | 4 March to 6 May |
| | | Raywood and Sebastian | | All year |
| | | Serpentine | | 1 July to 1 September |
| Wimmera & Avoca | GWMWater | Beulah, Brim, Donald, Jung, Lalbert, Manangatang, Minyip, Quambatook, Rupanyup, Ultima, Woomelang, Wycheproof | GWMWater system | 1 April to end year |

### 2.2.6 Augmenting water supply systems

A number of water businesses across the state upgraded their systems to augment their water supplies. While many of the emergency contingencies initiated in 2009–10 were continued in 2010–11, some important infrastructure projects progressed or completed during the year increased short- and long-term security of water supplies for urban and rural customers. Details of these projects are shown in Table 2-3.

A major water supply augmentation project that was undertaken in 2010–11 was the construction of a 150 GL/year desalination plant to service Melbourne, Geelong and towns in the Westernport and South Gippsland regions. This project also involves the construction of an 84-km pipeline to Melbourne. The project is expected to be completed by 2012.

#### Table 2-3 Infrastructure augmentations to improve water availability 2010–11

| Basin | Water business | Infrastructure | Description |
|---|---|---|---|
| Otway Coast | Barwon Water | Groundwater bores | Infrastructure upgrades including the construction of bores, a pre-treatment plant, pump stations and transfer mains for the Anglesea Borefield Project continued in 2010–11. The project commenced in December 2006 and was completed in 2011. In 2010–11, another bore was constructed and the bore field is now in production. |
| Wimmera | Central Highlands Water | Groundwater bores | Construction of the treatment facility continued as a part of the Landsborough Groundwater Project. Work completed in 2010–11 includes the construction and commissioning of the treatment facility. The project was completed in October 2011. |
| Avoca | Central Highlands Water | Groundwater Desalination | Work continued on the Avoca Groundwater Desalination Project to secure reliable drinking water supply and quality for the Avoca water supply system. Work completed in 2010–11 included the construction and commissioning of the water treatment facilities. The project was completed in July 2011. |
| Goulburn | Goulburn Valley Water | Pipeline | In December 2005 construction began of the Upper Goulburn Water Supply Project to provide better water quality. This involved the construction of a 7-km pipeline to Thornton and a 25-km pipeline to Eildon to transfer treated water from the Alexandra water treatment plant to the two towns. The project was completed in September 2011. |
| Loddon | Central Highlands Water | Groundwater | To improve water quality for the Lexton Water Supply System, investigations continued to locate a suitable groundwater resource for piping to the Lexton treatment plant. Work undertaken in 2010–11 included drilling investigations, planning and assessment of the pipeline route. |
| Loddon | Coliban Water | Pipeline | Work continued on the Raywood-Sebastian Pipeline Project which began in March 2009 to provide improved water quality and security. The pipeline will connect the towns of Raywood and Sebastian to the Bendigo water supply system. The project is expected to be completed in 2011–12. |
| Loddon | Goulburn-Murray Water | Pipeline | Goulburn-Murray Water continued the construction of the 145-km East Loddon pipeline and a 100 ML winter balancing storage. Work undertaken in 2010–11 included survey design and commencement of pipeline construction. The project is expected to be completed in 2011–12. |
| Tambo | East Gippsland Water | Storage tank | East Gippsland Water undertook the Swifts Creek tank relocation to increase the clear water volume availability. Works began in August 2010 and was completed in December 2011. |
| Ovens | North East Water | Storage | North East Water continued work to secure supply for Bright, Porepunkah and Wandiligong through plans to construct an off-stream raw water storage in the Upper Ovens catchment. Work undertaken in 2010–11 included an independent review of the site selection and design commencement. It is expected that the storage will be constructed in 2012–13. |
| Ovens | North East Water | Groundwater | An additional drought relief bore was also constructed in 2010–11 at Bright to augment surface water supply if required. |
| Ovens | North East Water | Plant | To improve water quality and security, North East Water is upgrading the Whitfield water supply through the construction of a new treatment plant and pipeline to connect the town to the King River rather than to Musk Gully Creek. The project commenced in July 2010 and is expected to be complete by June 2012. Works completed in 2010–11 included the design and survey. |
| Ovens | North East Water | Pipeline | To improve water quality and security, North East Water is constructing a pipeline from Chiltern to Springhurst. A pipeline exists from Wodonga to Chiltern, which will be extended 18-km to Springhurst. The project commenced in July 2010 and is expected to be complete in December 2011. Works completed in 2010–11 included design, survey, tender and commencement of construction. |

| | | | |
|---|---|---|---|
| Ovens | North East Water | Pipeline | To improve water quality and security and to reduce outdoor potable water usage, North East Water is constructing a pipeline from Yarrawonga to Bundalong (potable) and will maintain the town's existing supply from Lake Mulwala as a third pipe raw water supply for outdoor use in Bundalong. In 2010–11 work was done to plan and design the pipeline: it is expected to be completed in 2012. |
| Murray | East Gippsland Water | Storage | East Gippsland Water has constructed an additional raw water storage to improve the reliability of supply to Omeo when streamflow in Butchers Creek is low. Construction of the 10 ML storage began in August 2010 and was completed in April 2011. |
| Thomson | Southern Rural Water | Automation | Channel automation works continued to be undertaken, with flume gates being retrofitted to 50 regulators. In 2010–11, construction was completed and the system was tuned. This project was completed in December 2011. |
| Glenelg | Wannon Water | Pipeline | Wannon Water completed construction of the 52-kilometre Hamilton–Grampians pipeline in June 2010. The pipeline enables Wannon Water to transfer up to 2,000 ML of water annually from Rocklands Reservoir to supplement existing supplies from the Southern Grampians system. |
| South Gippsland | Westernport Water | Storage | Westernport Water is investigating the option of increasing the height of the Candowie Reservoir dam wall by up to 3 m to improve water supply security. This project is expected to be completed in June 2013. Work completed in 2010–11 includes the continuation of detailed design and business case development. |
| South Gippsland | Melbourne Water & DSE | Augmentation | Construction of a 150 GL/year desalination plant is currently taking place to service Melbourne, Geelong and towns in the Westernport and South Gippsland regions. The project also involves the construction of an 84-km pipeline to Melbourne. Works are expected to be completed by 2012. |
| South Gippsland | South Gippsland Water | Storage | Construction of the Toora Clearwater Storage Project to provide 4 ML of off-stream storage for the Toora Water Treatment plant began in June 2010. The project is expected to be completed in 2011–12. |
| Campaspe | Goulburn-Murray Water | Decommissioning | In 2010, decommissioning of the Campaspe Irrigation District began to achieve water savings. This will see irrigators being supplied from other systems. In 2010–11, the Campaspe Irrigation District merged with the Goulburn–Murray Irrigation District. |
| East Gippsland | East Gippsland Water | Groundwater augmentation | East Gippsland Water completed the Mallacoota Groundwater Augmentation in March 2011. This involved the construction of three groundwater bores to secure 100 ML of additional water to meet projected demands. |
| Latrobe | Gippsland Water | Pipeline | Gippsland Water continued construction of the 9-km pipeline from Yinnar to Boolarra to improve water security. The project commenced in November 2010 and is ongoing due to wet conditions. In 2010–11 the majority of the pipeline was constructed. |
| Latrobe | Gippsland Water | Pipeline | The Moe–Darnum Interconnection Pipeline Project continued. It is designed to reduce demand from the Tarago system through provision of water from the Moe system. The project commenced in March 2011 and is ongoing due to wet conditions. In 2010–11, the majority of the pipeline was constructed. |
| Bunyip | Melbourne Water & DSE | Augmentation | Construction of a 150 GL/year desalination plant is currently taking place. The desalinated water will be transported to Cardinia Reservoir by an 84-km pipeline to then supply both Melbourne and Geelong towns. Works are expected to be completed by 2012. |
| Bunyip | Gippsland Water | Pump station | Gippsland Water completed work on the Rokeby raw water pump station in 2010–11 The pump station will be used to transfer water from Melbourne Water's Westernport pipeline to Gippsland Water's Pederson pipeline. The project commenced in January 2010 and was completed in October 2010. |
| Bunyip | Melbourne Water | Pump station | Melbourne Water completed construction of the Cardinia Pump Station in 2011. This will transfer desalinated water from Cardinia Reservoir to Silvan Reservoir. |
| Werribee/Barwon | Barwon Water | Pipeline | Work commenced on the Melbourne to Geelong pipeline and a pump station to create a new water supply for Geelong. Work completed in 2010–11 includes the construction of a 31-km pipeline, connecting pipe works at Werribee and commencement of construction of the pump station. The project is expected to be completed in early 2012. |

### 2.2.7 Qualification of rights

With significant improvements to water reserves in 2010–11, there were no new qualifications to surface water rights made by the Minister during the year. However, 10 qualifications made in previous years continued into 2010–11 to ensure critical needs could be met if water shortages had continued. These are summarised in Table 2-4 and more detail is provided in the water accounts chapters for the relevant basins.

In July 2010, the Minister restored annual environmental flows of 22,000 ML to the Thomson and Yarra Rivers that were being retained in storage to supplement Melbourne's water supplies. Under the qualification of rights, the environmental flows were not due to be returned until Melbourne eased to lower restrictions, but water projects, conservation and better rainfall allowed the flows to be restored earlier.

In mid-October 2010, the Minister revoked all remaining qualifications in the Broken, Goulburn, Murray, Thomson and Yarra basins. Only qualifications in the Campaspe and Loddon basins continued, in order to maintain flexibility in the delivery of environmental water, preserve access to environmental water retained in storage under the terms of the qualifications, and to support an allocation on the Coliban rural system.

At the end of June 2011, all remaining qualifications to surface water expired.

The Minister for Water did not qualify any rights to groundwater entitlements in 2010–11. The Deutgam WSPA was subject to a total use ban for the beginning of 2010–11 as a result of a qualification in 2009-10. The amount of water that groundwater licence holders could use was increased to 25% on 4 January 2011 and then to 75% from 16 March. This remained in place up to 30 June 2011.

### Table 2-4 Qualifications of surface water rights in 2010–11

| Basin | Number of qualifications in place | Qualification type | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | New diversion point provided | Extended pumping/ diversion times | Reduced passing flow requirements | Differential access by priority entitlements | Modified cap | Access to unallocated water provided | Environmental water traded on market | Volume carried over |
| Murray | 1 | | | | | | | | |
| Broken | 1 | | | | | | | | |
| Goulburn | 2 | | | | | | | | |
| Campaspe | 1 | | | | | | | | |
| Loddon | 2 | | | | | | | | |
| Thomson | 2 | | | | | | | | |
| Yarra | 1 | | | | | | | | |
| Total | 10 | | | | | | | | |

## 2.3 Conclusion

Between 1997 and 2010, Victoria's rainfall pattern was unprecedented. During the period 2010–11, rainfall increased compared to the previous drought period and water resource availability increased. Streamflows in 2010–11 were generally above the long-term average conditions, and significantly higher than those experienced during the previous 13 years.

Some major infrastructure projects were undertaken in 2010–11 which helped to provide water to users. Augmentation works were also undertaken by water businesses in response to the long-term water shortages that had previously been experienced. Restrictions were eased for all towns across Victoria in 2010–11.

# 3 Water for consumptive use

## 3.1 Consumptive entitlements

Table 3-1 presents a summary of Victoria's consumptive entitlements in both 2010–11 and 2009–10. 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. The volume of bulk entitlements stayed constant in 2010–11.Groundwater entitlements also decreased compared to 2009–10.

The volume of groundwater licenses declined slightly in 2010–11 compared to 2009–10, although the number of licences rose slightly in 2010–11.

The impact of small-catchment dams remained consistent with that reported for the 2009–10 period. This is a function of the method used to estimate farm dam impacts, which differs only for dry conditions. Estimates of volumes taken by small-catchment dams use the method developed by DSE for the Flow Stress Ranking Project. In 2010–11, it was assumed that the usage and impact of farm dams was consistent with an average year. This is consistent with the approach used for 2009–10.

### Table 3-1 Consumptive water entitlements in Victoria as at 30 June 2010 and 2011

| Entitlement | Volume 2010–11 (ML) | Volume 2009–10 (ML) |
|---|---|---|
| Surface water | | |
| Bulk entitlements[(1)] | 5,781,850 | 6,167,550 [(5)] |
| Licences[(2)] | 425,755 | 338,189 |
| Small-catchment dams (mainly domestic and stock)[(3)] | 523,200 | 523,200 |
| Groundwater licences | 957,630 | 993,700 |
| Groundwater bulk entitlement [(4)] | 10,000 | 10,000 |
| **Total water entitlements** | **7,698,435** | **8,032,639** |

Notes:

(1) An estimate of the total volume of bulk entitlements granted as at 30 June 2011. Total volume does not include environmental entitlements.

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

(3) An estimate of water taken by small-catchment dams in 2010–11 including domestic dams, stock dams and small-catchment dams for commercial and irrigation use. The latter are required by the *Water Act 1989* to be licensed or registered, a process that is currently underway. The 2010–11 estimate may include some water that has been double counted. This is because some water previously classified as from a small-catchment dam may now also be counted as a licensed volume.

(4) 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 extract more than an average of 7,000 ML per year over any five-year period.

(5) The bulk entitlements for 2009–10 differs from the value of 6,008,150 ML reported in the *Victorian Water Accounts 2009–2010* due to updated data.

## 3.2 Water availability and use

The volume and use of Victoria's water resources for 2010–11 is summarised in Table 3-2.

It is important to note that the water-use data presented in this overview and in these 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.

Consistent with previous years, the volume of water entitlements issued in Victoria was less than the available resource. Table 3-2 shows that the available streamflow in 2010–11 was more than 43,000,000 ML, which is greater than the 7,058,010 ML of entitlements issued across the state.

The substantial difference between the volume of issued entitlements and volume of water used in 2010–11 demonstrates an important feature of the water allocation framework: an entitlement does not necessarily guarantee that the entitlement volume will always be available for use. An entitlement holder must meet all the conditions attached to their entitlement including meeting passing flow obligations and sharing any shortfall of the available water with other entitlement holders, including the environment. In 2010–11, water businesses addressed each shortfall by drawing on their reserves in storage and reducing their customers' use of water (through urban restrictions and irrigation allocations) to ensure that they operated within the conditions of their entitlements. Higher rainfall has also reduced the volume of water that is needed by users. As a consequence, the total volume of water extracted by water businesses and individuals from waterways across the state was significantly less than the total resource. The range of drought contingency measures by water businesses is discussed in Chapter 2 and the basin water accounts.

### Table 3-2 Victoria's water availability and water taken for consumptive use in 2010–11

| | Surface water(1) (ML) | Groundwater(2) (ML) | Recycled water (ML) |
|---|---|---|---|
| Total resource | 45,714,200 | 1,005,660 | 496,010 |
| Entitlement | 6,730,800 | 967,630 | not available |
| Water used | 2,822,590 | 221,100 | 117,640 |

Notes:

(1) Catchment inflow as shown in each basin water balance in the *Victorian Water Accounts 2010–11*, excluding inter-basin transfers, irrigation return flows and recycled water.

(2) The actual groundwater resource (that is, the volume of water in aquifers) is unknown. For the *Victorian Water Accounts 2010–2011*, the total resource has been assumed to be the sum of the allocation limit. For 2010–11, in some instances the licensed entitlement may be higher than the PCV, based on dairy wash licences moving into the licensing framework. PCVs will be adjusted to account for this.

## 3.2.1 Diversions under surface water consumptive entitlements

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).

Table 3-3 and Figure 3-1 show the diversions made under consumptive entitlements for each of the above four categories.

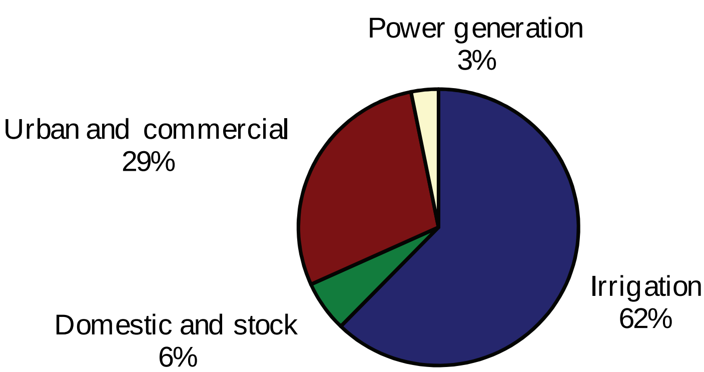
### Table 3-3 Surface water diversions made under consumptive entitlements 2010–11

| Consumptive end use | Volume of water diverted (ML) |
|---|---|
| Irrigation | 1,762,560 |
| Domestic and stock | 166,630 |
| Urban and commercial | 803,630 |
| Power generation | 89,770 |
| **Total consumptive diversions 2010–11** | **2,822,590** |
| Total consumptive diversions 2009–10 | 3,305,660 |

As shown in Table 3-3, the volume of water taken under consumptive bulk entitlements in 2010–11 decreased, compared to 2009–10. The decrease in 2010–11 was a result of decreased usage for irrigation and domestic and stock purposes. Water diverted for urban and commercial and power generation increased, compared to 2009–10.

Irrigation continues to be the highest category of water use in the state, comprising 62% of all diversions (Figure 3-1). This portion has decreased slightly, compared to 2009–10.

### Figure 3-1 Total surface water diversions for consumptive purposes in Victoria, 2010–11



### 3.2.2 Urban surface water consumption

Consumption in urban areas is often measured by the metered volume of water delivered to customers. This figure differs from the water-use figures presented in Table 3-3 and Figure 3-1 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 3-3 and Figure 3-1.

Metered urban water consumption in Victoria decreased in 2010–11, compared to 2009–10. Total urban water consumption by residential users decreased by 1% compared to 2009–10, and non-residential use decreased by 4% in 2010–11 compared to 2009–10. The largest decreases were in regional Victoria, with regional residential and non-residential customers decreasing their water consumption by 11% and 8% respectively. Table 3-4 is represented as a pie chart in Figure 3-2.

Urban consumption declined from 2009–10 to 2010–11, consistent with the reduction in total diversions over the same period.

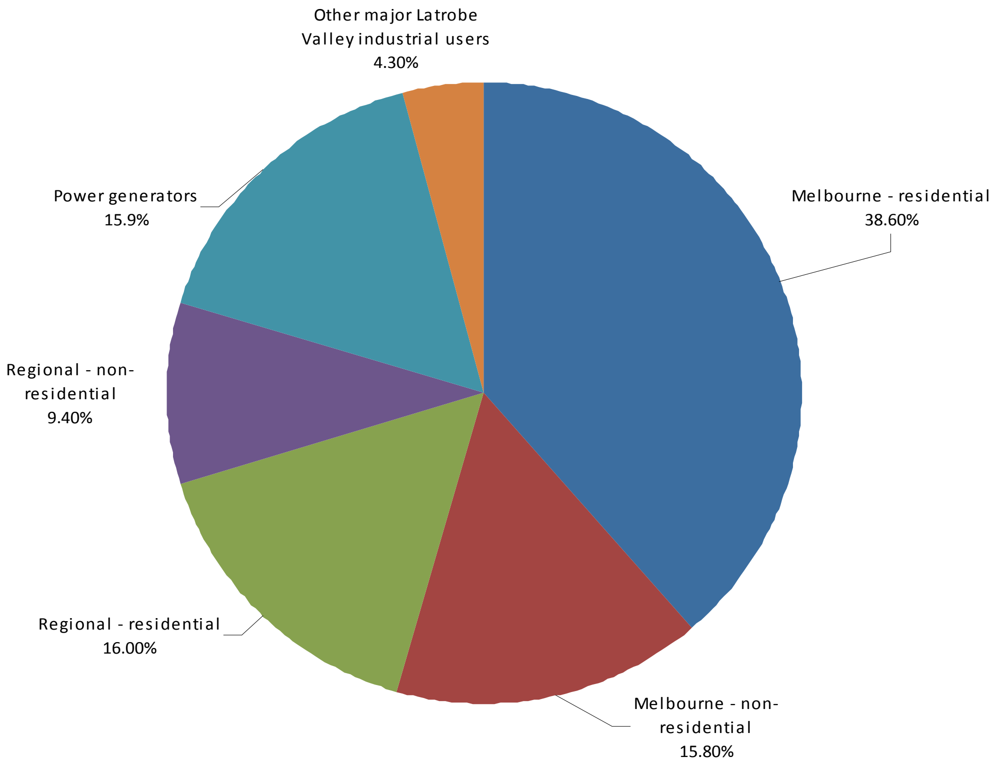
#### Table 3-4 Urban metered water consumption in Victoria 2010–11

| | 2010–11 (ML) | 2009–10 (ML) | Change (%) |
|---|---|---|---|
| Melbourne – residential | 217,720 | 219,740 | -1% |
| Melbourne – non-residential | 89,170 | 93,040 | -4% |
| Regional – residential | 90,140 | 101,590 | -11% |
| Regional – non-residential | 53,380 | 58,010 | -8% |
| Power generators (1) | 89,770 | 87,950 | 2% |
| Other major Latrobe Valley industrial users | 24,229 | 23,095 | 5% |
| **Total urban consumption** | **564,409** | **583,425** | **-3%** |

Note:

(1) Water consumption for power generators with their own bulk entitlements represents the volume of water diverted under those bulk entitlements and not necessarily what was ultimately used for power generation.

#### Figure 3-2 Consumptive uses of urban and commercial metered water in Victoria, 2010–11




### 3.2.3 Consumption by major users

Section 122ZJ of the *Water Act 1989* and section 77A of the *Water Industry Act 1994* require each Victorian urban water corporation and metropolitan retailer to publicly report on its major urban water customers each year.

As per the annual reporting requirements specified by the Minister for Water, all water businesses published in their annual reports the number of non-residential urban water customers using 200 ML or greater in 2010–11, categorised by a range of water consumption bands. This reporting requirement was a change from previous years in which water businesses were required to report on non-residential urban water customers using 50 ML or greater.

Table 3-5 presents a summary of the major water user information.

### Table 3-5 Major urban water users in Victoria 2010–11 and 2009–10

| Water consumption | Number of customers | |
|---|---|---|
| | 2010–11 | 2009–10 |
| Equal to or greater than 200 ML and less than 300 ML | 29 | 32 |
| Equal to or greater than 300 ML and less than 400 ML | 13 | 9 |
| Equal to or greater than 400 ML and less than 500 ML | 11 | 11 |
| Equal to or greater than 500 ML and less than 750 ML | 5 | 10 |
| Equal to or greater than 750 ML and less than 1,000 ML | 4 | 2 |
| Greater than 1000 | 12 | 12 |
| **Total customers** | **74** | **76** |

Note: East Gippsland Water, Western Water, Westernport Water and Melbourne Water do not have any major non-residential water customers as defined under section 122ZJ of the Water Act 1989.

There were 74 customers using 200 ML or more water across Victoria: 35 metropolitan Melbourne customers and 39 regional water customers. The total number of customers using 200 ML or more in 2010–11 has decreased by two, compared to 2009–10.

The Victorian Government and water businesses actively work with commercial and industrial customers on their water efficiency and trade waste management through targeted incentive and customer engagement programs.

The WaterMAP program, which requires all Victorian urban non-residential customers using 10 ML or more water a year to develop a water management action plan (waterMAP) in accordance with their local water business, has been in place since 2007. WaterMAP is a tool to help these customers plan long-term water efficiency measures.

In 2010–11 there were 1,650 participating waterMAP customers across Victoria: they saved approximately 5.5 billion L of water over the year. Over the life of the program, waterMAP customers have collectively saved approximately 22 billion L of water. These savings are significant, as the long-term water efficiency improvements implemented lead to ongoing savings.

## 3.3 Urban water conservation measures

### 3.3.1 Water Smart Gardens and Homes Rebates Scheme

A key component of the state's water efficiency strategy was the Water Smart Gardens and Homes Rebate Scheme.

Over 305,430 rebates for urban water customers have been provided since January 2003, saving almost 3.2 billion L of potable water each year (to 30 June 2011).

Generally, all rebate numbers were lower for 2010–11 than in the previous year. This is partially due to the wetter weather and reduction of water restrictions across the state.

Dual-flush toilet rebates were increased to $100 from $50 for the 2010–11 year and almost 6,000 rebates were granted. They were supported by the toilet retrofit program in Melbourne which provided dual-flush toilets fully installed at a discount price.

### Table 3-6 Rebates approved under the Water Smart Gardens and Homes Rebates Scheme

| Product | 2010–11 | 2009–10 | 2008–09 | 2007–08 | 2006–07 |
|---|---|---|---|---|---|
| AAA shower rose | 170 | 225 | 375 | 513 | 2,112 |
| AAA shower rose (1) | 366 | 503 | 577 | 345 | N/A |
| Dual flush toilet (2) | 5,935 | 7,067 | 1,532 | 1,845 | 3,389 |
| Greywater permanent tank system | 153 | 473 | 618 | 790 | 704 |
| High pressure cleaning device(3) | | N/A | N/A | 55 | 705 |
| Hot water recirculator (1) | 25 | 48 | 58 | 45 | N/A |
| Rainwater tank to toilet system | 95 | 487 | 271 | 172 | 399 |
| Rainwater tanks ($150 rebate) | 787 | 3,091 | 4,462 | 5,191 | 4,385 |
| Water conservation audit (4) | 2,490 | 890 | 10,289 | 5,446 | 822 |
| Rebate when purchasing $100 worth of goods | 13,185 | 19,713 | 27,717 | 14,554 | 19,847 |
| Large tank rebates: 2000 - 3999 (4999) L (connected to toilet or laundry)(5) (6) | 274 | 720 | 668 | 850 | 241 |
| Large tank rebates: > 4000 (5000) L (connected to toilet or laundry)(4) (5) | 498 | 1,203 | 810 | 749 | 172 |
| Large tank rebates: > 4000 (5000) L (connected to toilet and laundry)(4) (5) | 829 | 1,704 | 1,303 | 1,320 | 278 |
| **Total number of rebates** | **24,807** | **36,124** | **48,680** | **31,875** | **33,054** |

Notes:

(1) Rebate commenced 1 July 2007.

(2) Dual flush toilet rebate was $100 for 2010–11.

(3) Rebate finished June 2006.

(4) Rebate increased to $50 on 1 January 2007.

(5) Rebate commenced on 1 January 2007.

(6) Large tank sizes changed to 4,000 L from 1 July 2009.

N/A: Not applicable

### 3.3.2 Urban residential water consumption

Despite significantly greater rainfall in 2010–11 than in preceding years, Victoria's urban residential water consumers maintained water consumption at desirable levels.

Table 3-7 provides urban residential water consumption figures for the top 20 population centres in Victoria.

While half of the population centres represented in the table spent the whole reporting period on permanent water savings rules, Melbourne remained on water restrictions throughout, and Ballarat, Bendigo and Horsham were on water restrictions in the early part of 2010–11 before moving to permanent water savings rules.

Almost all locations reduced their per capita daily water consumption for 2010–11, compared to 2009-10. Mildura achieved a drop in daily water consumption of 120 L per capita from the 2009–10 figure, to 377 L per capita for 2010–11.

Total volumes of water consumed have been obtained from the 2010–11 annual reports of relevant water corporations while the average volumes of consumption have been calculated by DSE.

The data presented in the table is not intended to be comparative, in view of the different levels of restrictions applying, different climatic conditions driving demand for water, and different dwelling densities across the population centres.

Information within the table on water restrictions applicable to locations in 2010–11 adds context to the water consumption levels for each location.

Locations identified in the table may incorporate surrounding districts. Refer to the notes to establish whether additional locations are accounted for in locations identified.

At a different scale, Figure 3-3 provides a geographical context in which differing water consumption levels are recorded on a water corporation basis.

## Table 3-7 Urban residential water consumption and water restriction levels for the top 20 population centres in Victoria 2010–11

| Location | Permanent population | Average residential consumption (L) per capita per day (1) | Total residential consumption (ML) (1) | Water restrictions levels | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | July 2010 | August 2010 | September 2010 | October 2010 | November 2010 | December 2010 | January 2011 | February 2011 | March 2011 | April 2011 | May 2011 | June 2011 |
| Bacchus Marsh | 20,469 | 157 | 1,175 | | | | | | | | | | | | |
| Bairnsdale | 26,622 | 234 | 2,276 | | | | | | | | | | | | |
| Ballarat & district [2] | 105,386 | 150 | 5,758 | | | | | | | | | | | | |
| Bendigo | 88,824 | 167 | 5,402 | | | | | | | | | | | | |
| Colac & district | 15,264 | 261 | 1,452 | | | | | | | | | | | | |
| Cowes & district | 13,176 | 201 | 966 | | | | | | | | | | | | |
| Echuca | 13,262 | 228 | 1,105 | | | | | | | | | | | | |
| Geelong [3] | 264,526 | 165 | 15,979 | | | | | | | | | | | | |
| Horsham | 13,593 | 237 | 1,176 | | | | | | | | | | | | |
| Melbourne | 4,047,190 | 147 | 217,650 | | | | | | | | | | | | |
| Melton | 57,859 | 145 | 3,069 | | | | | | | | | | | | |
| Mildura [4] | 42,011 | 377 | 5,779 | | | | | | | | | | | | |
| Moe/Newborough [5] | 22,412 | 188 | 1,542 | | | | | | | | | | | | |
| Morwell/Traralgon & surrounds | 52,983 | 211 | 4,082 | | | | | | | | | | | | |
| Shepparton [6] | 52,742 | 224 | 4,314 | | | | | | | | | | | | |
| Sunbury/Macedon | 65,642 | 136 | 3,267 | | | | | | | | | | | | |
| Wangaratta | 19,655 | 192 | 1,375 | | | | | | | | | | | | |
| Warragul/Drouin [7] | 24,986 | 173 | 1,575 | | | | | | | | | | | | |
| Warrnambool | 32,255 | 165 | 1,947 | | | | | | | | | | | | |

| Legend | |
|---|---|
| Permanent Water Savings Rules | |
| Stage 1 | |
| Stage 2 | |
| Stage 3 | |
| Stage 3a | |
| Stage 4 with exemptions | |
| Stage 4 | |

Notes

(1) Totals appearing in this column are sourced where possible from 2010–11 annual reports for the relevant water corporations.

(2) Ballarat includes Ballan, Corindhap, Creswick, Scarsdale, Skipton and Wallace.

(3) Geelong includes Lara, Batesford, Waurn Ponds, Fyansford and adjoining semi-rural development, Leopold, Drysdale, Clifton Springs, Portarlington, Indented Head, St Leonards, Queenscliff, Point Lonsdale, Ocean Grove, Barwon Heads, Torquay, Jan Juc, Anglesea, Winchelsea and Birregurra.

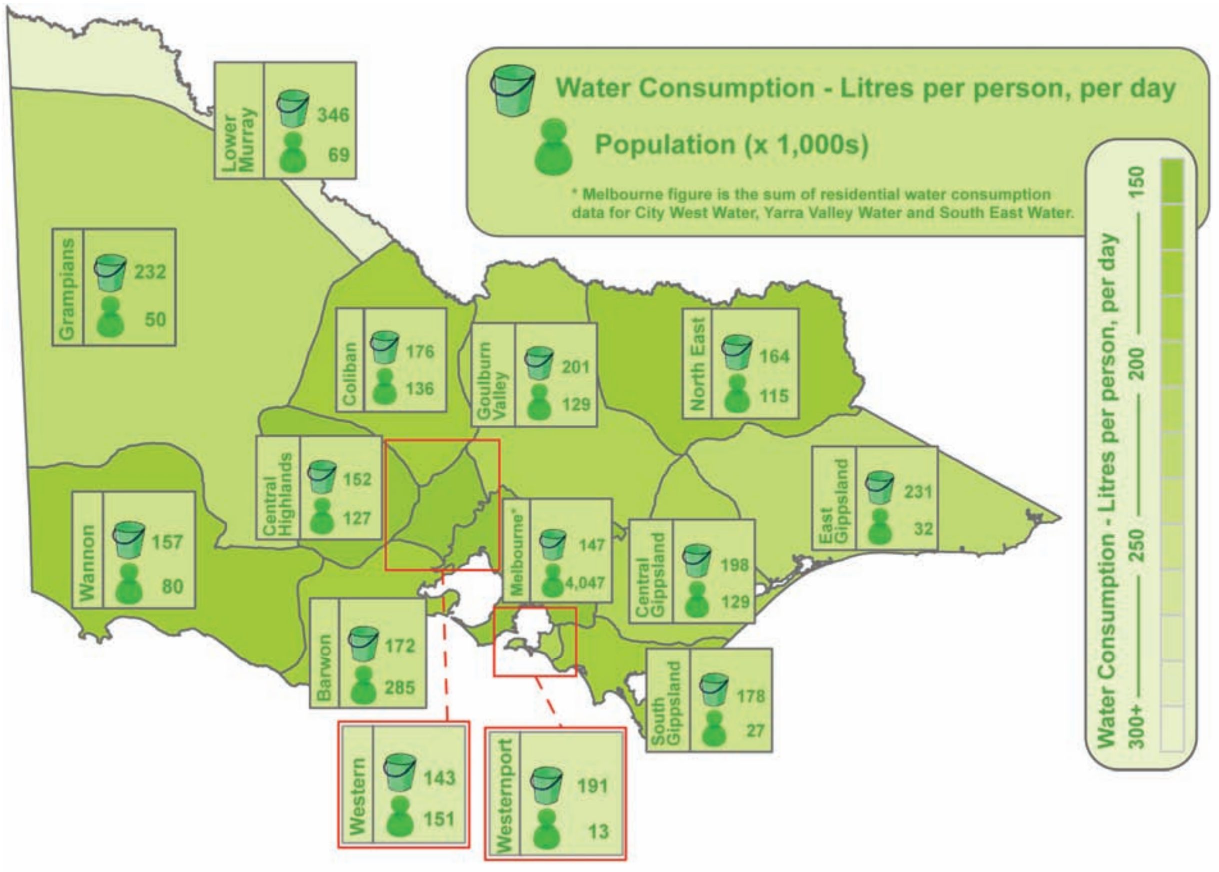
(4) Mildura includes Merbein and Irymple.

(5) Includes supplies to Moe, Newborough, Trafalgar, Yarragon, Yallourn and Yallourn North.

(6) Shepparton includes Congupna, Tallygaroopna, Mooroopna and Toolamba.

(7) Includes supplies to Buln Buln, Darnum, Drouin, Nilma, Rokeby and Warragul.

**Figure 3-3 Daily per-capita water consumption, 2010–11, by water corporation**




### 3.3.3 Schools Water Efficiency Program

The Schools Water Efficiency Program (SWEP) commenced in 2006 and offered schools the opportunity to identify and implement low-cost solutions to achieve indoor water savings. SWEP was completed in 2010. 1739 schools participated in the program. The results from participating schools (which undertook works) were significant, with water savings averaging 12.6% per school or an annual total of 271 million L. SWEP exceeded the target of 12.5% water saving at schools set at the start of the program.

The assistance provided by the Department of Education and Early Childhood Development in mandating that all Victoria's public schools participate in SWEP helped to gain a high level of participation by schools. This has resulted in an understanding about what other action may be taken to save water in our public schools through audit reports prepared for the various schools.

Work on a new initiative to assist in monitoring the ongoing water use of schools, and to use this information in the classroom, started in 2010–11. This data-logging project will assist in finding water leaks in schools and provide information to students to teach them about water use at their school. This project is scheduled to commence in the classroom in early 2012.

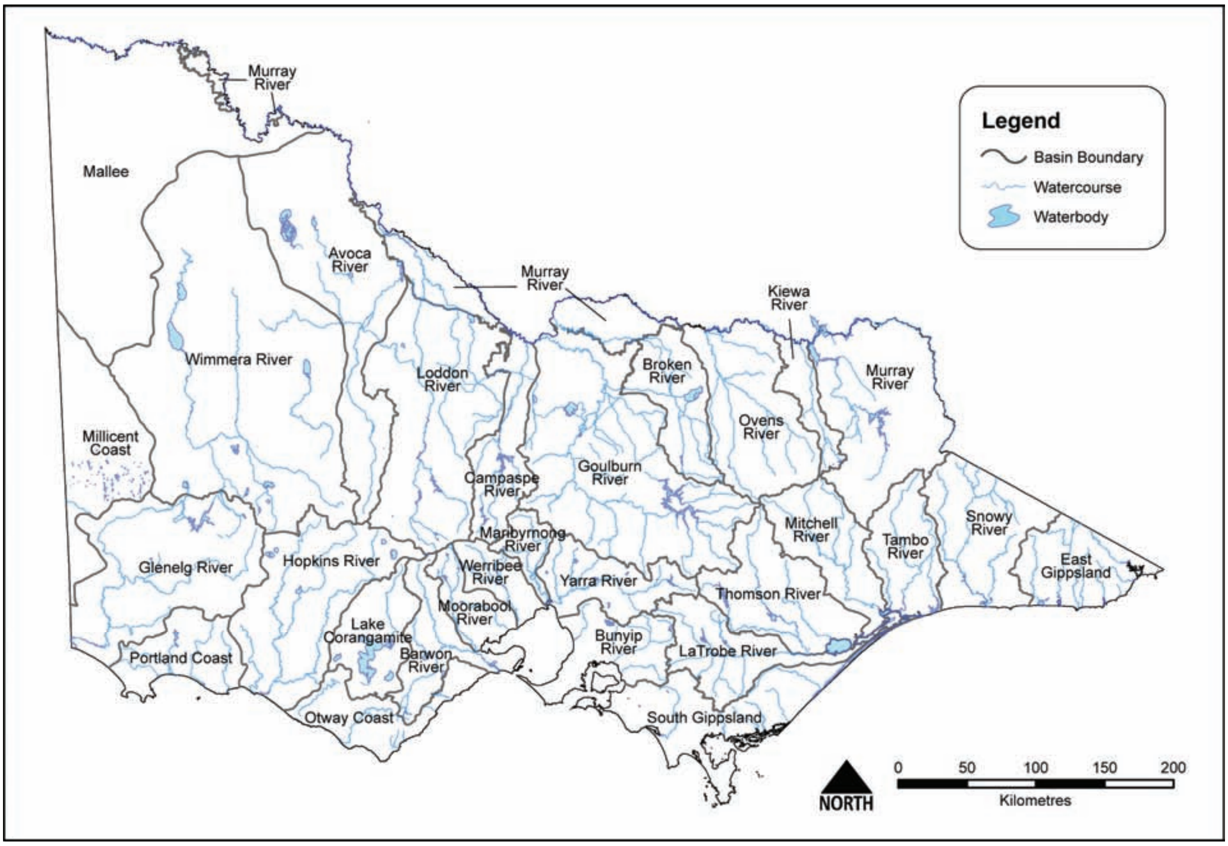
## 3.4 Surface water entitlement and use

This section provides an overview of the extractions of surface water under bulk 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 River Murray downstream of Lake Hume. The extent of each of Victoria's river basins is shown in Figure 3-4.

Refer to Part 2 of this report for details of water availability and use in each basin.

## Figure 3-4 River basins in Victoria




Water businesses have an obligation to report on water diversions against their entitlements in their annual reports. These annual reports can be found on the website of each water business.

Part 2 of this report shows water use against each bulk entitlement and an assessment of compliance with the entitlement volume. Some bulk entitlements have an upper limit described, for example as a five-year or ten-year rolling average. The outcome of the compliance calculation is reported in the relevant basin chapter.

The information on water diversions against water business entitlements in Part 2 is as reported in water business annual reports, except where water businesses have provided updated information.

Table 3-8 shows the volume of entitlements and water used under bulk entitlements, licences and rights in each basin, and the volume diverted from waterways in 2010–11. The volume diverted in each basin is within the entitlement volume.

The volume of water taken under bulk entitlements in 2010–11 was only 38% of the total entitlement volume. This is likely due to higher rainfall suppressing demand for water.

The bulk entitlement volumes for some basins have changed compared to the values reported in the 2009–10 accounts.

In the Mitchell basin, the average annual volume of East Gippsland Water's Bairnsdale bulk entitlement increased by 3,306 ML in 2010–11. East Gippsland Water's Bruthen and Lakes Entrance bulk entitlements in the Tambo basin were revoked and the entitlement volumes were transferred to the Bairnsdale bulk entitlement. East Gippsland Water has been supplying Bruthen and Lakes Entrance from the Mitchell River for some years, due to ongoing water quality and reliability issues.

In the Moorabool basin, Barwon Water and Central Highlands Water's bulk entitlements for Lal Lal Reservoir were reduced by an average annual volume of 2,500 ML as part of establishing an environmental entitlement for the Moorabool River, one of Victoria's most stressed river systems.

Following completion of the Wimmera–Mallee pipeline in late 2009–10, GWMWater, Wannon Water and Coliban Water's existing bulk entitlements for the Wimmera and Glenelg rivers were revoked. New entitlements were granted in 2010–11 in order to formally allocate water savings and as a result of operational changes from the completion of the pipeline.

A new bulk entitlement was granted for Apollo Bay in the Otway Coast basin in 2010–11. The new entitlement consolidates Barwon Water's existing surface water licences and bulk entitlement for the Barwon River, and makes provisions for a new pump station and storage that is planned for construction by 2014.

Western Water was granted a new bulk entitlement for the Melbourne supply system in October 2010 after purchasing an additional 7,000 ML of entitlement to supplement local water sources for towns west of Melbourne.

## Table 3-8 Volume allocated and taken under surface water entitlements in 2010–11

| Basin | Bulk entitlements(1) | | | Unregulated river licensed diversions(1) | | | Small-catchment dams |
|---|---|---|---|---|---|---|---|
| | Entitlement volume(2) (ML) | Volume taken(3) (ML) | Volume taken (% of entitlement volume) | Entitlement volume (ML) | Volume taken (ML) | Volume taken (% of entitlement volume) | Volume taken(4) (ML) |
| Murray | 2,210,270 | 830,890 | 38% | 83,750 | 2,400 | 3% | 6,500 |
| Kiewa | 1,130 | 500 | 44% | 20,680 | 700 | 3% | 3,900 |
| Ovens | 58,130 | 9,000 | 15% | 28,200 | 400 | 1% | 15,900 |
| Broken | 25,600 | 1,650 | 6% | 12,090 | 100 | 1% | 15,800 |
| Goulburn | 2,197,550 | 590,120 | 27% | 47,370 | 3,000 | 6% | 47,500 |
| Campaspe | 139,840 | 20,610 | 15% | 9,160 | 100 | 1% | 28,800 |
| Loddon | 56,750 | 14,180 | 25% | 34,260 | 700 | 2% | 50,000 |
| Avoca | 280 | 40 | 14% | 3,620 | 100 | 3% | 12,700 |
| Mallee | 0 | 0 | n/a | 0 | 0 | n/a | 0 |
| Wimmera(5) | 125,610 | 18,840 | 15% | 2,550 | 0 | 0% | 14,400 |
| East Gippsland | 620 | 150 | 24% | 770 | 260 | 34% | 1,100 |
| Snowy | 2,200 | 820 | 37% | 3,990 | 490 | 12% | 3,400 |
| Tambo | 340 | 20 | 6% | 4,200 | 510 | 12% | 3,900 |
| Mitchell | 9,210 | 3,960 | 43% | 16,910 | 5,930 | 35% | 4,500 |
| Thomson | 468,233 | 186,037 | 40% | 17,190 | 8,080 | 47% | 7,000 |
| Latrobe | 216,840 | 125,100 | 58% | 23,910 | 4,220 | 18% | 20,500 |
| South Gippsland | 17,020 | 7,680 | 45% | 12,920 | 3,780 | 29% | 24,300 |
| Bunyip | 39,600 | 19,270 | 49% | 19,450 | 3,670 | 19% | 15,500 |
| Yarra | 435,250 | 464,130 | 107% | 50,870 | 12,100 | 24% | 15,900 |
| Maribyrnong | 9,920 | 1,170 | 12% | 2,010 | 400 | 20% | 7,800 |
| Werribee | 37,680 | 12,960 | 34% | 1,110 | 300 | 27% | 9,300 |
| Moorabool | 43,100 | 8,178 | 19% | 3,740 | 720 | 19% | 22,200 |
| Barwon | 55,730 | 40,890 | 73% | 5,590 | 1,430 | 26% | 30,900 |
| Corangamite | 0 | 0 | n/a | 1,261 | 216 | 17% | 12,300 |
| Otway Coast | 19,670 | 12,920 | 66% | 6,660 | 1,870 | 28% | 12,800 |
| Hopkins | 630 | 150 | 24% | 10,690 | 900 | 8% | 64,600 |
| Portland Coast | 0 | 0 | n/a | 1,744 | 78 | 4% | 16,200 |
| Glenelg(5) | 4,550 | 2,840 | 60% | 1,040 | 260 | 25% | 55,500 |
| Millicent Coast | 0 | 0 | n/a | 20 | 0 | 0% | 0 |
| **Total** | **6,162,590** | **2,360,750** | **38%** | **425,755** | **52,714** | **12%** | **523,200** |

Notes:

(1) Bulk entitlement volumes are rounded to the nearest 10 ML.

(2) These are estimates of the total volume of bulk entitlement granted as at 30 June 2011. Estimates are for an average year and are not adjusted for trade, caps that are climatically adjusted, or caps that are long-term rolling averages. They include environmental and consumptive entitlements.

(3) This includes water taken under bulk entitlements and water taken under historical rights.

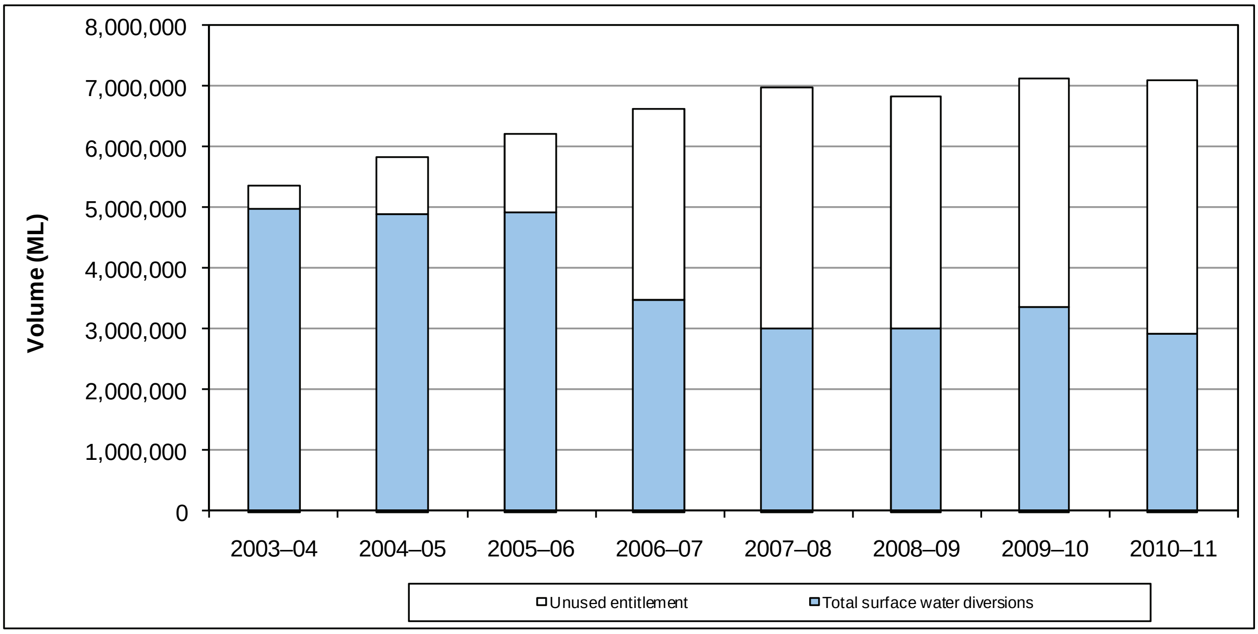
(4) This refers to the total volume of usage from small-catchment dams (that is, for both domestic and stock and irrigation and commercial use).

(5) Water taken under the Wimmera and Glenelg rivers bulk entitlement cannot be split into each river basin and is therefore included only under the Wimmera basin in this table.

n/a: Not applicable

Table 3-5 shows the volume of water diverted under surface water entitlements, over the past eight years. The volume of entitlements differs for the reasons outlined in Section 3.1. For the first three years, the volume diverted under these entitlements remained largely stable as most irrigation seasonal allocations remained at or around 100% or more, and urban restrictions were low and isolated to specific regions in the state. As a result of the ongoing drought, water availability continued to remain below the volume available historically, and total surface water diversions from 2006–07 to 2009–10 were significantly lower. The total volume of water diverted in 2010–11 decreased by 432,389 ML, compared to 2009–10. However, this decrease most likely indicates suppressed demand for water due to the very wet conditions experienced in 2010–11, as opposed to low water availability.

**Figure 3-5 Surface water entitlements and associated diversions**




## 3.5 Groundwater entitlement and use

Full details of water entitlements and use from each GMA and WSPA in 2010–11 are presented in Appendix A.

In 2010–11, total groundwater licensed entitlement was approximately 967,600 ML across the state. The total groundwater use across the state, including domestic and stock use, was approximately 221,100 ML, which was significantly less than the volume used in 2009–10 (438,140 ML).

In 2010–11, the total volume of licensed groundwater extracted from GMAs and WSPAs was approximately 146,000 ML not including UAs. This included metered use of 114,897 ML and estimated use of 31,098 ML. This was a decrease of 53%, compared to 2009–10 (309,280 ML).

Domestic and stock use (58,445 ML) was estimated to account for approximately 26% of total groundwater use (221,096 ML). This was an increase from approximately 18% of total groundwater use in 2009–10.

In Victoria's GMAs, licensed groundwater entitlements totalled 252,753 ML, with total use of 77,073 ML consisting of 31,212 ML of metered extractions and an estimated 30,413 ML of unmetered extractions. Estimated domestic and stock use in these areas was 15,448 ML.

Licensed groundwater entitlements in WSPAs totalled 593,412 ML, with total use of 101,938 ML consisting of 83,685 ML of metered extractions and an estimated 685 ML of unmetered extractions. Estimated domestic and stock use in these areas was 17,568 ML.

Estimated groundwater entitlement in the unincorporated areas was approximately 121,470 ML, with approximately 42,086 ML extracted. This was significantly lower than 2009–10 when entitlement was approximately 129,447 ML and 85,568 ML was extracted. The decrease in groundwater use was most likely due to wetter conditions and access to surface water supplies.

The total volume of groundwater extracted for urban use in 2010–11 was 11,358 ML, which was approximately 5% of the total groundwater extracted.

Approximately 70 towns have a groundwater entitlement as either a supplementary or primary water supply. Due to the wetter conditions and availability of surface water resources in 2010–11, only 57 of these licences recorded any extraction. The largest of these was Greater Geelong with extraction of 3,092 ML. In 2007–08, Barwon Water initiated an investigation to source additional groundwater supplies from the Jan Juc GMA to secure a future water supply for the area. A bulk entitlement was issued on 1 July 2009 to supplement existing supplies. Groundwater extraction under the authority of the Anglesea bulk entitlement in 2010–11 was 1,948 ML. Figure 3-6 shows the location of towns where groundwater is used for urban water supply.

Permanent and temporary trade of groundwater occurred across the state, with 33 permanent trades totalling 3,047 ML and 69 temporary trades totalling 5,923 ML. The majority of groundwater trading occurred in the central, eastern and southern regions of Victoria.

**Figure 3-6 Location of towns where groundwater is used for urban supply**

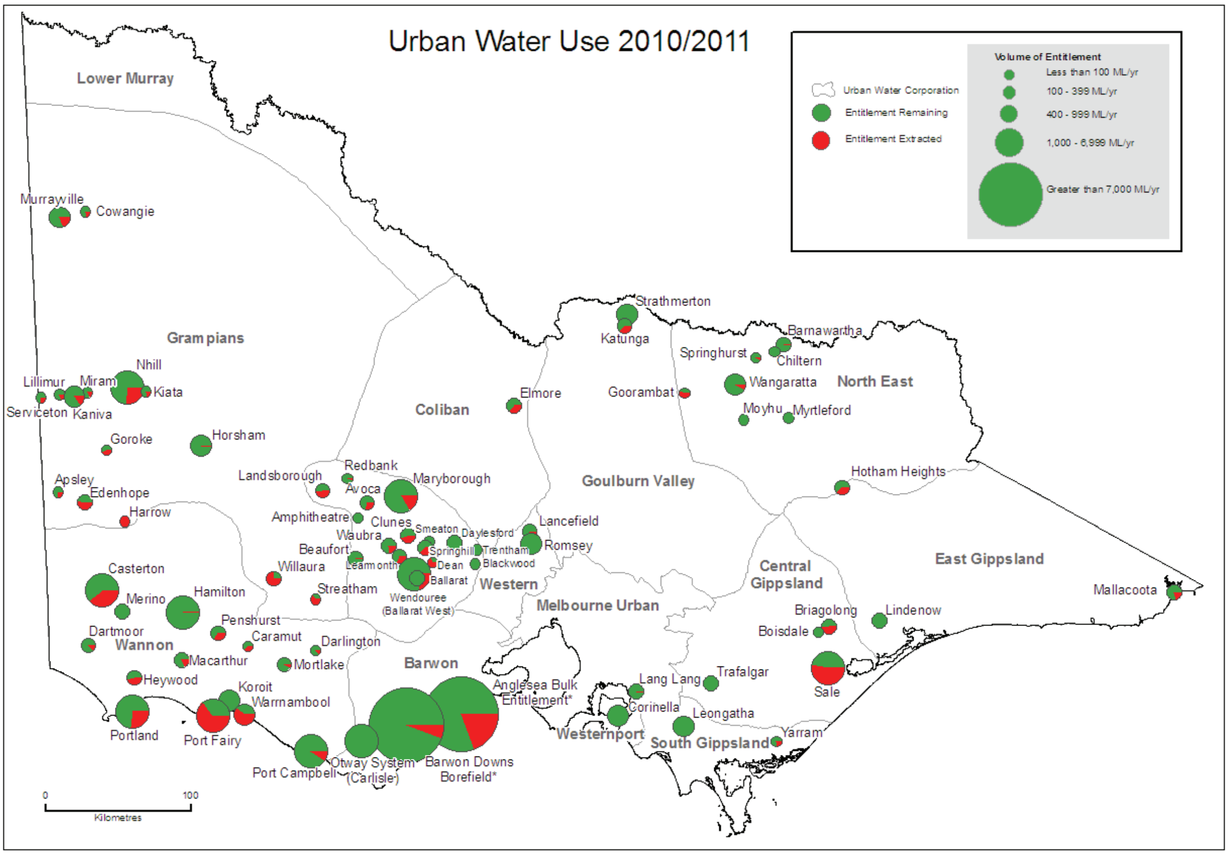
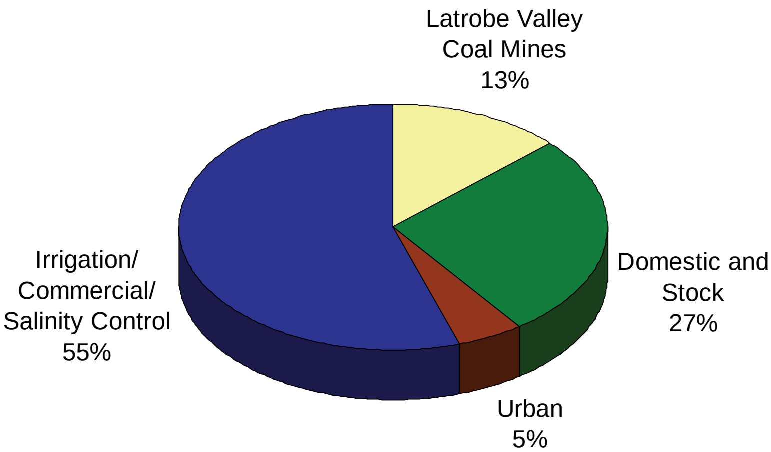



Figure 3-7 shows groundwater extraction by use in GMAs and WSPAs.

**Figure 3-7 Groundwater extraction by use in GMAs and WSPAs**




## 3.6 Water trade

Water entitlements in the regulated systems of northern Victoria were unbundled on 1 July 2007. The southern regulated systems of Thomson/Macalister and Werribee were unbundled on 1 July 2008. Unbundling converted prior water rights or take-and-use licences in declared water systems into three separate entitlements being:

- a water share (a right to take)
- a delivery share or extraction share (a right to have water delivered)
- a water-use licence or registration (a right to use).

A water share is a legally recognised, secure share of the water available for use in a declared water system. A water share is specified as a maximum volume of seasonal allocation that may be made against that share. Post-unbundling, both water shares and the allocation made against them may be traded. Additionally, in areas of Victoria which still remain bundled, bundled entitlement volume may be transferred either permanently or temporarily.

### 3.6.1 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 in this report is to show the movement of water into or out of basins.

Unbundling in 2007 and 2008 changed the definition of 'movement of water entitlement', because it coincided with the replacement of exchange rate trade within unbundled systems with a new system of tagged trade. Under exchange rate trade, an entitlement trade from the Goulburn to the Murray resulted in cancellation of the Goulburn entitlement and issue of a Murray entitlement, the volume of which was determined by the relevant exchange rate. Under the new system of tagged trade, the source of an entitlement never changes, but its point of use does. The purchaser of a Goulburn entitlement on the Murray therefore still holds a Goulburn entitlement but tags it for use on the Murray. This means that they still receive Goulburn allocations.

Under a system of tagged trading, the movement of water shares as a result of trade must be assessed by considering the change in the point of use, rather than the source of the water share (as this never changes). In this report, change of a water share location is represented by a change in the water share's grouped delivery system. The change of location can arise as part of a transfer of ownership (the new owner wishes the water share to be used at a new location) or separately, through an application to vary or associate a water share (an existing owner wishes to shift the water share to another location). Information on the movement of water shares in 2010–11 is based on data in the water register about these two application types (transfer all or part of a water share, and vary a water share).

The volume of water shares transferred or varied in Victoria in 2010–11 is summarised in Table 3-9.

As mentioned above, this table shows trade of water shares according to where they are intended to be used, rather than where they are sourced, as the source of water shares now rarely changes.

#### Table 3-9 Water share transfers and variations 2010–11 (1,2,3,4)

| Nominated delivery system group | High-reliability water shares | | | Low- and spill-reliability water shares | | |
|---|---|---|---|---|---|---|
| | Source (ML) | Destination (ML) | Net into basin (ML) | Source (ML) | Destination (ML) | Net into basin (ML) |
| Murray | 161,676 | 96,699 | -64,977 | 53,521 | 52,717 | -804 |
| Ovens | 1,440 | 1,200 | -240 | 570 | 583 | 13 |
| Broken | 748 | 408 | -341 | 79 | 79 | 0 |
| Goulburn | 100,580 | 65,119 | -35,461 | 40,696 | 40,270 | -426 |
| Campaspe | 16,419 | 797 | -15,622 | 10,891 | 690 | -10,201 |
| Loddon | 26,275 | 13,842 | -12,433 | 7,253 | 7,335 | 82 |
| Non-water users (3) (Northern Victoria) | 50,998 | 180,072 | 129,074 | 19,149 | 30,484 | 11,335 |
| Non-water users (3) (Southern Victoria) | 10 | 113 | 103 | 19 | 68 | 49 |
| Thomson/Macalister | 15,811 | 15,708 | -103 | 7,513 | 7,465 | -49 |
| Werribee | 673 | 673 | 0 | 310 | 310 | 0 |
| **All Victoria 2010–11** | **374,629** | **374,629** | **0** | **139,999** | **139,999** | **0** |
| All Victoria 2009–10 | 904,680 | 853,305 | -51,375 | 150,721 | 148,650 | -2,070 |

Notes:

(1) This table summarises all water share transfers and variations recorded in the Victorian Water Register in 2010–11. Trades that were in progress at the end of the year will be finalised in 2011–12.

(2) Transfer applications result in a change of ownership. In some cases, the ownership change occurs with a transfer of land. Transfers of ownership that are part of a water and land sale are also included in this table. Variations do not involve a change of ownership.

(3) When water shares are disassociated from land, they are classified as being in the non-water-user category. This includes water shares purchased by the Commonwealth for environmental use, water shares disassociated from Victorian land for use interstate, and water shares disassociated by owners for other reasons.

(4) Nominated delivery systems are grouped for the purposes of providing a trade summary from a large number of individual delivery systems.

The volume of high-reliability water shares with delivery system changes in the northern basins was 358 GL, compared to only 16 GL in the south. Water markets in southern Victoria are less developed than in the north where there is a larger volume of entitlements, more irrigators and a longer history of trading water.

The key trend visible in the table is the continued disassociation of water shares from land, resulting in their assignment to the non-water-user category. In 2009-10, most of the disassociated water shares were from the Murray basin.

### 3.6.2 Allocation trade

In the unbundled systems, water share holders can buy and sell allocation (seasonal allocation made against water shares) through a trade of allocation. The volume of allocation trade in Victoria in 2010–11 is summarised in Table 3-10. This table shows allocation trade according to where the water was stored or sourced, rather than where it was intended to be used. This is appropriate because a trade of allocation doesn't mean that the water will necessarily be used in that location, in that year. There is also more linkage between systems, allowing trade to occur in the northern basins.

#### Table 3-10 Allocation trade in Victoria 2010–11 [1,2]

| Basin | Bought (ML) | Sold (ML) | Net transfer to basin (ML) |
|---|---|---|---|
| Murray | 638,819 | 558,770 | 80,049 |
| Ovens | 10 | 10 | 0 |
| Broken | 30 | 30 | 0 |
| Goulburn | 408,473 | 402,180 | 6,293 |
| Campaspe | 5,251 | 14,368 | -9,118 |
| Loddon | 843 | 1,959 | -1,116 |
| Thomson/Macalister | 4,882 | 4,882 | 0 |
| Werribee | 633 | 633 | 0 |
| New South Wales | 16,070 | 87,179 | -76,326 |
| South Australia | 213,101 | 318,089 | -104,989 |
| **All Victoria 2010–11** | **1,288,111** | **1,388,100** | **-105,206** |
| All Victoria 2009–10 | 818,631 | 819,384 | -753 |

Notes:

(1) This table shows approved allocation trades in the Victorian Water Register for trading zones in regulated water systems.

(2) In a pool exchange, some sellers (say 20) sell to some buyers (say 15) at the pool price. Administratively, this is implemented in the water register as 20 trades to a clearing account and then 15 trades from that clearing account. To avoid double counting, only the seller side is counted (that is, it counts as 20 trades).

A total of 1288 GL of allocation was traded on the Victorian water market in 2010–11. This included 1,053 GL of trade in northern Victoria and 6 GL in southern Victoria. Overall, Victoria was a net seller of allocation, exporting a small volume to New South Wales and South Australia. This was a significant increase in the volume of trade compared to 2009–10.

### 3.6.3 Surface water bundled entitlement transfers

There are still some bundled entitlements (entitlements where the right to take and use water are not separated) in existence, mainly in unregulated water systems. Bundled entitlement holders can transfer part or all of their entitlement volume either permanently or temporarily. Permanent and temporary transfers of surface water bundled entitlement volume in 2010–11 are summarised in Table 3-11. Bundled entitlement volume cannot be transferred between basins: therefore, all transfers are within basin such that the volume bought and sold is equal for a given basin.

The temporary market for bundled entitlement volume was more active than the permanent market, with over 1,200 ML of temporary transfers compared to 31 ML of permanent transfers. Most transfers occurred in the Barwon basin in the south, and the Ovens basin in the north.

#### Table 3-11 Surface water bundled entitlement transfers 2010–11

| Basin | Permanent transfers (ML) | Temporary transfers (ML) |
|---|---|---|
| Goulburn [1] | 11 | 2 |
| Broken [1] | 0 | 0 |
| Campaspe [1] | 0 | 0 |
| Loddon [1] | 0 | 0 |
| Murray [1] | 0 | 85 |
| Ovens [1] | 2 | 322 |
| Kiewa [1] | 0 | 0 |
| Avoca | 0 | 0 |
| Mallee | 0 | 0 |
| Wimmera | 0 | 0 |
| East Gippsland | 0 | 0 |
| Snowy | 0 | 59 |
| Tambo | 0 | 0 |
| Mitchell | 5 | 5 |
| Latrobe | 0 | 0 |

| Basin | Permanent transfers (ML) | Temporary transfers (ML) |
|---|---|---|
| Thomson | 0 | 137 |
| South Gippsland | 0 | 0 |
| Bunyip | 4 | 12 |
| Yarra | 0 | 0 |
| Maribyrnong | 0 | 0 |
| Werribee | 0 | 0 |
| Moorabool | 0 | 40 |
| Barwon | 0 | 426 |
| Corangamite | 0 | 0 |
| Otway Coast | 0 | 0 |
| Hopkins | 0 | 136 |
| Portland Coast | 0 | 0 |
| Glenelg | 9 | 7 |
| Millicent Coast | 0 | 0 |
| **All Victoria 2010–11** | **31** | **1231** |

Note:

(1) Transfers of a water entitlement with land are not included above.

Urban water businesses that participated in the water market in 2010–11 were Goulburn Valley Water, Gippsland Water, GWMWater, Melbourne Water and North East Water. Unlike previous years, most urban water business participation was in the permanent water market rather than in the temporary market, based on volumes traded. In terms of the number of trades, the temporary market was more active. GWMWater was a significant player on the permanent market, with net trades totalling 439 ML in four transactions. On the temporary market, Goulburn Valley Water sold 16 GL in 72 trades. Details of trades are reported in the Victorian Water Accounts for each of the bulk entitlements held by water businesses.

### 3.6.4 Groundwater bundled entitlement transfers

Groundwater trade information is reported in Appendix C. In 2010–11, 3,047 ML was permanently traded while temporary trades accounted for 5,923 ML. Trades occurred in groundwater areas managed by Goulburn-Murray Water, Southern Rural Water and Grampians Wimmera Mallee Water.

## 3.7 Recycled water

The total volume of 495,742 ML of wastewater produced in 2010–11 was higher than the 398,973 ML produced in 2009–10. The volume of water recycled by Victoria's water businesses for use external to treatment plants in 2010–11 decreased, compared to 2009–10. The recycled volume was 54,653 ML, which represents a reduction of 40,200 ML. The volume recycled represents 11% of the total volume available for reuse at the end of the wastewater treatment process. An additional 20,252 ML was recycled for use within the wastewater treatment process, which increases the proportion of recycled water to 15% of wastewater available for recycling. The volumes and percentages used in the following paragraphs only refer to recycled water supplied for use external to the treatment plants.

In 2010–11, the volume of water recycled by the Eastern Treatment Plant was 16,741 ML, which was a decrease on the 20,496 ML recycled in 2009–10. 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 reduced from 54,322 ML in 2009–10 to 29,972 ML in 2010–11. This decrease is largely attributable to a reduction in the volume sold to Melbourne retailers, decreasing from 12,785 ML in 2009–10 to 1,912 ML in 2010–11, and also a decrease in agriculture use.

Including the treatment plants operated by the Melbourne metropolitan retailers, the volume of water recycled in Melbourne was 31,688 ML or 9%. The percentage of recycled water was higher outside Melbourne where weather conditions, the availability of land and access to potential purchasers (that is, agricultural producers) are more favourable. Excluding the wastewater recycled in Melbourne, the remainder of the state recycled 18%, or 22,965 ML, of the wastewater available for reuse. This was lower than in 2009–10, when it was 31,036 ML.

## Table 3-12 Volume of wastewater recycled in 2010–11

| Basin[(1)] | Total volume of wastewater produced | Volume recycled excluding within process (ML) | % of wastewater recycled excluding within process | Volume recycled within process (ML) | % of wastewater recycled including within process |
|---|---|---|---|---|---|
| Murray | 9,972 | 3,479 | 35% | 0 | 35% |
| Kiewa | 424 | 181 | 43% | 0 | 43% |
| Ovens | 3,521 | 606 | 17% | 0 | 17% |
| Broken | 198 | 198 | 100% | 0 | 100% |
| Goulburn | 9,745 | 3,746 | 38% | 0 | 38% |
| Campaspe | 2,165 | 574 | 27% | 7 | 27% |
| Loddon | 8,585 | 1,761 | 21% | 0 | 21% |
| Avoca | 166 | 88 | 53% | 0 | 53% |
| Mallee | N/A | N/A | N/A | N/A | N/A |
| Wimmera | 1,669 | 1,613 | 97% | 0 | 97% |
| East Gippsland | 56 | 56 | 100% | 0 | 100% |
| Snowy | 359 | 359 | 100% | 0 | 100% |
| Tambo | 542 | 542 | 100% | 0 | 100% |
| Mitchell | 1,431 | 1,412 | 99% | 0 | 99% |
| Thomson | 301 | 271 | 90% | 0 | 90% |
| Latrobe | 25,841 | 797 | 3% | 0 | 3% |
| South Gippsland | 5,426 | 181 | 3% | 8 | 3% |
| Bunyip | 174,624 | 2,937 | 2% | 15,502 | 11% |
| Yarra | 11,435 | 572 | 5% | 1,854 | 21% |
| Maribyrnong | 3,531 | 621 | 18% | 575 | 34% |
| Werribee | 190,269 | 32,757 | 17% | 266 | 17% |
| Moorabool | N/A | N/A | N/A | N/A | N/A |
| Barwon | 30,305 | 755 | 2% | 1,849 | 9% |
| Corangamite | 2,695 | 159 | 6% | 26 | 7% |
| Otway Coast | 1,572 | 136 | 9% | 159 | 19% |
| Hopkins | 6,585 | 431 | 7% | 6 | 7% |
| Portland Coast | 2,776 | 53 | 2% | 0 | 2% |
| Glenelg | 1,550 | 368 | 24% | 0 | 24% |
| Millicent Coast | 133 | 45 | 34% | 0 | 34% |
| **Total 2010–11** | **495,875** | **54,698** | **11%** | **20,252** | **15%** |
| Total 2009–10 | 398,973 | 94,810 | 24% | 19,951 | 29% |

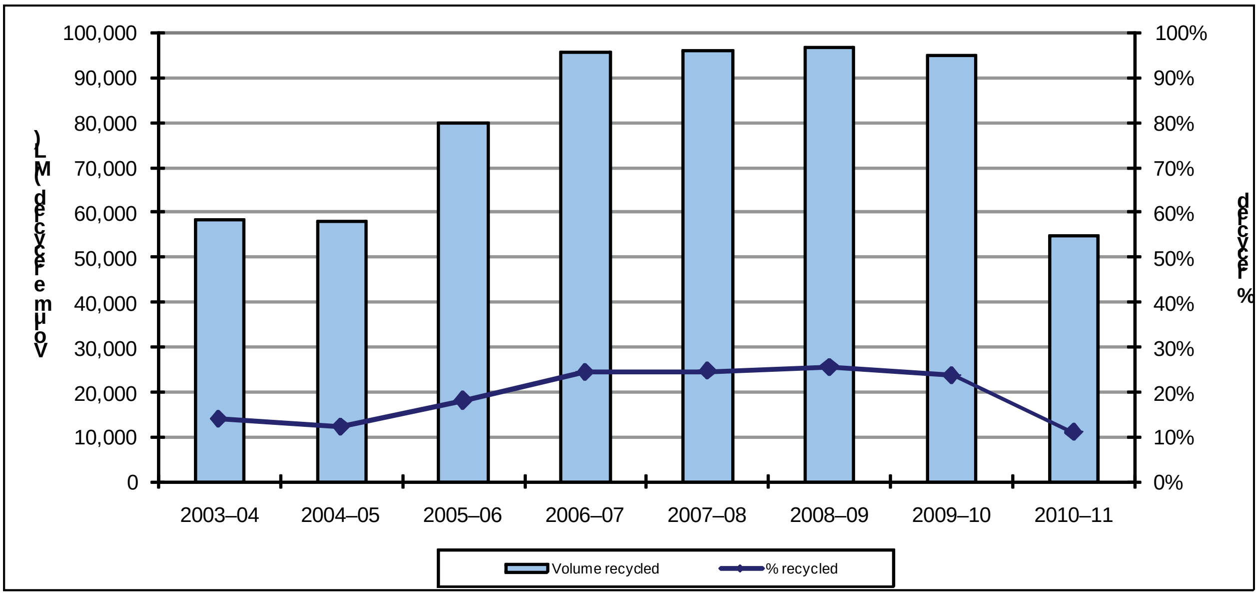
Notes:

(1) Recycled water is reported in the river basin where the wastewater is treated. For example, most of the wastewater treated in the Werribee and Bunyip river basins comes from other river basins.

N/A: Not applicable as there are no wastewater treatment plants within the basin.

Figure 3-8 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, with Melbourne contributing 20,000 ML to 25,000 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. As noted above, Melbourne recycled more than 65,000 ML in 2009–10, three times the volume it recycled in 2003–04. The volume and percentage recycled in 2010–11 was less than that recycled in the previous year, due to reduced demand for recycled water as a result of higher rainfall.

### Figure 3-8 Recycled water volume and percentage, 2003–04 to 2010–11[1]




Note:

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

## 3.8 Conclusions

Victoria's water entitlement system comprises well-defined rights to water and markets to reallocate water between users. The total volume of water defined in entitlements in Victoria in 2010–11 was 7,223,784 ML.

The volume of Victoria's surface water, groundwater and recycled water in 2010–11 was approximately 45,000,000 ML. The majority of this was surface water, of which 43,461,800 ML was available across the state. This was roughly 170% of the long-term annual average streamflow and is a significant increase on 2009–10.

Diversions under surface water consumptive entitlements decreased in 2010–11 to 2,897,081 ML. This was about half of the total surface water entitlement.

Irrigation remained by far the highest category of water use in the state, comprising 64% of all water use.

Increased allocations in the large irrigation districts of northern Victoria compared to previous years ensured the water market was again very active in 2010–11. During this period, the majority of water share transfers and variations were from the Murray and Goulburn basins. In the Murray basin, there was a net transfer of 64,977 ML of high-reliability water shares and 804 ML of low-reliability water shares from the Murray basin, with 35,461 ML and 430 ML of high- and low-reliability transfer respectively from the Goulburn basin. The volume of high-reliability water shares transferred or varied in the northern basins was 180,000 ML, compared to only 16,000 ML in the south. A total of 1,288,000 ML of allocation was traded on the Victorian water market in 2010–11. This included 1,100,000 ML of trade in northern Victoria and 6,000 ML in southern Victoria. Overall, Victoria was a net seller of allocation, exporting a small volume of allocation to New South Wales and South Australia.

Groundwater use across the state in 2010–11 was significantly less than previous years, at 221,100 ML. The majority of groundwater was extracted under licence within GMAs and WSPAs.

A total of 54,650 ML of wastewater was recycled in 2010–11. This was lower than the volume recycled in 2009–10. Although the volume of wastewater recycled in Melbourne was much larger than the volume recycled in regional Victoria, the proportion of wastewater recycled was higher in regional Victoria.

# 4 Water for the environment

## 4.1 The environment's share of water

The Environmental Water Reserve (EWR) is the legal framework by which water is set aside to maintain the environmental values of rivers, wetlands and streams. After more than a decade of drought, rainfall and catchment runoff filled many wetlands to capacity, and generated high natural flows in many river systems. As a result, there was a marked increase in the volume of above-cap water in river systems across the state, which constitutes the major component of the EWR. As water supplies to townships recovered, temporary qualifications of rights to water were progressively lifted in 2010–11, restoring environmental flows and providing relief to some river systems.

Rivers have naturally variable flow regimes, resulting from rainfall and run-off within their catchments. Environmental health for rivers can be achieved through seasonal flow regimes and should not be assessed solely on the total volume of water leaving a basin.

Part 2 of the water accounts sets out the basis of the EWR for each basin. The objective of the EWR is to preserve the environmental values and health of water ecosystems. Water is set aside under the EWR through:

- entitlements for the environment
- obligations on entitlements (including the passing flows that water corporations or licensed diverters are obliged to provide out of storage or past a diversion point)
- stream flow or groundwater management plans
- above-cap water (which is water leaving the basin, under the section titled **Rainfall, flows and storages**. This water includes water that is left over after limits on diversions have been reached, and unregulated flows which cannot be kept in storage. Most of the EWR is above-cap water and this component is most susceptible to climate change).

Reporting of the groundwater EWR will be progressively introduced into the Victorian water accounts in future years.

## 4.2 Entitlements for the environment

In 2010–11 the Minister for Environment held 20 entitlements for the environment. The use of water held in storage under these entitlements is set out in Table 4-1. Entitlements held by the Minister for Environment that do not involve water held in storage are set out in Table 4-2. Where relevant, the use of this water is described more fully in the basin chapters in Part 2.

Seven new environmental entitlements were created in 2010–11:

- Macalister River Environmental Entitlement 2010
- Moorabool River Environmental Entitlement 2010
- Latrobe River Environmental Entitlement 2010
- Goulburn River Environmental Entitlement 2010
- Wimmera and Glenelg Rivers Environmental Entitlement 2010
- Werribee River Environmental Entitlement 2011
- Barwon River Environmental Entitlement 2011.

The Macalister River entitlement resulted from modernisation work completed in the Macalister Irrigation District. The Moorabool River and Werribee River entitlements entitle the Minister for Environment to a share of inflows into storages on these rivers. The new Goulburn River entitlement is for 1,432 ML of high-reliability water and results from water savings from the Wimmera-Mallee pipeline. The Wimmera and Glenelg rivers entitlement replaces the revoked environment's Bulk Entitlement (Wimmera and Glenelg Rivers – Flora and Fauna) Conversion Order 2004 and was created in order to make use of the environmental entitlement provisions of the *Water Act 1989* which were established to allocate environmental entitlements. The Latrobe River and Barwon River entitlements permit the Minister for Environment to use unregulated flows to periodically water particular wetlands along these rivers.

Amendments were made to some environmental entitlements during this year.

The Bulk Entitlement (Loddon River – Environmental Reserve) Order 2005 was amended to include water savings from the Wimmera-Mallee Pipeline Project. The amendment creates an additional 7,940 ML of entitlement, with allocation of water against this entitlement dependent upon the seasonal allocation of high-reliability water shares being greater than 1% on the Goulburn system in April of the previous year. Upon reaching this threshold, the full entitlement volume is made available.

The Yarra Environmental Entitlement 2006 was amended to include an additional 55 ML of water recovered through a stream flow tender pilot program in the catchments of Olinda Creek, Stringybark Creek and Pauls, Steels and Dixons creeks, which is now available to supplement environmental flows in the Yarra River downstream of Olinda Creek.

The Tarago and Bunyip Rivers Environmental Entitlement 2009 was amended to correct a mistake in the description of the water sharing arrangements to make it clear that the environment receives a 10% share of inflow to the Tarago Reservoir, net of the volume required to meet the bulk entitlements' passing flow obligations.

The Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999 was amended to include an unregulated flow entitlement for the environment in the River Murray, in recognition of Victoria's historic use of Murray unregulated flows for environmental watering.

Amendments were made to the 20 bulk entitlements and environmental entitlements held by the Minister for Environment in June 2011 to ensure consistency with the new Victorian Environmental Water Holder (VEWH) framework.

As of 1 July 2011, all environmental entitlements held by the Minister for Environment will be transferred to the VEWH. 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.

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. The CEWH is likely to hold significant volumes of water in Victorian storages for environmental purposes. Delivery of Commonwealth environmental water in Victoria is managed by DSE, 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.

## Table 4-1 Entitlements for the environment in storage in 2010–11 (ML)

| Entitlement | | Entitlement at 30 June 2010 | 2010–11 allocation | Allocation carried over from 2009-10 | Trade in from CEWH | Trade in from Living Murray | Trade out from Living Murray | Trade from Victoria (net) | Donated water | Total water available in 2010–11 | Water used in 2010–11 | Carried over to 2011/12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Entitlement** | **Entitlement type** | **A** | **B** | **C** | **D** | **E** | **F** | **G** | **H** | **B+C+D+E-F+G+H** | **I** | **B+C+D+E-F+G+H-J** |
| River Murray Flora and Fauna | High reliability | 27,600 | 27,600 | 15,298 | - | 17,200 | - | -10,000 | - | 50,098 | 26,732 | 23,366 |
| | Unregulated(1) | 40,000 | N/A | N/A | N/A | N/A | N/A | N/A | | 18,817 | 18,817 | - |
| River Murray Flora and Fauna - Living Murray | High reliability | 5,710 | 5,710 | 3,710 | - | 102,589 | 6,339 | - | | 105,670 | 100,000 | 5,670 |
| | Low reliability | 101,850 | - | - | - | - | - | - | - | | | - |
| | Unregulated(1) | 34,300 | N/A | N/A | N/A | N/A | N/A | N/A | | 34,300 | 34,300 | - |
| River Murray Flora and Fauna - Barmah Millewa EWA | High reliability(2) | 50,000 | 50,000 | 130,500 | - | - | - | - | | 180,500 | 84,500 | 96,000 |
| | Low reliability | 25,000 | - | | - | - | - | - | | | | |
| River Murray EWR | N/A (3) | - | - | - | - | - | - | - | - | | | - |
| Goulburn System EWR | N/A (3) | - | - | - | - | - | - | - | | - | - | - |
| Goulburn Environmental Water Savings Supply Deed(5) | N/A | N/A | 282 | - | 54,277 | - | - | 10,000 | | 64,593 | 61,313 | 3,562 |
| Goulburn System Living Murray | High reliability | 39,625 | 39,625 | 16,684 | - | 30,263 | 46,398 | - | | 40,173 | 33,000 | 7,173 |
| | Low reliability | 156,980 | - | 11,160 | | 68,810 | 11,160 | - | - | 79,970 | - | 68,810 |
| Campaspe River (6) | N/A | N/A | - | - | 2,300 | - | - | - | | 2,300 | 2,140 | 160 |
| Campaspe River Living Murray | High reliability | 5,048 | 5,048 | - | - | - | - | - | | 5,048 | - | 5,048 |
| | Low reliability | 126 | 126 | - | - | - | - | - | | 126 | - | 126 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Loddon River Environmental Reserve | High reliability | 2,000 | 2,000 | - | - | - | - | - | | 2,000 | - | 2,000 |
| | Provisional reliability(4) | 7,940 | - | - | - | - | - | - | | - | - | - |
| | Low reliability | 2,105 | - | - | 506 | - | - | - | | 506 | 427 | 79 |
| Wimmera Glenelg Rivers | Regulated | 40,560 | 40,560 | - | - | - | - | - | | 40,560 | 9,030 | 31,530 |
| | Wimmera Mallee wetlands | 1,000 | 1,000 | - | - | - | - | - | | 1,000 | - | 1,000 |
| Macalister River | High reliability | 7,111 | 7,111 | - | - | - | - | - | | 10,666 | 10,666 | - |
| | Low reliability | 3,555 | 3,555 | | - | - | - | - | | | | |
| Thomson River | High reliability | 10,000 | 10,000 | 5,634 | - | - | - | - | | 15,634 | 12,839 | 2,795 |
| Tarago and Bunyip Rivers | N/A | 3,000(7) | 2,715 | 285 | - | - | - | - | | 3,000 | - | 3,000 |
| Yarra River | High reliability | 17,000 | 17,000 | 18,325 | - | - | - | - | | 35,325 | - | 35,325 |
| Werribee River | N/A | see note(8) | 3,091 | N/A | - | - | - | - | | 3,091 | - | 3,092 |
| Moorabool River | N/A | 2,500(9) | 6,891 | 77 | - | - | - | - | | 6,968 | 691 | 6,277 |

Notes:

(1) Unregulated entitlement volume available only in declared periods of unregulated flow in the River Murray, as determined by MDBA River Operations.

(2) The Barmah–Millewa Forest Environmental Water Allocation (EWA) is not strictly an environmental entitlement but has many similar characteristics. It is an obligation set out in Goulburn–Murray Water's bulk entitlement, and this water is for use in the Barmah–Millewa Forest, in accordance with specific rules. New South Wales holds an equivalent volume. Use of this water is approved by the VEWH and New South Wales Office of Water, in consultation with the MDBA, to contribute environmental water for the long-term sustainability of the forest and wetland.

(3) The volume available under this entitlement will be amended upon completion of water savings projects associated with Stage 1 of the Northern Victoria Irrigation Renewal Program (NVIRP). In the interim period, the environment's 1/3 share of the annual water savings from Stage 1 of the program are provided under a supply agreement.

(4) Allocation of water against this entitlement is dependent upon the seasonal allocation of high-reliability water shares being greater than 1% on the Goulburn system in April of the previous year.

(5) The allocation of NVIRP Stage 1 water savings and mitigation water is made under the Goulburn Environmental Water Savings Supply Deed.

(6) Victoria does not hold entitlement in the Campaspe system, but to enable environmental water to be used in the system, allocation can be traded in from Victorian and CEWH entitlements.

(7) This volume represents the average annual entitlement volume. The entitlement consists of passing flows and a 10.3% share of inflows into storage, with the actual volume available in any year depending upon inflow conditions.

(8) The Werribee environmental entitlement consists of a 10% share of inflows into storage, with the actual volume available in any year depending upon inflow conditions.

(9) This volume represents the average annual entitlement volume. The entitlement consists of a 11.9% share of inflows into storage, with the actual volume available in any year depending upon inflow conditions.

N/A: Not applicable

## Table 4-2 Other entitlements for the environment in 2010–11

| Entitlement | Basin | Entitlement to Water |
|---|---|---|
| Silver and Wallaby Creek | Goulburn | Passing flows |
| Birch Creek – Bullarook System | Loddon | Passing flows |
| Latrobe River | Latrobe | Unregulated |
| Barwon | Barwon | Unregulated |
| Yarra River | Yarra | Unregulated |
| Wimmera and Glenelg rivers | Wimmera and Glenelg | Passing flows and unregulated |

Victoria continues to meet its obligations to provide improved environmental flows in the Snowy River through the establishment of environmental bulk entitlements in the Murray and Goulburn rivers. Allocations under these entitlements are used within the Murray and Goulburn rivers to supply consumptive users, who would otherwise have been supplied through water diverted from the Snowy River. This water is then shared between the Snowy River and the River Murray to improve environmental flows.

Under the Snowy Water Inquiry Outcomes Implementation Deed, releases to the Snowy 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 Scheme on the basis of one-third to the River Murray and two-thirds to the Snowy River, subject to certain conditions, such as the payback of the Mowamba Borrowings Account.

The information on the Snowy River Entitlements in Table 4-3 was sourced from the NSW Office of Water.

### Table 4-3 Snowy River entitlements 2010–11 (ML)

| Entitlement source | Entitlement at 1 Feb 2011 (ML) | Volume for release in 2010–11 (ML) |
|---|---|---|
| Victoria (1) | 81,454 | 18,943 |
| New South Wales (2) | 151,061 | 74,356 |
| **Total** | **232,515** | **93,299** |
| *Apportioned to Snowy River increased flows* | | *38,000* |
| *Apportioned to River Murray increased flows* | | *31,100* |
| *Apportioned to Mowamba Borrowings Account* | | *24,200* |

Notes:

(1) Primarily high-reliability entitlements

(2) Primarily high-security entitlements

## 4.3 Seasonal conditions and environmental water

In 2010–11, high rainfall and river flows provided a marked change to Victoria's water environments to that of the previous 13 years of drought conditions. As a result, the focus of environmental water management shifted from protecting drought refuges to building on and maximising the benefits of natural high flows.

The above-average rainfall in 2010–11 also meant that Victoria's water resource position improved. This resulted in a progressive lifting of qualification of rights, put in place during the extreme water shortages experienced over the last 5 years, to ensure water supplies to some townships. Qualifications of rights, enacted by the Minister for Water, are the legal instrument through which such arrangements are made (refer to Section 2.11 for more information on qualification of rights). Where qualifications of rights occur, a risk assessment is undertaken and environmental contingency plans developed to mitigate potential environmental risks.

The EWR was reduced through nine qualifications of rights on six rivers in 2010–11 including the Broken, Goulburn, Campaspe, Loddon, Thomson, and Yarra rivers.

As a result of effective water conservation projects and improved rainfall the annual environmental flows of 22,000 ML to the Thomson and Yarra Rivers was restored in July 2010, ahead of schedule.

In mid-October 2010, the Minister revoked all remaining qualifications in the Broken, Goulburn, Murray, Thomson and Yarra basins. Only qualifications in the Campaspe and Loddon basins continued, in order to maintain flexibility in the delivery of environmental water, preserve access to environmental water retained in storage under the terms of the qualifications, and to support an allocation on the Coliban rural system.

At the end of June 2011, all remaining qualifications to surface water expired.

## 4.4 Compliance with passing flow requirements

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

Generally, a high level of compliance was reported in 2010–11. However, the Minister for Water qualified rights in some systems in 2010–11 which resulted in a reduction or removal of some obligations to meet passing flow requirements. Details are in the basin water accounts in Part 2 of this report. No major breach of passing flow compliance was reported in 2010–11.

## 4.5 Total flow at basin outlet

Table 4-4 shows the total amount of water in each basin together with the amount of water that leaves the basin after water is extracted for consumptive use. This is expressed as a proportion of the annual flow of water that would have left the basin if there were no extractions.

Given the highly variable and seasonal nature of flows in Victorian rivers and the complex demands made of them by water extractions 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.

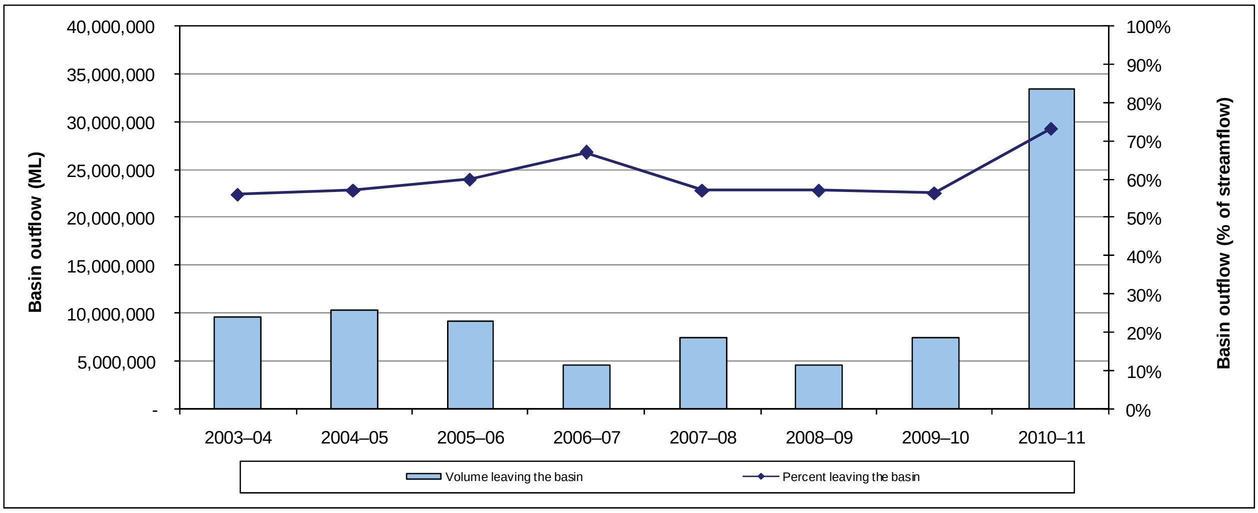
In 2010–11, the proportion of total flow leaving the basin as a percentage of total flow increased in all basins compared to 2009–10. The basins that experienced the lowest proportions of water leaving the basin as a percentage of total flow in 2010–11 were the Campaspe (52%), Avoca (54%), Thomson (54%), Goulburn (55%) and Moorabool (58%). This compares to 2009–10 where the basins that experienced the lowest proportions of water leaving the basin as a percentage of total flow were the Loddon (2%), Werribee (3%), Wimmera (5%), Avoca (0%) and Moorabool (4%).

The proportion of annual flow leaving the basin was greater than 90% in 2010–11in thirteen basins, an increase from the ten basins in 2009–10. All except the Kiewa and Ovens were in the south of the state.

Across the state the proportion of total flow leaving the basins increased from the 56% in 2009-10 to 74% in 2010–11. The volume of water leaving the basins increased from 7,495 GL in 2009–10 to 32,164 GL in 2010–11, resulting from substantially higher basin inflows and decreased extractions. As noted in Section 4.1, seasonal flow regimes are important for environmental health of rivers, and the environmental health of Victoria's rivers should not be assessed solely on total basin outflows.

The total Victorian basin outflows are presented in Table 4-4 and Figure 4-1.

## Figure 4-1 Basin outflows, 2003–04 to 2010–11




## Table 4-4 Volume leaving the basin 2010–11

| Basin | Outflow to | 2010–11 | | | 2009–10 | |
|---|---|---|---|---|---|---|
| | | Streamflow if no extractions (ML) | Total volume leaving the basin (ML) | Proportion of total flow leaving the basin in 2010–11 (%) | Total volume leaving the basin (ML) | Proportion of total flow leaving the basin in 2009–10 (%) |
| Murray [(1)] | River Murray (South Australia) | 15,846,500 | 8,975,500 | 57% | 802,800 | 25% |
| Kiewa[(2)] | River Murray | 1,164,500 | 1,082,000 | 93% | 485,000 | 92% |
| Ovens | River Murray | 3,470,000 | 3,428,800 | 99% | 873,700 | 93% |
| Broken | River Murray | 686,800 | 592,300 | 86% | 22,700 | 36% |
| Goulburn | River Murray | 5,777,400 | 3,193,100 | 55% | 212,100 | 12% |
| Campaspe | River Murray | 815,600 | 426,400 | 52% | 5,300 | 7% |
| Loddon | River Murray | 2,178,600 | 1,864,600 | 86% | 2,200 | 2% |
| Avoca[(3)] | Lake Bael Bael and the Marshes | 188,200 | 101,600 | 54% | 0 | 0% |
| Mallee[(4)] | River Murray | Not available | Not available | Not available | Not available | Not available |
| Wimmera[(3)] | Lakes Hindmarsh and Albacutya | 646,900 | 462,100 | 71% | 4,100 | 5% |
| East Gippsland | Bass Strait | 791,600 | 789,900 | 100% | 240,300 | 99% |
| Snowy (Vic. only)[(5)] | Bass Strait | 1,014,200 | 1,321,400 | 130% | 553,300 | 99% |
| Tambo | Gippsland Lakes | 185,000 | 178,500 | 96% | 73,400 | 91% |
| Mitchell | Gippsland Lakes | 969,700 | 954,200 | 98% | 550,800 | 96% |
| Thomson | Gippsland Lakes | 970,500 | 521,500 | 54% | 230,700 | 36% |
| Latrobe | Gippsland Lakes | 1,099,600 | 956,400 | 87% | 369,900 | 71% |
| South Gippsland | Bass Strait, Western Port | 1,568,000 | 1,529,000 | 98% | 671,400 | 94% |
| Bunyip | Bass Strait, Western Port, Port Phillip Bay | 1,185,400 | 1,158,200 | 98% | 567,700 | 95% |
| Yarra[(6)] | Port Phillip Bay | 1,453,600 | 943,700 | 65% | 217,900 | 38% |
| Maribyrnong | Port Phillip Bay | 249,400 | 222,200 | 89% | 9,100 | 38% |
| Werribee | Port Phillip Bay | 267,000 | 178,000 | 67% | 600 | 3% |
| Moorabool | Port Phillip Bay | 262,800 | 152,100 | 58% | 1,700 | 4% |
| Barwon | Port Phillip Bay, Bass Strait | 352,100 | 329,800 | 94% | 91,300 | 62% |

| | | | | | | |
|---|---|---|---|---|---|---|
| Corangamite[3] | Corangamite lakes | 518,600 | 501,600 | 97% | 126,600 | 88% |
| Otway Coast | Bass Strait | 1,463,700 | 1,434,000 | 98% | 738,900 | 96% |
| Hopkins | Bass Strait | 1,072,400 | 982,100 | 92% | 167,800 | 65% |
| Portland Coast | Bass Strait | 522,300 | 504,200 | 97% | 258,200 | 93% |
| Glenelg | Bass Strait | 993,800 | 704,900 | 71% | 217,200 | 66% |
| Millicent Coast[4] | South Australia | Not available | Not available | Not available | Not available | Not available |
| **Total** | | **45,714,200** | **33,488,100** | **73%** | **7,494,700** | **56%** |

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.

## 4.6 Streamflow management plans

Streamflow management plans (SFMPs) determine how river water will be shared between consumptive uses and the environment in declared WSPAs in unregulated systems. Under government policy, 21 priority systems were identified for development of a 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.

In 2009–10, the Northern Region Sustainable Water Strategy was released. This stated that SFMPs would no longer be developed for the Kiewa River, King Parrot Creek, Yea River and Sevens Creek. The other priority rivers in the east and the west of the state are being reassessed through the Gippsland Region Sustainable Water Strategy and the Western Region Sustainable Water Strategy. These strategies are due for release in 2011.

Where SFMPs will no longer be developed, local management plans (also referred to as local management rules) 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.

In 2010–11, there were six SFMPs in effect in Victoria, all of which relate to the Yarra basin. Preparatory work continued on some others, with the focus on rivers with high environmental values that are flow-stressed.

A precursor to the establishment of a SFMP is the declaration by the Minister for Water of a WSPA under section 27 of the *Water Act 1989*. WSPAs protect the area's surface water resources through the development of a management plan that aims for equitable management and long-term sustainability of the resource. No WSPAs were declared in 2010–11. In September 2010, following the recommendations of the Northern Region Sustainable Water Strategy, WSPAs for King Parrot Creek and Yea River were abolished as SFMPs would no longer be developed for them.

Work continued on developing SFMPs for Woori Yallock Creek WSPA and Little Yarra and Don Rivers WSPA as well as on the integrated groundwater and surface water management plan in the Upper Ovens WSPA.

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 six SFMPs that are in effect, and hence information regarding its compliance with the SFMPs is available from its 2010–11 annual report.

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

| Basin | Work undertaken in 2010–11 |
|---|---|
| Kiewa | Local management rules were recommended under the Northern Region Sustainable Water Strategy. Work has commenced to develop these. |
| Ovens River above Myrtleford | Continued development of a management plan. |
| Goulburn: King Parrot Creek, Yea River, Sevens Creek | Local management rules were recommended under the Northern Region Sustainable Water Strategy. Work has commenced to develop these. |
| Thomson: Avon River | Reviewed under the Gippsland Region Sustainable Water Strategy: a local management plan was recommended. |
| Latrobe (upper) | Reviewed under the Gippsland Region Sustainable Water Strategy: a local management plan was recommended. |
| South Gippsland:<br>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<br><br>Woori Yallock Creek and Little Yarra–Don rivers | All approved and operational<br><br>Continued development of management plans. |
| Maribyrnong (upper) | Continuing work |
| Barwon: Main stem and tributaries to the south including Leigh River, but excluding Moorabool 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. |
| Upper Wimmera River | Reviewed under the Western Region Sustainable Water Strategy: a local management plan was recommended. |

## 4.7 Trade in environmental water

The Minister for Environment may trade allocation of environmental water where this would benefit the EWR (under section 48L (2) of the *Water Act 1989*). Trade is important to ensure environmental water is available where it is needed. For example, as Victoria does not have an environmental water entitlement in the Campaspe system, water must be traded using entitlements in other systems.

Trades are also made under Victorian environmental entitlements held by the Minister in trust for others, such as the Living Murray Program. Depending on annual environmental watering priorities and management of the Living Murray portfolio across the Murray–Darling Basin, trades may be undertaken both into and out of Victoria, on instruction from the Living Murray Program. In 2010–11, this equated to 154,965 ML of net trade into Victoria.

In addition, to facilitate the use of Commonwealth environmental water in Victorian rivers and wetlands, allocation trades into Victorian entitlements are required. In 2010–11, this equated to 57,083 ML of net trade into Victoria.

## 4.8 Conclusion

The high river flows and wet catchment conditions that occurred in 2010–11 presented markedly different considerations for the use of environmental water, compared to conditions under the ongoing drought. The focus of environmental water management shifted from protecting drought refuges to building resilience and maximising the environmental benefits of natural high flows.

As rainfall and runoff increased the volumes in water storages and Victoria’s water resource position improved, the temporary qualifications of recent years that had reduced the EWR were progressively lifted. At the end of June 2011, all remaining qualifications to surface water expired.

Seven new environmental entitlements were established and amendments were made to some environmental entitlements in 2010–11, including amendments relating to the transfer of Victoria’s environmental entitlements to the new VEWH, as of July 2011.

As a result of the high rainfall and river flows, basin outflows in 2010–11 were higher as a percentage of total inflows; and the total volume of water leaving was greater than in 2009–10. The outflows increased from 7,495 GL in 2009–10 to 33,488 GL in 2010–11. This was the highest volume of outflows since 2003–04.

Ongoing development of SFMPs and the Upper Ovens River Integrated Groundwater and Surface Water Management Plan continued in 2010–11 and six SFMPs were in operation during this period.

# Part 2: Basin water accounts 2010–11

Part 2 presents an account of water in each of Victoria's 29 river basins in 2010–11.

Chapter 5 provides an outline of how the accounts are compiled and identifies the key assumptions and limitations of the data.

Chapters 6 to 34 report on each basin, providing:

- a basin summary, using data in the Victorian Water Accounts as well as contextual information about what occurred in the basin in the reporting period
- the current management arrangements for water resources within the basin
- information on rainfall, inflows and storages in the basin in 2010–11
- a map of the basin
- the total water resources in each basin
- surface water, groundwater, recycled water and water for the environment in the basin
- seasonal allocations and restrictions on water use, diversions and extractions.

## Alphabetical listing of Victoria's river basins


| Basin | Chapter |
|---|---|
| Avoca | 13 |
| Barwon | 1 |
| Broken | 9 |
| Bunyip | 1 |
| Campaspe | 11 |
| Corangamite | 29 |
| East Gippsland | 16 |
| Glenelg | 33 |
| Goulburn | 10 |
| Hopkins | 31 |
| Kiewa | 7 |
| Latrobe | 21 |
| Loddon | 12 |
| Mallee | 14 |
| Maribyrnong | 25 |
| Millicent Coast | 34 |
| Mitchell | 19 |
| Moorabool | 27 |
| Murray | 6 |
| Otway Coast | 30 |
| Ovens | 8 |
| Portland Coast | 32 |
| Snowy | 17 |
| South Gippsland | 22 |
| Tambo | 18 |
| Thomson | 20 |
| Werribee | 26 |
| Wimmera | 15 |
| Yarra | 24 |

# 5 Overview of methodology

## 5.1 Introduction

This chapter outlines how the Victorian Water Accounts are constructed. It explains some important assumptions and limitations of the data in the accounts, which should be read in conjunction with the information in each basin chapter.

Surface water data is reported according to river basin boundaries as designated by the AWRC. This is consistent with Victoria's surface water allocation framework, which aims for a sustainable balance between water that can be taken from the river for consumption, and water that the river needs to maintain its health at a level acceptable to the community.

Some data is not aligned with river basin boundaries, and this data has been treated in various ways. For example, GMUs often do not fit neatly within river basins and require a different system of reporting. Groundwater is reported within each river basin according to its surface area within the basin, to indicate the total resource and its use.

The accounts present information on the location of diversions and extractions, rather than use. Diversions include urban diversions, irrigation district diversions, regulated river licensed diversions, unregulated river licensed diversions, environmental water diversions and small-catchment dams. Because diversions are recorded at the point of offtake, not the point of end use, they include the volume of transmission losses that may occur before water is delivered to customers. Diversions are usually for consumptive uses, although some diversions are for other purposes (including environmental purposes).

All information for each of the 29 basins is provided for the period 1 July 2010 to 30 June 2011. Responsibilities for water management are reported in the accounts as they were during 2010–11. Any changes to responsibilities since the end of June 2011 will be reported in future water accounts.

The accounts are generally reported in megalitres (ML): one megalitre equals one million litres. Volumes of surface water and groundwater entitlements, entitlement transfers and uses from surface water entitlements have been reported to the nearest ML as required to assess compliance. All other values in the report, such as catchment inflows, the surface-water balance and small-catchment-dam usage have been rounded to the nearest 100 ML. Gigalitres (GL: one thousand megalitres) are only used where volumes are sufficient to express them in this way.

The *Victorian Water Accounts 2010–11* do not provide information on water quality or the environmental health of waterways unless it affects water availability and use. Details of river health programs are available from the relevant catchment management authorities. An assessment of the environmental health of rivers and streams in each of Victoria's river basins is available in the *Index of stream condition: the second benchmark of Victorian river condition* (DSE 2005, at www.vicwaterdata.net). The benchmark is undertaken every five years and was undertaken in 2010; it is expected to be reported in the latter half of 2012.

## 5.2 Data sources

The Victorian Water Accounts are compiled from information obtained from:

- responses to requests for data to water businesses, catchment management authorities, DSE, major users of water and the MDBA
- water consumption and recycled water data collected from water businesses by the 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 Victorian 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.

## 5.3 Comparison with 2009–10

This is the eighth year that the water accounts have been compiled. For comparative purposes, water balance information for each basin in 2010–11 is presented alongside the values reported in 2009–10.

Differences between 2010–11 and previous years are, in most cases, the result of changes in climatic conditions or water use. However, as noted below, some differences are due to improvements in estimation methodologies or data collection methods. In some cases, minor errors, omissions or updates relating to the published 2009–10 data were identified in preparing the 2010–11 data. In these cases, revised 2009–10 figures have been presented with accompanying notes explaining why those figures are different to what was reported last year.

In many cases, these revisions flow through to the water balance of the relevant basin. Where a revision to a 2009–10 number has already been explained in the table that provides input into the water balance (for example a bulk entitlement table), a note has not also been included with the water balance table. Due to the catchment inflows in most cases being back-calculated using the other terms in the water balance, any change to one of those terms will also affect the catchment inflow.

## 5.4 Methodology, key assumptions and limitations of data

A number of key assumptions and limitations of the data should be borne in mind when interpreting the accounts. Qualifications and interpretation of the data are provided, usually in the notes below each table. Notes are provided:

- where qualification of the data, or further information, is warranted
- where the previous method to calculate or derive information has been revised
- to explain large or significant differences between 2010–11 values and those of previous years
- where data is only applicable to some basins (such as streamflow management plans), in which case the affected basins contain references to the relevant items.

### 5.4.1 Surface water resources

Surface water is always reported in the basin from which it is extracted. However, the report usually (but not always) indicates if water is transferred to another basin or basins where it is temporarily stored or used. For example, Coliban Water has a bulk entitlement to divert water from Lake Eppalock (which is located in the Campaspe basin) and transfer the water to Bendigo (which is located in the Loddon basin). In the water accounts, the water is accounted for at the point of diversion (the Campaspe basin) and not the point of use (the Loddon basin).

This similarly applies to Victoria's major cross-basin irrigation supply systems. Information on water supplied to the Rochester Irrigation Area, located at the downstream end of the Campaspe basin, is presented in the Goulburn basin, where its primary source of supply is located.

The metering of surface water resources is close to 100%.

Statewide estimates of evapotranspiration (ET) are presented in Appendix D. These estimates are based on results from SoilFlux, a one dimensional water balance model. ET was calculated for the most up-to-date land use (in 2009), rainfall (in 2010–11) and a historic rainfall sequence (1961–1990). As the primary purpose of the Victorian Water Accounts is to report on the availability and use of surface and ground water, ET has not been added to the river basin water accounts in the following chapters.

ET estimates require many approximations and assumptions, which make the accuracy uncertain. Reporting ET at the basin scale helps to reduce this uncertainty by smoothing out the errors that would occur at individual points in the landscape.

Major assumptions and limitations include assumptions in the SoilFlux model, including:

- using 1-km gridded data for land use, geology, depth to groundwater, and rainfall
- not allowing for changes in water storage (that is, rises and falls in the water table and soil moisture) or lateral flow
- condensing land use information for 2009 from the Victorian Land Use Information System (Department of Primary Industries) into 10 representative land use types to facilitate water balance modelling

ET for public land areas was generated by establishing relationships between ET, rainfall and depth to groundwater for each of the vegetation types modelled. These relationships were derived from results of previous SoilFlux modelling. This was necessary because previous projects had modelled only private land, and there were no estimates of ET from public land.

The impacts on flooding and inundation (including the major flooding in the summer of 2010–11) on ET have not been incorporated into ET estimates.

These estimates do not account for water applied by irrigation. In irrigation districts in northern Victorian basins, irrigation has been estimated to increase ET by between 110% and 160% of the dryland estimate.

The impacts of bushfires on forest vegetation (and, in turn, on ET) have not been incorporated into this study. Bushfires are known to have major impacts on ET as forest vegetation may be killed or damaged.

### 5.4.2 Groundwater resources

As noted earlier in these accounts, management of groundwater in Victoria is based on allocating resources within:

- groundwater management areas (GMAs)
- water supply protection areas (WSPAs)
- 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 a different GMUs, and each GMU is reported individually in the accounts.

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.

In the state water reports for 2003–04, 2004–05 and 2005–06, where a GMU had more than 5% of its surface area located within a given basin, it was included in the *Compliance with licensed groundwater volumes* table and the total volume of entitlement and use was reported. For example, the Goroke GMA is located in the Millicent Coast and Wimmera basins. In the 2005–06 report, the Goroke GMA's total entitlement limit of 2,200 ML was reported in each of the two basins. Whilst this approach ensured some reporting of groundwater within basins, it also resulted in groundwater entitlements and use sometimes being reported more than once.

The accounting for groundwater was revised in 2006–07, and the same method has been used for the Victorian Water Accounts since then. 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 (where 35.2% of its surface area is located), the Otway Coast basin (55.7%) and the Hopkins basin (9.1%). Therefore, in the Corangamite basin, all volumes for the Colongulac GMA are accounted for by multiplying the total volume (for example, entitlement volume, usage etc.) by 35.2%. Three exceptions are the Portland, Gerangamete and Cardigan GMAs.

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 of which is extracted from the Portland Basin. The remainder of the licensed entitlement was shared on a proportional basis between Cardigan, Barwon and Corangamite basins. 2,466 ML was extracted from the Portland GMA within the Portland Basin for urban supplies. There was no non-urban metered use in 2010–11. 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 of which is extracted from the Hopkins Basin. The remainder of the licensed entitlement was shared on a proportional basis between Cardigan, Barwon and Corangamite basins. 604 ML was extracted from the Cardigan GMA within the Hopkins Basin for urban supplies. The remaining 109 ML of metered use (non-urban) was shared on a proportional basis between Cardigan, Barwon and Corangamite basins. Barwon Water is the sole licence holder in the Gerangamete GMA and uses groundwater to supplement Geelong's water supply (see Table 28-9). 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.

Stock and domestic use for 2010–11 was estimated to be 2 ML/bore/year in groundwater areas managed by Goulburn–Murray Water and Grampians Wimmera Mallee Water and 1.5 ML/bore/year in groundwater areas managed by Southern Rural Water (except for the Nepean GMA, which was estimated at 1 ML/bore/year, and Deutgam WSPA which was estimated at 0.1 ML/bore/year).

It should be noted that while this report rounds percentages to the nearest percent, the underlying calculation multiplies by the actual percent. In the above example, the Cardigan GMA in the Corangamite basin would show that it has 20% of its surface area within the basin, however all volumes are multiplied by 19.9%.

This method does not perfectly reflect where the entitlement and use is actually located. In the example above, it is likely that groundwater bores are not evenly distributed across the Cardigan GMA and therefore more or less than 19.9% of bores will be located in the Corangamite basin. Further, some bores are licensed to extract more water than others, which will also result in inaccuracies in the volumes reported. However, the revised methodology is likely to result in a more meaningful representation of groundwater entitlements and use in each of the basins.

As in prior years, 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. For example, in the Broken basin chapter, .

Table 9-8 includes the Katunga WSPA, because this GMU has more than 5% of its area within the Broken basin. The Shepparton WSPA, with 1.1% of its area within the Broken basin, has not been included in .

Table 9-8 because it is lower than the 5% threshold. In this instance, the 1.1% that is located within the Broken basin is added to the basin that holds the largest proportion of the WSPA's surface area: in this case, the Goulburn basin. In 2010–11, the proportions were recalculated as the spatial layer used for the surface water basins was modified.

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 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. For 2010–11, in some instances the licensed entitlement may be higher than the PCV, based on dairy wash licences moving into the licensing framework. PCVs will be adjusted to take account of this. The Dairy Shed Water Licence Transition Scheme was developed to ensure water used in the dairy shed—such as water for washing yards, milking equipment, platforms and other plant—is fully licensed and accounted for.

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. A limitation of 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 an UA, although there is no groundwater compliance table within the Avoca basin because there are no WSPAs or GMAs. In this instance, it was also necessary to amend Table 13-2 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 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. The methodology was slightly revised in 2009–10 to better account for domestic and stock bores in unincorporated areas. Bores that were located spatially within a GMU but did not have a constructed depth within the GMU's depth range were allocated to an unincorporated area. The numbers reported are based on the surface area percentage within the basin. As indicated above, those GMAs and WSPAs with less than 5% surface area within the basin are not reported within that basin.

Metering programs are now complete, with all new licences since 2004 metered and all historic licences greater than 20 ML now metered. This enables more accurate reporting.

Rounding applied to groundwater resource and total use (presented in the second table in each basin chapter) are to the nearest 10 ML for volumes less than 1,000 ML and the nearest 100 ML for volumes greater than 1,000 ML.

### 5.4.3 Recycled water

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.

Recycled water data was collected from each water business by the ESC, separated into categories including:

- volume of wastewater produced, excluding evaporation
- 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
- volume discharged to the environment (ocean outfalls or inland water discharges).

The reuse information collected by the ESC is prepared by each of the relevant water businesses in accordance with the commission's performance reporting framework (which includes an audit component). Although the commission has high-level definitions of the end-use categories that water businesses must report on, in some cases it is possible that certain recycling activities may be classified by different businesses under different end-use categories.

In the three editions of the state water report, the volume of water recycled 'within process' was included in the total volume recycled and the percentage recycled. In the 2006–07, 2007–08, 2008–09, 2009–10 and 2010–11 Victorian Water Accounts, the volume recycled within process has still been included in the volume recycled, but has been excluded from the percentage recycled. This methodology has been applied in this report, to be consistent with the percentages reported in the ESC's annual performance report.

## 5.5 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions on water use due to water scarcity or poor water quality are reported in the basin accounts according to the basin in which the restriction occurs.

For urban water corporations and metropolitan retailers, restrictions target outdoor water use. Each urban water businesses has developed restriction policies which it applies in accordance with the drought response plans developed for each supply system. When water restrictions are not in force, all water consumers must still abide by permanent water saving measures (which are not reported in the tables for each basin). The department collects information about restrictions from water authorities throughout the year.

The amount of water made available to irrigators each year is determined by seasonal water allocations. The seasonal allocation differs from urban restrictions in that every year each irrigator is allocated a share of the available resource (which will vary from year to year). This seasonal allocation can be used at any time throughout the irrigation season. Water use can be further restricted by qualifying rights. While seasonal allocations largely apply to surface water, they are progressively being introduced into groundwater management planning.

Seasonal allocations are expressed as a percentage of entitlement (whether water share, water right or licensed volume). They are made early in the irrigation season and are 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 businesses throughout the irrigation season and increased if the available water exceeds their forecasts. The initial seasonal allocations are often low because water authorities do not know until late spring how much water will be available for use. Seasonal allocations are reported for each basin with an irrigation supply system.

Restrictions on licensed diversions from unregulated streams are typically applied through:

- rostering (also referred to as Stage 1 restrictions), which restricts the time or day on which water can be diverted from rivers
- stage 2, 3 and 4 restrictions: by a 25%, 50% and 75% reduction in diversion rate respectively
- irrigation ban, whereby no water can be diverted.
- Restrictions are reported for each basin with licenses for diversions from unregulated streams.

## 5.6 Surface-water balance

A number of assumptions were made in preparing the surface-water balance for each river basin.

Only on-stream storages greater than 1,000 ML were included in the water balance. Off-stream storages are not reported because this would double count the water that has already been diverted from rivers or extracted from groundwater. While storages that are less than 1,000 ML are important locally, they are a generally insignificant proportion of total storage at a river basin and statewide levels. Figure 1 in each basin includes all major on-stream and off-stream storages over 1,000 ML in the basin.

The unknown item in each water balance is generally the catchment inflows. Inflows have been back-calculated as the sum of basin outflows plus diversions.

The method of calculating in-stream losses (that is, infiltration from streams to groundwater, flows to floodplains and evaporation) is based on the loss functions used in models such as REALM.

Unless otherwise reported by water businesses, domestic and stock water users were assumed to divert their full entitlement volume.

The water accounts exclude diversions from rivers under domestic and stock rights which do not require a licence. The volume associated with these rights is relatively small.

Data available for the 2010–11 accounts is presented with rainfall and evaporation reported as separate items for most major storages. In previous accounts, net evaporation from major storages was reported, which accounted for the difference between rainfall and evaporation.

Inflows to the Kiewa basin, which are shared between New South Wales and Victoria, were reported as a consolidated volume and the outflows were split between New South Wales and Victorian shares.

In the Murray basin, inflows to Lake Victoria were not recorded as inflows to the Murray basin since those flows are actually transfers from elsewhere within the basin. The volume held in the Menindee Lakes in 2010–11 was above the designated threshold, and Victoria therefore had access to a 50% share of the storage. Victoria's share of the inflows into the Menindee Lakes is included in the Murray basin inflows in the accounts. Note that in years when the control of the Menindee Lakes reverts to New South Wales due to low storage volume, the storage volume and inflow is not included in the Murray balance. A release to the Murray via the Snowy Mountains Hydro-Electric Scheme was included as an inflow or transfer to the basin because it is consistent with the water balance protocols established in the methodology.

## 5.7 Small-catchment dams

Small-catchment dams include dams used for domestic and stock purposes, which are not required to be licensed. They also include dams used for commercial and irrigation purposes, which are now required to be registered (under the *Water Act 1989*) but for which registration has not yet been completed. When registration is complete, registered dams will be included as part of the unregulated licences category in future water accounts. Small-catchment dams filled by domestic and stock channel runs, such as in the Wimmera region, have been excluded.

As undertaken previously, small-catchment dam information was sourced from DSE's Flow Stress Ranking Project. Inflows for 2010–11 were considered similar to an average year when assessing the impact of farm dams.

Small-catchment dam information is presented in terms of average annual data. While the number of dams, their sizes and their uses are generally known, data about the volume of water that they actually use over the year is not readily available. It is therefore assumed to be similar to the estimated average annual usage in 2010–11.

## 5.8 Water entitlement trades

The Victorian Water Register is a register of water entitlements and transactions. It was launched on 1 July 2007 and initially included entitlements in the regulated northern Victorian water systems. On July 1 2008, the Water Register was extended to include entitlements in the regulated systems of Thomson/Macalister and Werribee in southern Victoria. This register was used to obtain information on water trade in Victoria in 2010–11. The data presented is for all transfers of allocation and water shares which were finalised in 2010–11.

The *Transfers and variations of water shares in the basin* table represents a summary of the movement of water shares into and out of the basin delivery systems in 2010–11 for systems that have been unbundled. The *Surface water bundled entitlement volume transfers* table summarises the movement of bundled entitlements in the basin in

2010–11. These tables are applicable to basins with bundled entitlements: that is, entitlements where the right to take and the right to use water are not separated. Interstate trade occurs from some basins, including the Murray and Goulburn basins.

The *Allocation trade in the basin* table represents an aggregate of the volume of allocation trade (the seasonal allocation made against water shares).

These tables provide a quantification of Victorian transfers in the basins.

## 5.9 Volume diverted

Water businesses are obliged to report on water use against their entitlements in their annual reports, which are on each water business' website. The Victorian Water Accounts present:

- the volume of surface water diverted from rivers relative to the volume in each bulk entitlement order, with:
- licensed diversions on regulated streams reported as part of bulk entitlements
- licensed diversions on unregulated streams reported as a separate line item in each basin
- volumes diverted under bulk entitlements provided by the water businesses: they have not been audited to ensure compliance was actually achieved
- volume of groundwater extracted relative to licensed volume for a GMA or WSPA: this is reported according to the proportion of the aquifer that lies within a basin and not at the individual-licence-holder level, which is assessed separately by water businesses.

Where a bulk entitlement was not finalised before 1 July 2011, compliance against the entitlement has not been assessed in the accounts and will be reported in future water accounts.

## 5.10 Water for the environment

Information set out in this report on water for the environment was obtained from:

- annual reports prepared by catchment management authorities and Melbourne Water
- discussion with representatives of catchment management authorities
- responses to questionnaires sent to water businesses responsible for meeting passing flow requirements under their bulk entitlements and section 51 licences
- streamflow management plan annual reports prepared by Melbourne Water
- the DSE's Sustainable Water Environments Division.

## 5.11 Comparison of the water accounts with other data sources

These accounts have been prepared using readily available information. Water accounts for parts of Victoria are also published in the MDBA Independent Audit Group's report on extraction cap compliance and other reports. Some of these documents may not have been finalised at the time of preparing the water accounts and consequently the values presented in the water accounts may be subject to revision within those documents. The method of reporting may also be different: small-catchment dams, for example, are reported in the water accounts but not included in diversion figures for extraction cap reporting.

Water businesses present information individually in each of their annual reports. It is important to note when comparing the water accounts with these annual reports that water businesses only report on their area of jurisdiction. For example, Goulburn–Murray Water and Lower Murray Water only report on water trades that they have processed, and it is only by presenting the sum of trades processed by these two businesses that an accurate picture of volumes traded can be obtained for the Murray basin.

While all efforts have been taken to ensure the accuracy and completeness of data presented, the DSE is not responsible for the results of any actions taken on the basis of information in this report, nor for any errors or omissions.

The National Water Account published by the Bureau of Meteorology contains water accounting reports for the Murray–Darling basin and Melbourne regions, which provide information at a regional water management scale. The Victorian Water Accounts provide information at a more local (that is, river basin and GMU) level.

# 6 Murray basin (Victoria)

This chapter sets out the accounts for the Murray basin. For detailed information about how they were compiled, refer to Chapter 5.

## 6.1 Murray basin summary

Inflows to the Murray basin in 2010–11 were close to double the long-term average and were significantly greater than inflows over the previous five years.

The volume held in Victoria's share of the major Murray system storages increased from 39% of capacity at the start of 2010–11 to 81% of capacity by the end of June 2011.

While allocations in the regulated Murray system began the year at 0% for the fourth year in a row, the allocation for high-reliability water shares reached 100% on 15 October 2010. This was the second consecutive year that the allocation for high-reliability entitlements reached 100%.

With the significant improvement in water availability, the Minister for Water revoked qualifications of rights to water in the Murray basin in October 2010.

By the end of January 2011, there were no towns in the Murray basin that remained subject to water restrictions.

All bans and restrictions on licenced diversion from unregulated streams were gradually removed by the end of September 2011.

Groundwater users in the Katunga WSPA were restricted in 2010–11. Total groundwater use in the basin reduced significantly compared to 2009–10, due to a reduction in extractions from both the Katunga WSPA and Shepparton WSPA.

## 6.2 Responsibilities for management of water resources

The MDBA is responsible under the Murray-Darling Basin Agreement for managing the water resources of the basin on behalf of Victoria, New South Wales, Queensland, the Australian Capital Territory and South Australia. Under the agreement, Victoria shares the volume of water stored in the basin's storages with New South Wales and holds a share of the total reservoir capacity to store and release its share of inflows. The agreement also specifies the minimum volume that both states must pass along the River Murray to South Australia.

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 6-1 shows the responsibilities of various authorities within the Victorian-controlled parts of the Murray basin in 2009–10. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 6-1 Responsibilities for water resources management within the Murray basin (Victoria), 2010–11

| 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 River Murray and operates the River Murray supply system |
| Department of Sustainability and Environment | | | | Coordinates Victoria's input to resource management associated with the River Murray |
| 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 | Manages private groundwater and | Supplies towns along the River Murray from | |

| | | | | |
|---|---|---|---|---|
| | and the First Mildura irrigation districts | surface water diversions in the Sunraysia region | Swan Hill to the South Australian border, including Robinvale and Mildura | |
| North East Water | | | Supplies towns upstream of Lake Mulwala, including Wodonga and Yarrawonga | Obliged to meet passing flow requirements |
| Goulburn Valley Water | | | Supplies towns in the Murray Valley Irrigation Area, including Cobram | |
| Coliban Water | | | Supplies towns in the Torrumbarry Irrigation Area | |
| East Gippsland Water | | | Supplies Omeo and Dinner Plain | |
| GWMWater | | | Supplies towns and farms with domestic and stock water in the Northern Mallee area | |
| North East Catchment Management Authority | | | | Manages waterways within the North East CMA area |
| Mallee Catchment Management Authority | | | | Manages waterways within the Mallee CMA area |

## 6.3 Rainfall, flows and storage in 2010–11

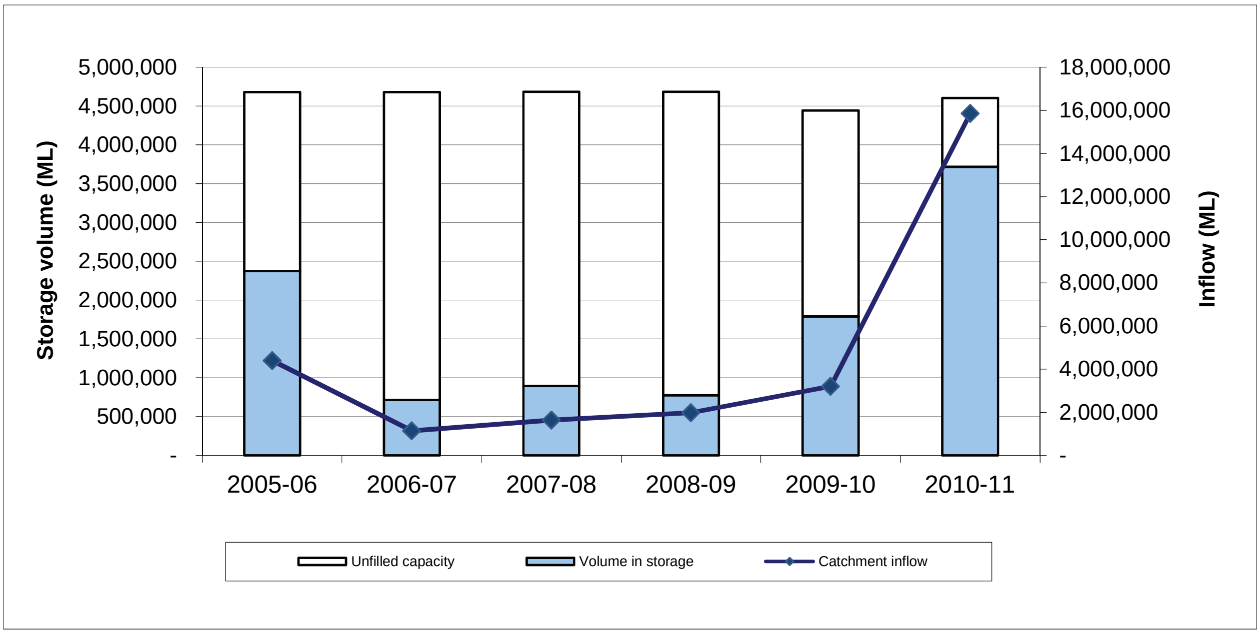
Rainfall across the Murray basin in 2010–11 was between 150% and 300% of the long-term average. Victoria's share of catchment inflows were significantly greater than annual inflows over the previous five years, and were more than double the long-term average of 7,618,000 ML.

The Victorian component of water flowing from the Murray basin to South Australia was 8,975,500 ML in 2010–11. This represented 57% of the total inflows into the basin, compared to 25% in 2010–11.

The volume held in major storages (storages greater than 1,000 ML capacity) in the Murray basin increased from 1,788,700 ML (39% of capacity) at the start of 2010–11 to 3,715,200 ML by the end of the year (81% of capacity). This includes Victoria's share of Lake Hume, Lake Dartmouth, Kings Billabong, Lake Cullulleraine, Lake Victoria and the Menindee Lakes.

Only volumes for major on-stream storages have been included in the water balance: as such, Kings Billabong has not been included.

### Figure 6-1 All major storages and catchment inflows in the Murray basin (Victoria)



## 6.4 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. 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 River Murray.

### Table 6-2 Summary of total water resources and water use in the Murray basin (Victoria), 2010–11

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | 16,152,700 | 839,800 |
| Groundwater(2) | 115,000 | 16,700 |
| Recycled water | 9,970 | 3,480 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 6-9 and the estimated domestic and stock use as presented in Table 6-10.

(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

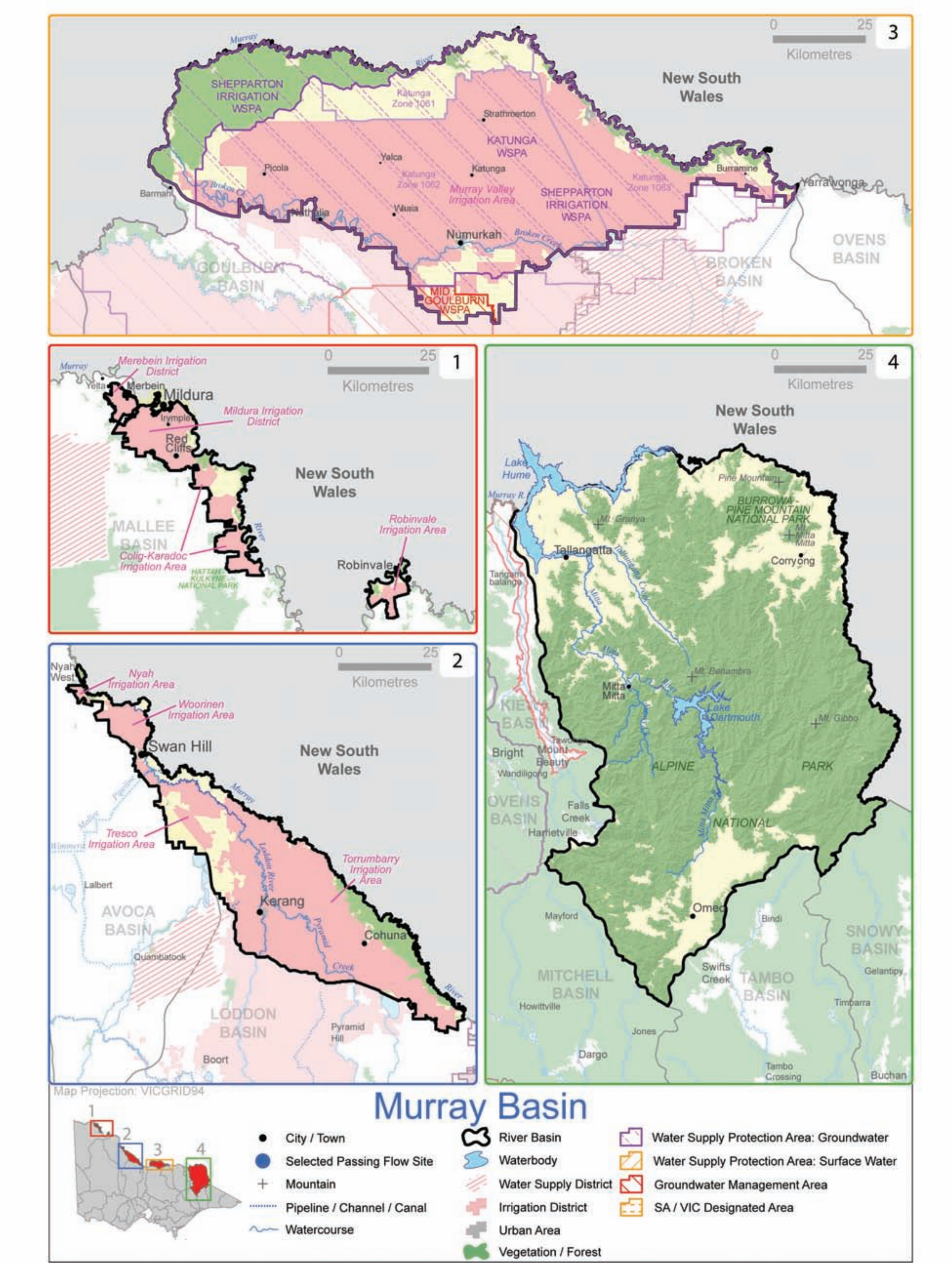
### 6.4.1 Infrastructure projects to improve water availability

Ongoing major infrastructure projects in the Murray basin include the Northern Victorian Irrigation Renewal Project which commenced in 2007 and is expected to be complete in 2014. The project involves replacing existing irrigation infrastructure to improve operational efficiency (including works to reduce channel outfalls, leakage and seepage) and rationalising the distribution system.

East Gippsland Water has constructed an additional raw water storage to improve the reliability of supply to Omeo when streamflow in Butchers Creek is low. Construction of the 10 ML storage began in August 2010 and was completed in April 2011.

## 6.5 Location of water resources

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



# 6.6 Surface water resources

## 6.6.1 Water balance

A surface-water balance for the Murray basin (Victoria) is shown in Table 6-3.

### Table 6-3 Balance of surface water in the Murray basin (Victoria)

| Water account component | 2010–11 (ML)(1) | 2009–10 (ML)(1) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | 1,788,700 | 772,000 |
| Volume in storage at end of year | 3,715,200 | 1,787,700(8) |
| **Change in storage** | **1,926,500** | **1,016,700** |
| **Inflows** | | |
| Catchment inflow(2) | 15,846,500 | 3,199,100 |
| Rainfall on major storages | 198,600 | 29,500 |
| Spills from NSW share of storage | - | 80,000 |
| Return flow from irrigation | 103,600 | 20,100 |
| Treated wastewater discharged back to river | 4,010 | 2,870 |
| **Sub-total** | **16,152,700** | **3,331,600** |
| **Usage** | | |
| Urban diversions | 27,470 | 32,950 |
| Irrigation district diversions | 552,600 | 655,400 |
| Licensed diversions from regulated streams | 205,300 | 252,200 |
| Licensed diversions from unregulated streams | 2,400 | 2,100 |
| Environmental water diversions | 45,500 | 36,500 |
| Small-catchment dams | 6,500 | 6,500 |
| **Sub-total** | **839,800** | **985,700** |
| **Losses** | | |
| Evaporation losses from major storages | 375,700 | 243,300 (6) (7) |
| Evaporation from small-catchment dams (3) | 1,100 | 1,100 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(4)(5) | 3,010,100 | 217,900(8) |
| **Sub-total** | **3,386,900** | **462,300** |
| **Water passed at outlet of basin** | | |
| River Murray flow to South Australia from Victoria's allocation | 8,975,500 | 802,800 |
| Spills to NSW share of storages | 892,500 | 0 |
| Ceding to NSW storages per Murray-Darling Basin Agreement | 131,500 | 64,100 |

Notes:

(1) The volumes in this table may not be consistent with the MDBA's final accounts, as different methods of reporting have been used.

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

(3) Data for water usage from small-catchment dams is provided by DSE. Evaporation losses are calculated by subtracting estimated usage from total water harvested.

(4) Estimate based on the difference between Victoria's share of inflows and outflows. Includes environmental diversions under surplus flow conditions.

(5) The instream losses component is a balancing item which is affected by errors in all other components, however the numbers are based on the best possible information at the time of finalising the accounts.

(6) This volume includes an estimate of evaporation from Lake Mulwala and Torrumbarry Weir based on long-term historical conditions rather than specifically for the 2010–2011 reporting period.

(7) Separate estimates of rainfall and evaporation were not available for Lake Hume and Lake Dartmouth. In these locations, net evaporation information was provided by the relevant authority and has been incorporated into the water balance evaporation item directly.

(8) Some elements of the 2009–10 water balance have been revised since the publication of the *Victorian Water Accounts 2009–2010.* These changes reault from updated storage ratings and climate data. As losses are the balancing item in this basin, this value is has also been updated.

## 6.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 6-4 are estimated by DSE, as outlined in Chapter 5.

### Table 6-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 7,200 | 3,600 | n/a |
| Registered commercial and irrigation | 3,400 | 2,900 | n/a |
| **Total** | **10,600** | **6,500** | **7,600** |

n/a: No information available

## 6.6.3 Water entitlement trade

Surface water was traded into, out of, and within the Murray basin in 2010–11 through water share transfers and variations, allocation trades and temporary transfers of bundled entitlement. Water share and allocation transactions made up the bulk of this movement, with no permanent transfers of bundled entitlement and only a small volume being transferred on a temporary basis during the year.

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Table 6-5 summarises the movement of water shares into and out of the Murray basin delivery systems in 20010–11. The water share market in the Murray was one of the most active of all Victorian basins, due in part to the large volume of water shares in the basin.

### Table 6-5 Transfers and variations of water shares in the Murray (Vic) basin 2010–11 [(1), (2)]

| Delivery system | High-reliability water shares | | | Low-reliability water shares | | |
|---|---|---|---|---|---|---|
| | Source (ML) (3) | Destination (ML) (3) | Net into basin (ML) | Source (ML) (3) | Destination (ML) (3) | Net into basin (ML) |
| River Murray | 4,422 | 8,479 | -4,057 | 1,232 | 1,178 | 54 |
| Robinvale, Red Cliffs, Merbein, First Murray Irrigation District | 11,824 | 17,384 | -5,560 | 152 | 126 | 26 |
| Nyah, Tresco and Woorinen | 4,511 | 4,983 | -472 | 1,005 | 972 | 33 |
| Torrumbarry Irrigation Area | 32,647 | 59,074 | -26,427 | 31,860 | 31,144 | 716 |
| Lower Murray Water - River Murray | 16,623 | 32,482 | -15,859 | 2,364 | 890 | 1,474 |
| Murray Valley Irrigation Area | 26,671 | 39,274 | -12,602 | 16,103 | 19,210 | -3,107 |
| Katunga Groundwater | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total 2010–11** | 96,699 | 161,676 | -64,977 | 52,717 | 53,521 | -804 |
| Total 2009–10 | 480,308 | 645,692 | -165,384 | 40,709 | 55,954 | 1,474 |

Notes:

(1) This table summarises all recorded water share transfers and variations in the Murray basin delivery systems in 2010–11. Trades that were in progress at the end of the year will be finalised in 2011–2012.

(2) Transfer applications result in a change of ownership. In some cases, the ownership change occurs with a transfer of land. Transfers of ownership that are part of a water or land sale are also included in this table. Variations do not invoice a change of ownership.

(3) The Source column is the use location of the water share before the trade or variation, and the Destination column the use location afterwards. Use locations are reported here as grouped nominated delivery systems. A positive number for net trade into the basin means that a greater volume of water shares have nominated that use location than have nominated a use location outside the group.

Table 6-6 summarises the trade of allocation in Victoria's share of the Murray basin in 2010–11. A total of 638,819 ML of allocation was traded into the Murray basin, including 219,811 ML traded within the basin. There was 338,960 ML of trade out of the basin, resulting in a net import to the basin of 80,049 ML.

### Table 6-6 Allocation trade in the Murray (Vic) basin[1, 2]

| Allocation trade type | Volume traded 2010–11 (ML) | Volume traded 2009–10 (ML) |
|---|---|---|
| Trade within Murray (Vic) basin | 219,811 | 217,029 |
| Trade from other Victorian basins | 80,562 | 39,391 |
| Trade to other Victorian basins | 145,671 | 80,059 |
| Interstate trade – inbound | 338,446 | 85,271 |
| Interstate trade – outbound | 193,289 | 80,335 |
| **Total trade into the Murray (Vic) basin** | **638,819** | **341,691** |
| **Net trade into the Murray (Vic) basin** | **80,049** | **-35,732** |

Notes:

(1) This table summarises allocation trades approved into, out of and within the Victorian Murray basin trading zones ( Zone 6 Murray–Dartmouth to Barmah, Zone 7 Murray–Barmah to SA, and Zone 6B Lower Broken Creek) compared to trade in other Victorian and interstate basins. Data on allocation trade between New South Wales and South Australian basins is not relevant to this report and therefore not included.
(2) In a pool exchange, some sellers (say 20) sell to some buyers (say 15) at the pool price. Administratively, this is implemented in the water register as 20 trades to a clearing account and then 15 trades from that clearing account. To avoid double counting, only the seller side is counted (that is, it counts as 20 trades).

In 2010–11, 85 ML of bundled entitlement volume in the Murray basin was transferred on a temporary basis. Table 6-7 summarises the trade of bundled entitlement volume in the Murray basin in 2010–11.

### Table 6-7 Surface water bundled entitlement volume transfers in the Murray Basin 2010–11

| Trading zone | Permanent transfers (ML) | Temporary transfers (ML) |
|---|---|---|
| Barmah to Nyah unregulated | 0 | 0 |
| Upper Murray main stem unregulated | 0 | 0 |
| Upper Murray unregulated | 0 | 85 |
| **Total 2010–11** | **0** | **85** |
| Total 2009–10 | 4 | 87 |

## 6.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement in the Murray basin is shown in Table 6-8. The total volume diverted in 2010–11 was less than the volume diverted in 2009–10.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Goulburn-Murray Water. Compliance with individual bulk entitlements in Table 6-8 is deemed to occur if water diverted did not exceed the maximum volume allowed to be diverted in 2010–11.

### Table 6-8 Volume of water diverted under surface water entitlements in the Murray basin (Victoria)

| Bulk entitlement | Bulk entitlement period (years) | Average bulk entitlement over period (ML) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance?(1) |
|---|---|---|---|---|---|
| *East Gippsland Water* | | | | | |
| Omeo | 1 | 77 | 0 | 58 | Yes |
| *Coliban Water* | | | | | |
| River Murray | 1 | 6,285 | 0 | 3,024 | Yes |
| *Goulburn Valley Water* | | | | | |
| River Murray | 1 | 5,593 | 0 | 4,016 | Yes |
| *North East Water* | | | | | |
| Bundalong | 1 | 51 | 0 | 11 | Yes |
| Corryong | 1 | 680 | 0 | 174 | Yes |
| Cudgewa | 1 | 29 | 0 | 0 | Yes |
| Dartmouth | 1 | 60 | 0 | 20 | Yes |
| Walwa | 1 | 61 | 0 | 14 | Yes |
| River Murray(2) | 1 | 12,794 | (10) | 6,576 | Yes |
| Eskdale(2) | 1 | N/A | 10 | 10 | N/A |
| *GWMWater* | | | | | |
| River Murray | 1 | 5,402 | 0 | 2,696 | Yes |
| *Goulburn-Murray Water* | | | | | |
| River Murray | 1 | 1,499,866 | 0 | 352,216 | Yes |
| *Lower Murray Water* | | | | | |
| River Murray – Lower Murray Urban and Rural Water – Urban | 1 | 30,971 | 0 | 13,568 | Yes |
| River Murray – Lower Murray Urban and Rural Water – Irrigation | 1 | 351,738 | 0 | 225,608 | Yes |
| River Murray – First Mildura Irrigation Trust | 1 | 59,297 | 0 | 13,261 | Yes |
| *Minister for Environment* | | | | | |
| River Murray – Flora and Fauna | 1 | 67,600 | | 45,550 | Yes |
| River Murray – Living Murray Initiative | 1 | 139,970 | | 134,300 | Yes |
| River Murray – Snowy Environmental Reserve | 1 | 29,794 | | 29,794 | Yes |

| Total annual volume of bulk entitlements 2010–11 | | 2,210,268 | 0 | 830,894 | |
|---|---|---|---|---|---|
| Total annual volume of bulk entitlements 2009–10 | | 2,185,489 | 1,289 | 977,022 | |
| *Licensed diversions from unregulated streams 2010–11* | | 83,753 | | 2,400 | |
| *Licensed diversions from unregulated streams 2009–10* | | *28,233* | | *2,100* | |

Notes:

(1) Compliance with River Murray bulk entitlements is also assessed against the Murray–Darling basin annual cap target for the Murray, Kiewa and Ovens basins. Details of this are contained in the MDBA's *Water audit monitoring report 2010–11*.

(2) North East Water transferred 10 ML from its River Murray bulk entitlement to enable a supply to the newly constructed water supply system for the Eskdale township, before a bulk entitlement being formalised for this system.

n/a: Not applicable

## 6.7 Groundwater resources

Licensed groundwater entitlements and use within the Murray basin for 2010–11 is presented in Table 6-9. Murray basin groundwater includes a proportion of the Katunga and Shepparton WSPAs. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

Groundwater use in the Murray basin reduced significantly in 2010–11, compared to 2009–10. Although groundwater levels in the Shepparton WSPA saw some recovery in response to the reduced usage, and recharge, provided by recent wetter conditions, overall groundwater levels are still lower now than they were five years ago. 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 2010–11 and groundwater levels are stable within the WSPA.

### Table 6-9 Licensed groundwater volumes, Murray basin (Victoria) 2010–11

| WSPA/GMA[1] | GMA/ WSPA depth limits[2] (m) | Entitlement limit[3] (ML/year) | Licensed entitlement[4] (ML/year) | Metered use (ML) | Estimated use in unmetered bores (ML)[5] | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Katunga WSPA (80%)[6] | >25 | 33,881 | 48,437 | 9,323 | - | 9,323 | 24,934 |
| Shepparton WSPA (31%) | ≤25 | 64,404 | 64,404 | 5,169 | - | 5,169 | 15,369 |
| **Total[7]** | | **98,285** | **112,841** | **14,492** | **-** | **14,492** | **40,303** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11. The entitlement limit in the Katunga WSPA is represented by 70% PCV due to restrictions in 2010–11.

(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.

(5) Bores with a licensed entitlement less than 20 ML per year are not metered in WSPAs and GMAs. No estimates have been provided for these bores: however, it is thought that this volume is negligible in most WSPAs and GMAs.

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

(7) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 6-10.

### Table 6-10 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | Number of domestic and stock bores[1][2] | Estimated domestic and stock use (assuming 2 ML per bore) (ML)[3] |
|---|---|---|
| Katunga WSPA (80%) | 557 | 1,114 |
| Shepparton WSPA (31%) | 534 | 1,068 |
| **Total** | **1,091** | **2,182** |

Notes:

(1) 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 6-9.

(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data before rounding.

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 6-11. Groundwater use for Dinner Plain increased slightly in 2010–11 compared to 2009–10, while groundwater use for Katunga reduced slightly and groundwater use for Strathmerton remained constant.

### Table 6-11 Urban groundwater usage

| Town supplied[(1)] | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Dinner Plain | 120 | 45 | 42 |
| Katunga | 110 | 39 | 46 |
| Strathmerton | 730 | 0 | 0 |
| **Total** | **960** | **84** | **88** |

Notes:

(1) Barnawartha groundwater use was, up to 2006–07, reported within the Murray basin in previous Victorian water accounts. A review of the basin boundaries indicated that the extractions for Barnawartha are located in the Ovens basin.

## 6.8 Qualification of rights

The qualification of rights in the Murray water system continued into 2010–11 to ensure essential needs could be met if dry conditions continued. The year commenced with Victoria's share of the Murray's storages at 39% of capacity and a zero allocation for Victoria's Murray system water shares. The qualification ensured that water corporations could supply water to towns, and for essential domestic and stock needs, while reserves remained low.

Victoria's Murray system water reserves had recovered sufficiently for a 23% allocation to be announced on 16 August 2010, at which time normal allocation arrangements resumed.

The Minister for Water revoked the qualification of rights in October 2010.

### Table 6-12 Qualifications of rights

| Legal instruments | Dates | Qualification type | Qualification description | Trigger for resuming normal sharing rules | Date trigger reached |
|---|---|---|---|---|---|
| Temporary qualification of rights in the Murray water system, July 2009 | 1 July 2009 to 8 October 2010 | Differential access by priority entitlements | Enabled domestic and stock users to take the volume of water necessary for essential needs (such as household purposes and for fire fighting); commercial and industrial users were able to take water for limited purposes. | 20% allocation or higher for high-reliability shares on the Murray system. | 16 August 2010 |
| | | | Enabled urban water corporations (Lower Murray Water, GWMWater, Coliban Water, Goulburn Valley Water and North East Water) to supply the essential needs of urban water users. | 10% allocation or higher for high-reliability shares on the Murray system. | 16 August 2010 |

## 6.9 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers, licensed diversions from unregulated streams, and groundwater extractions are presented in Table 6-13.

Urban restrictions in the Murray system were gradually lifted by the end of January 2011 following significant improvements in water availability.

The Murray system began the year with a zero allocation for high-reliability water shares. The allocation increased to 100% by mid-October. This was the second consecutive year since 2005–06 that the allocation for high-reliability entitlements reached 100%. There was no allocation against low-reliability water shares in the Murray system in 2010–11.

All bans and restrictions on licenced diversion from unregulated streams were gradually removed by the end of September 2011.

### Table 6-13 Seasonal allocations and restrictions on water use in Murray basin (Victoria), 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Urban | Cohuna, Gunbower and Leitchville | For Cohuna: Stage 2 restrictions from 1 July 2010 to 30 September 2010, Stage 1 restrictions from 1 October 2010 to 14 January 2011<br>For Leitchville: Stage 1 restrictions from 1 July 2010 to 30 September 2010<br>For Gunbower: Stage 2 restrictions from 1 July 2010 to 14 January 2011 |
| | Irymple, Kerang, Koondrook, Lake Boga, Merbein, Mildura, Murrabit, Piangil, Red Cliffs, Robinvale and Swan Hill | Stage 1 restrictions from 1 July 2010 to 2 October 2010 |
| | Walwa | Stage 4 restrictions from 6 September 2010 to 9 September 2010 |
| | Echuca | Stage 1 restrictions from 1 July 2010 to 30 September 2010 |
| Licensed diversions on unregulated streams | Sheepwash Creek (tributary of Ulupna Creek) | Stage 3 restriction from July to September 2010 |
| | Murray (below Hume) tributaries, Upper Murray (above Hume) tributaries | Irrigation ban from July to August 2010 |
| | Indigo Creek, Black Dog Creek (upper) | Irrigation ban from July to September 2010 |
| | Cudgewa Creek (Upper Murray) | Irrigation ban in July and August 2010 |
| | Back Creek (tributary of Little Snowy Creek) | Stage 4 restriction in July 2010 |
| | Little Snowy Creek | Stage 4 restriction in July 2010 |
| | Livingstone Creek | Irrigation ban in July and August 2010 |
| | Scrubby Creek | Stage 3 restriction in August 2010 |
| | Waterfall (tributary of Tallangatta Creek) | Irrigation ban in July and August 2010 |
| Irrigation and regulated diversions | Murray system (gravity and pumped) | Allocation began the year at 0% for high-reliability water shares and reached 100% on 15 October 2010. Low-reliability water shares remained at 0% allocation all year. |
| Groundwater | Katunga WSPA | Extractions from Katunga WSPA were restricted to 70% of licence volume in 2010–11. |

## 6.10 Recycled water

Around 35% of the volume of wastewater passing through treatment plants in the basin was recycled for consumptive use (Table 6-14), mostly for agricultural purposes. This was lower than the proportion recycled in 2009–10, though the volume of wastewater produced was larger.

### Table 6-14 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 (ML)[3] |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation[1] | Within process[2] | | |
| Bellbridge | 37 | 37 | 100% | 0 | 37 | 0 | 0 | 0 | 0 |
| Bundalong | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| Cobram | 137 | 137 | 100% | 0 | 137 | 0 | 0 | 0 | 0 |
| Cohuna | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| Corryong | 177 | 63 | 35% | 0 | 63 | 0 | 0 | 0 | 114 |
| Dartmouth | 13 | 0 | 0% | 0 | 0 | 0 | 0 | 13 | 0 |
| Gunbower/ Leitchville | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| Koondrook | 51 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 51 |
| Koorlong | 1,687 | 1,492 | 88% | 0 | 1,492 | 0 | 0 | 0 | 195 |
| Lake Boga | 39 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 39 |
| Merbein | 106 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 106 |
| Mildura | 1,869 | 1,064 | 57% | 0 | 1,064 | 0 | 0 | 0 | 805 |
| Nathalia | 105 | 59 | 56% | 0 | 59 | 0 | 0 | 46 | 0 |
| Numurkah | 162 | 79 | 49% | 0 | 79 | 0 | 0 | 83 | 0 |
| Nyah/Nyah West | 53 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 53 |
| Omeo | 34 | 34 | 100% | 0 | 34 | 0 | 0 | 0 | 0 |
| Red Cliffs | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| Robinvale | 206 | 179 | 87% | 0 | 179 | 0 | 0 | 0 | 26 |
| Strathmerton | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| Swan Hill | 1,165 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 1,165 |
| Tallangatta | 89 | 89 | 100% | 0 | 89 | 0 | 0 | 0 | 0 |
| Wodonga | 3,871 | 75 | 2% | 75 | 0 | 0 | 0 | 3,871 | -75 |
| Yarrawonga | 171 | 171 | 100% | 0 | 171 | 0 | 0 | 0 | 0 |
| **Total 2010–11** | **9,972** | **3,479** | **35%** | **75** | **3,404** | **0** | **0** | **4,014** | **2,479** |
| Total 2009–10 | 7,718 | 4,121 | 53% | 751 | 3,370 | 0 | 0 | 2,868 | 728 |

Notes:

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

(2) 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.

## 6.11 Water for the environment

### 6.11.1 Environmental Water Reserve

Important environmental assets depend on the EWR in the Murray basin. The Barmah–Millewa Forest, Gunbower Forest, Hattah Lakes and Kerang Wetlands are located along the River Murray and are all internationally significant wetlands listed under the Ramsar convention and are 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 River Murray to function ecologically.

In 2010–11 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 Minister for Environment
- the Living Murray Environmental Entitlement comprised 5,710 ML of high-reliability, 101,850 ML of low-reliability and 34,000 ML of unregulated entitlements held by the Minister for Environment on behalf of the MDBA
- the Barmah–Millewa Forest Environmental Water Allocation (EWA) – a significant operational rule embedded in consumptive entitlements
- the Environmental Entitlement (River Murray – Environmental Water Reserve) 2010
- 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: that is, water above cap.

### 6.11.2 Entitlements for the environment

A number of environmental watering actions took place in the Murray system in 2010–11, including delivery of Victorian and Living Murray environmental water.

A significant watering event was undertaken at Barmah–Millewa Forest in 2010–11, using water from Victorian, Living Murray and New South Wales entitlements. A total of 428,000 ML was delivered to the forest, including 84,500 ML of Victorian and 134,500 ML of NSW Barmah–Millewa EWA entitlement, 199,000 ML of Living Murray entitlement (100,000 ML of which was delivered from the Victorian entitlement), and 10,000 ML of NSW entitlement. These deliveries helped to sustain water levels in the Barmah–Millewa forest, supporting the largest bird breeding event in over 60 years.

Over 40,000 ML of Victorian environmental entitlement was delivered to wetlands across northern Victoria, using water available under the Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999. Sites watered included Hattah Lakes, Lindsay and Wallpolla islands, various floodplain wetlands off the River Murray channel, and wetlands within the Kerang region.

The Living Murray program also delivered 34,300 ML of River Murray unregulated flows, available under the Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999, to meet environmental water demand in the Lower Lakes in South Australia.

A number of trades are made under Victorian environmental entitlements held in trust for other programs, including the Living Murray program. The program holds entitlement across the Murray–Darling Basin, and depending on the annual environmental watering priorities and management of their portfolio across the basin, trades are undertaken both into and out of Victoria, upon instruction from the program.

### 6.11.3 Passing flow compliance

All passing flow requirements were complied with for the Murray Basin in 2010–11.

Table 6-15 shows selected passing flow compliance for the River Murray flora and fauna bulk entitlement.

#### Table 6-15 Selected passing flow compliance in the Murray basin

| River | Passing flow | |
|---|---|---|
| River Murray | Instrument where passing flows are specified | Bulk Entitlement (River Murray – Flora and Fauna) Conversion Order 1999 |
| | Responsible authority | Minister for Environment |
| | Compliance point | Not applicable |
| | Passing flow compliance | • Lindsay River dilution water: less than 91.3 GL per year<br>• Barmah-Millewa Forest Water: high security entitlement 50 GL per year; lower security entitlement 25 GL per year |

# 7 Kiewa basin

This chapter sets out the accounts for the Kiewa basin. For detailed information about how they were compiled, refer to Chapter 5.

## 7.1 Kiewa basin summary

Rainfall in the Kiewa basin ranged between 125% and 200% of the long-term average. Catchment inflows were 169% of the long-term average and were more than double the volume of inflows in 2009–10.

Licensed diversions from many unregulated streams were banned at the beginning of 2010–11. Bans were gradually lifted as streamflow conditions improved over the first half of the year.

There were no restrictions on urban water use during the year.

## 7.2 Responsibilities for management of water resources

Table 7-1 shows the responsibilities of various authorities within the Kiewa basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 7-1 Responsibilities for water resources management within the Kiewa basin, 2010–11

| Authority | Irrigation and rural water supply | 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 operations<br>Obliged to meet passing flow requirements |
| North East Catchment Management Authority | | | | Manages waterways for the whole of the Kiewa basin |

## 7.3 Rainfall, flows and storages in 2010–11

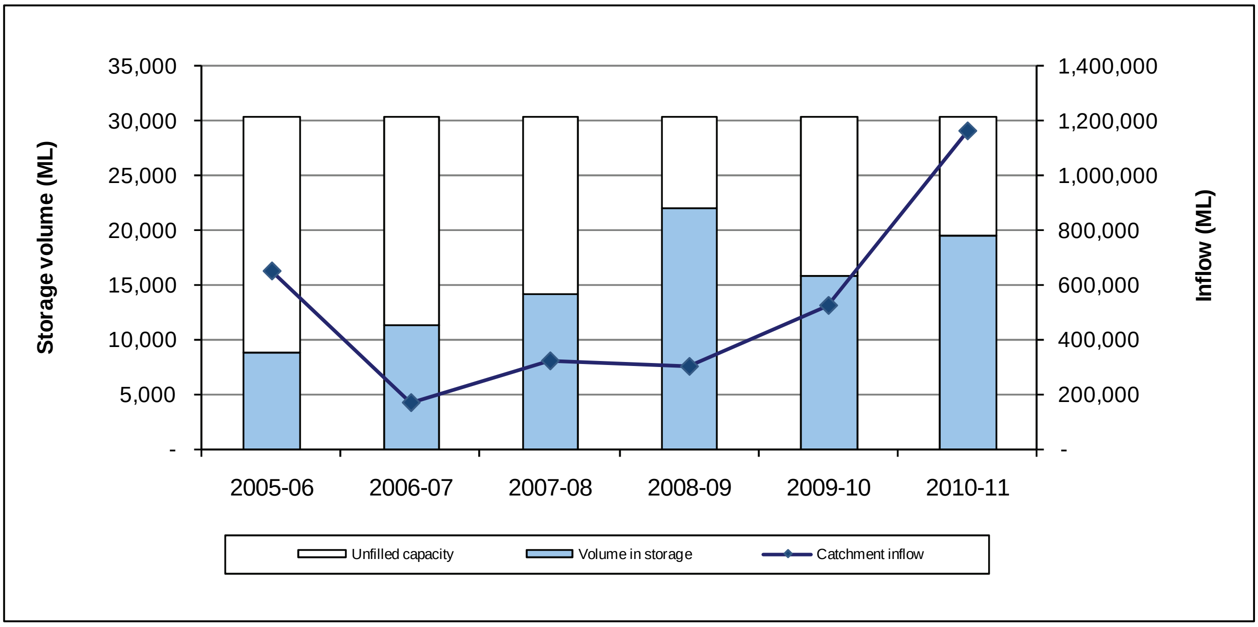
In 2010–11, rainfall in the Kiewa basin ranged between 125% of the long-term average in the upper catchment and 200% in the lower catchment. Inflows were 169% of the long-term average (689,000 ML). Figure 7-1 illustrates the greater magnitude of inflows to the basin, compared to the previous five years.

The volume of water flowing from the Kiewa basin into the River Murray increased to 1,082,000 ML in 2010–11 (including the New South Wales share of Kiewa River flows under the Murray–Darling Basin Agreement). This volume was almost double the 2009–10 outflow volume of 485,000 ML. The volume of water flowing from the Kiewa basin into the River Murray in 2010–11 represented 93% of the total inflows into the Kiewa basin, compared to 77% in 2009–10.

Storage levels for all major storages (storages greater than 1,000 ML capacity) in the basin increased from 15,865 ML at the start of July 2010 to 19,636 ML (64% of capacity) by the end of June 2011.

Only volumes for major on-stream storages have been included in the water balance: off-stream storages such as Pretty Valley Basin and Clover Pondage have not been included.

### Figure 7-1 All major storages and catchment inflows in the Kiewa basin




## 7.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Kiewa basin are shown in Table 7-2. Only a small proportion of the surface water resources in the Kiewa basin (0.4%) were extracted for consumptive use.

An overview of the methodology used to derive the information presented in this chapter is set out in Chapter 5.

### Table 7-2 Summary of total water resources and water use in the Kiewa basin, 2010–11

| Water source | Total water resource (ML)[1] | Total use (ML) |
|---|---|---|
| Surface water | 1,164,600 | 5,100 |
| Groundwater [2] | 1,800 | 120 |
| Recycled water | 420 | 180 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 7-7 and the estimated domestic and stock use as presented in Table 7-8.

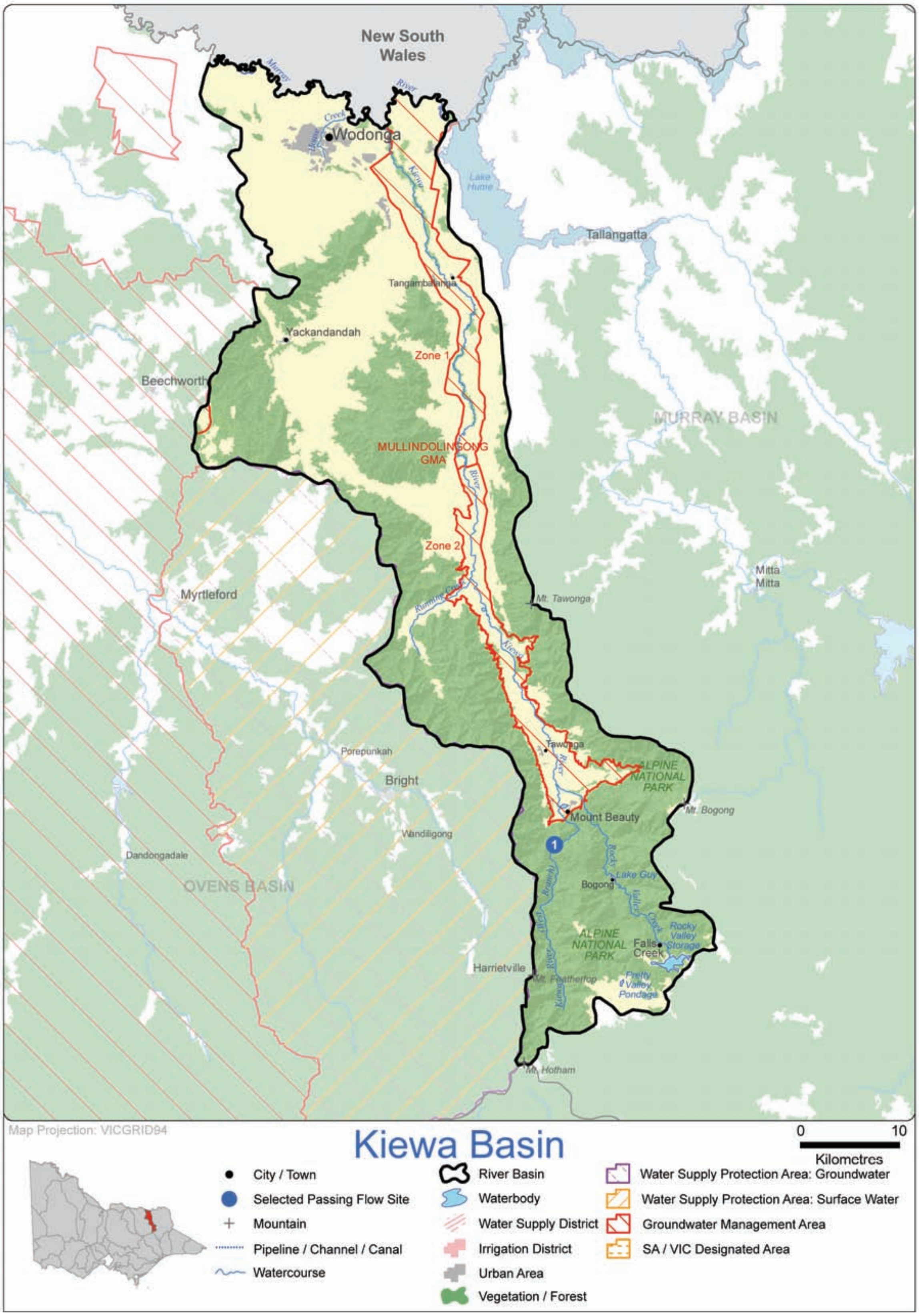
(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

### 7.4.1 Infrastructure projects to improve water availability

There were no infrastructure projects to improve water availability within the Kiewa basin in 2010–11.

## 7.5 Location of water resources

### Figure 7-2 Map of the Kiewa basin



## 7.6 Surface water resources

### 7.6.1 Water balance

A surface-water balance for the Kiewa basin is shown in Table 7-3. Note that only on-stream storages greater than 1,000 ML capacity have been included in the water balance.

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

#### Table 7-3 Balance of surface water in the Kiewa basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | 15,100 | 21,500 |
| Volume in storage at end of year | 18,900 | 15,100 |
| **Change in storage** | **3,800** | **(6,400)** |
| **Inflows** | | |
| Catchment inflow (1) | 1,164,500 | 525,400 |
| Rainfall on major storages | n/a | n/a |
| Transfers from other basins | - | - |
| Return flow from irrigation | - | - |
| Treated effluent discharged back to river(2) | 130 | 140 |
| **Sub-total** | **1,164,600** | **525,500** |
| **Usage** | | |
| Urban diversions | 500 | 540 |
| Licensed diversions from unregulated streams | 700 | 3,800 |
| Small-catchment dams | 3,900 | 3,900 |
| **Sub-total** | **5,100** | **8,200** |
| **Losses** | | |
| Evaporation losses from major storages | n/a | n/a |
| Evaporation from small-catchment dams (3) | 1,100 | 1,100 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation (4) | 72,600 | 37,600 |
| **Sub-total** | **73,700** | **38,700** |
| **Water passed at outlet of basin** | | |
| Kiewa basin outflow to River Murray – Victoria share | 541,000 | 242,500 |
| Kiewa basin outflow to River Murray – NSW share | 541,000 | 242,500 |

Notes:
(1) Inflows have been back-calculated from outflows plus diversions.
(2) For 2010–11, this represents only water returned from the alpine resorts.
(3) Evaporation losses are calculated by subtracting estimated usage from the total water harvested.
(4) Losses are estimated using loss functions from the Kiewa River REALM.
n/a: rainfall and evaporation data is not available for the storages in the Kiewa basin.

### 7.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 7-4 are estimated by DSE, as outlined in Chapter 5.

#### Table 7-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 4,000 | 2,000 | n/a |
| Registered commercial and irrigation | 2,300 | 1,900 | n/a |
| **Total** | **6,300** | **3,900** | **5,000** |

n/a: No information available

### 7.6.3 Water entitlement trades

No surface water trades took place in the Kiewa basin for 2010–11. Table 7-5 provides a summary for both the permanent and temporary transfers that took place in 2009–10 and 2010–11.

### Table 7-5 Surface water bundled entitlement volume transfers in the Kiewa Basin 2010–11

| Trading zone | Permanent transfers | | | Temporary transfers | | |
|---|---|---|---|---|---|---|
| | Bought (ML) | Sold (ML) | Net into basin (ML) | Bought (ML) | Sold (ML) | Net into basin (ML) |
| Kiewa main stem unregulated | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total 2010–11** | 0 | 0 | 0 | 0 | 0 | 0 |
| Total 2009–10 | 82 | 82 | 0 | 222 | 222 | 0 |

### 7.6.4 Volume diverted

The volume of water diverted under North East Water's and AGL Hydro Ltd's bulk water entitlements is shown in Table 7-6. Compliance with individual bulk entitlement volumes is deemed to occur if water diverted did not exceed the maximum volume allowed to be diverted in 2010–11. Licences on unregulated streams are not fully metered and water usage is an estimate provided by Goulburn-Murray Water.

### Table 7-6 Volume of water diverted under surface water entitlements in the Kiewa basin

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance?(1) |
|---|---|---|---|---|---|
| *North East Water* | | | | | |
| Kiewa – Tangambalanga | 1 | 179 | - | - | Yes |
| Mount Beauty – Tawonga | 1 | 719 | - | 324 | Yes |
| Yackandandah | 1 | 178 | - | 155 | Yes |
| *AGL Hydro Ltd* | | | | | |
| Bogong Village | 1 | 50 | - | 25 | Yes |
| Kiewa – Southern Hydro Ltd (2) | 1 | - | - | - | Yes |
| **Total annual volume of bulk entitlements 2010–11** | | **1,126** | **-** | **504** | |
| **Total annual volume of bulk entitlements 2009–10** | | **1,157** | **-** | **543** | |
| *Licensed diversions from unregulated streams 2010–11* | | *20,676* | | *700* | |
| *Licensed diversions from unregulated streams 2009–10* | | *18,511* | | *3,800* | |

Notes:

(1) Compliance with River Murray bulk entitlements is also assessed against the Murray–Darling basin annual cap target for the Murray, Kiewa and Ovens basins. Details of this are contained in the MDBA's *Water audit monitoring report 2010–11*.

(2) The Kiewa – 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.

## 7.7 Groundwater resources

Licensed groundwater entitlements and use for the Mullindolingong GMA in the Kiewa basin, excluding domestic and stock use, are shown in Table 7-7. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

Groundwater levels in the Mullindolingong GMA had an increasing trend through 2010–11.

### Table 7-7 Licensed groundwater volumes, Kiewa basin 2010–11

| WSPA/GMA (1) | GMA/WSPA depth limits(2) (m) | Entitlement limit(3) (ML/year) | Licensed entitlement(4) (ML/year) | Metered use (ML) | Estimated use in unmetered bores(5) (ML) | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Mullindolingong GMA (100%) | All depths | 6,980 | 1,732 | 13 | - | 13 | - |
| **Total** | | **6,980** | **1,732** | **13** | **-** | **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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11.

(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.

(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.

An estimate of domestic and stock groundwater use is provided in Table 7-8. Groundwater is not used as an additional source to supply urban customers in the Kiewa Basin.

### Table 7-8 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores(1)(2) | Estimated domestic and stock use (assuming 2 ML per bore) (ML)(3) |
|---|---|---|
| Mullindolingong GMA (100%) | 52 | 104 |
| **Total** | **52** | **104** |

Notes:

(1) 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 7-7.

(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data before rounding.

## 7.8 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to licensed diversions from unregulated streams are shown in Table 7-9. Licensed diversions from many of the Kiewa's unregulated streams were banned early in 2010–11. Bans were gradually lifted by the end of January 2011. There were no restrictions on urban water use in 2010–11

### Table 7-9 Seasonal allocations and restrictions on water use in Kiewa basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Licensed diversions on unregulated streams | Basin Creek, Deep Creek | Irrigation ban from July to November 2010 |
| | Running Creek | |
| | Back Creek (Yackandandah Creek) | Irrigation ban in July 2010 |
| | Back Creek (9 Mile Creek), Sheep Creek, Cherry Tree Creek, Bay Creek, Hellhole Creek, House Creek, Middle Creek, Nine Mile Creek, Sheepwash Creek, Kiewa Creek Tributary | Irrigation ban in July and August 2010 |
| | Glen Creek, Morgans Creek, Junction Creek | Irrigation ban from July to September 2010 |
| | Plain Creek | Irrigation ban from July 2010 to January 2011 |
| | Yackandandah Creek and tributaries | Irrigation ban in August 2010 |

## 7.9 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 wastewater produced and the proportion of wastewater recycled increased in 2010–11, compared to 2009–10.

### Table 7-10 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 (ML)[(3)] |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation [(1)] | Within process [(2)] | | |
| Baranduda | - | - | 0% | - | - | - | - | - | - |
| Dinner Plain | 107 | 107 | 100% | - | 107 | - | - | - | - |
| Mount Beauty | 242 | - | 0% | - | - | - | - | - | 242 |
| Yackandandah | 75 | 75 | 100% | - | 75 | - | - | - | - |
| **Total 2010–11 [(4)]** | **424** | **181** | **43%** | **-** | **181** | **-** | **-** | **-** | **242** |
| Total 2009–10 | 282 | 96 | 34% | - | 96 | - | - | - | 185 |

Notes:

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

(2) 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.

(4) Recycled water returned in Table 7-3 includes returns from alpine resorts.

## 7.10 Water for the environment

### 7.10.1 Environmental Water Reserve

Important environment 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 EWR in the Kiewa Basin. Water from the Kiewa Basin also feeds into the River Murray, helping to protect environmental assets within that basin.

In 2010–11 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 (that is, water above cap).

### 7.10.2 Passing flow compliance

Some bulk entitlements require passing flows to be met at specified points in a waterway. Others detail flow-sharing arrangements, which restrict the volume of water an authority can take depending on streamflow conditions.

All passing flow requirements were complied with for the Kiewa Basin in 2010–11. Table 7-11 shows selected passing flow rules in the Kiewa basin for the bulk entitlement compliance point in AGL Hydro's Kiewa bulk entitlement. The location of this compliance point can be seen in Figure 7-2.

### Table 7-11 Selected passing flow compliance in the Kiewa basin

| River | Passing flow | |
|---|---|---|
| East and West Kiewa rivers and tributaries, Bundara River and tributaries | Instrument where passing flows are specified | Bulk Entitlement (Kiewa – Southern Hydro Limited) Conversion Transfer Order 1998 |
| | Responsible authority | AGL Hydro Ltd |
| | Compliance point | Mount Beauty Regulating Pondage (shown as 1 in Figure 7-2) |
| | Passing flow compliance | The lesser of 100 ML per day or the daily average of the natural inflow to the waterway recorded over the previous seven days passed at the Mount Beauty Regulating Pondage |

### 7.10.3 Streamflow management plans

Local management rules were recommended for the Kiewa Basin under the Northern Region Sustainable Water Strategy. Work has commenced to develop these.

# 8 Ovens basin

This chapter sets out the accounts for the Ovens basin. For detailed information about how they were compiled, refer to Chapter 5.

## 8.1 Ovens basin summary

Rainfall in the Ovens basin ranged between 100% and 200% of the long-term average. Catchment inflows were close to double the long-term average, and almost four times greater than inflows in 2009–10.

Only two towns were subject to water restrictions in 2010–11. North East Water implemented Stage 4 restrictions for Bundalong and Springhurst during periods when water carting was required in response to water quality issues.

Rural diverters from some streams within the Ovens basin were subject to restrictions and irrigation bans at the beginning of the year, which were all lifted in August 2010. Restriction levels for most towns were gradually reduced over the year with increased water availability, but urban water use was lower than in 2009–10.

Licensed diverters on unregulated streams used half as much water as last year, though restrictions and bans on use were mostly only in place for a few months at the beginning of the 2010–11. The volume of licensed diversions from regulated streams was also significantly lower, compared to 2009–10.

Licensed groundwater use in the basin declined compared to 2009–10 as extractions from the Lower Ovens GMA and Upper Ovens WSPA continued to fall.

## 8.2 Responsibilities for management of water resources

Table 8-1 shows the responsibilities of various authorities within the Ovens basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 8-1 Responsibilities for water resources management within the Ovens basin, 2010–11

| 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<br>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 |

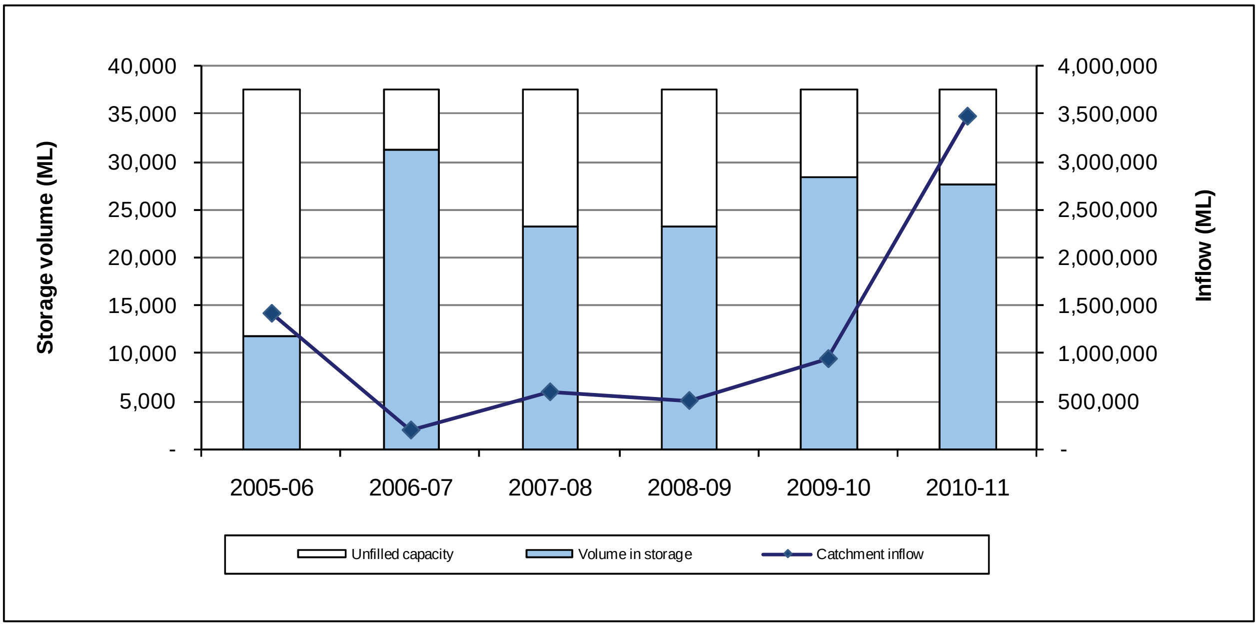
## 8.3 Rainfall, flows and storages in 2010–11

In 2010–11, rainfall across the Ovens basin ranged between 200% of the long-term average in the lower catchment to 100% in the upper catchment. Inflows in 2010–11 were 197% of the long-term annual average (1,758,000 ML), compared to 53% in 2009–10. This was the first time in five years where inflows were above the long-term average.

The volume of water flowing from the Ovens basin into the River Murray was 3,428,800 ML in 2010–11. This represented 99% of the total inflows into the basin, compared to 93% in 2009–10.

The total volume of water held in major storages in the Ovens basin was 28,400 ML at 1 July 2010 and decreased to 27,600 ML by end June 2011, or 74% of capacity. Major on-stream storages include Lake Buffalo and Lake William Hovell.

### Figure 8-1 All major storages and catchment inflows in the Ovens basin




## 8.4 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 8-2. The volume of surface water resources in 2010–11 increased to 3,479,500 ML, compared to 942,500 ML in 2009–10. While water availability increased, water use decreased by approximately 11,400 ML, compared to 2009–10.

### Table 8-2 Summary of total water resources and water use in the Ovens basin, 2010–11

| Water source | Total water resource (ML) | Total use (ML) |
|---|---|---|
| Surface water | 3,479,500 | 25,300 |
| Groundwater (1) (2) | 26,400 | 5,900 |
| Recycled water | 3,520 | 610 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 8-9 and the estimated domestic and stock use as presented in Table 8-10.

(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

### 8.4.1 Infrastructure projects to improve water availability

North East Water continues work to secure supply for Bright, Porepunkah and Wandiligong through plans to construct an off-stream raw water storage in the Upper Ovens catchment. Work undertaken in 2010–11 included an independent review of the site selection and design commencement. It is expected that the storage will be constructed in 2012–13. An additional drought relief bore was also constructed in 2010–11 at Bright to augment the surface water supply if required.

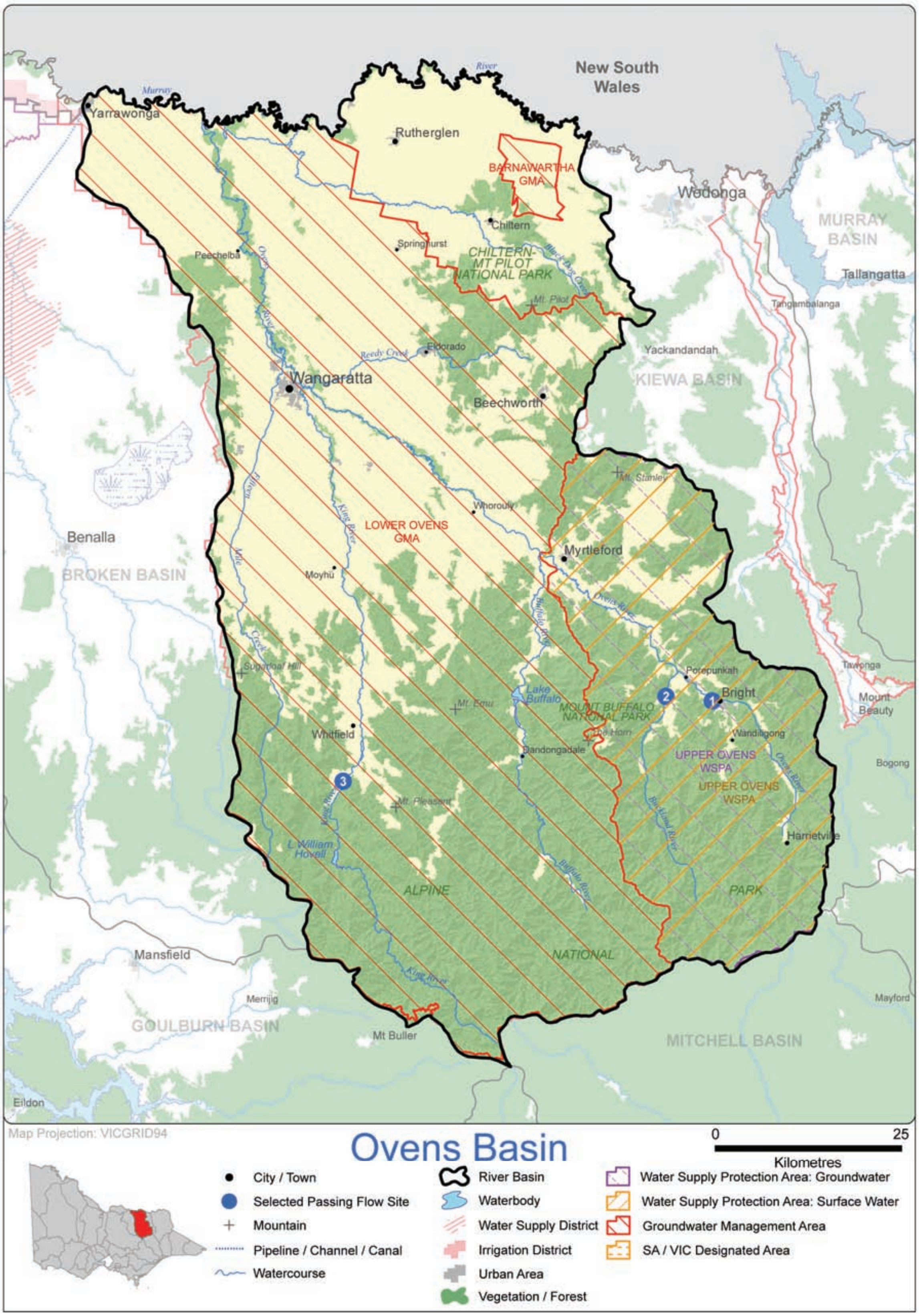
To improve water quality and security, North East Water is upgrading the Whitfield Water Supply by constructing a new treatment plant and pipeline to connect the town to the King River rather than to Musk Gully Creek. The project commenced in July 2010 and is expected to be completed by June 2012. Works completed in 2010–11 included the design and survey stages.

To improve water quality and security, North East Water is constructing a pipeline from Chiltern to Springhurst. This will extend the existing pipeline from Wodonga to Chiltern 18 km to Springhurst. The project commenced in July 2010 and is expected to be completed in December 2011. Works completed in 2010–11 include the design, survey and tender stages, and the commencement of construction.

To improve water quality and security and to reduce outdoor potable water usage, North East Water is upgrading the current Bundalong supply with a dual-pipe water supply system consisting of a drinking water supply, to be piped from Yarrawonga, for in-house use and a raw water supply, from Lake Mulwala, for outdoor use. In 2010–11, work was done to plan and design the pipeline which is expected to be completed in 2012.

## 8.5 Location of water resources

### Figure 8-2 Map of the Ovens basin



## 8.6 Surface water resources

### 8.6.1 Water balance

A surface-water balance for the Ovens basin is shown in Table 8-3. Only those storages greater than 1,000 ML capacity have been included in the water balance.

### Table 8-3 Balance of surface water in the Ovens basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | 28,400 | 23,300 |
| Volume in storage at end of year | 27,600 | 28,400 |
| **Change in storage** | **(800)** | **5,100** |
| **Inflows** | | |
| Catchment inflow[1] | 3,470,000 | 936,200 |
| Rainfall on major storages | 6,600 | 4,900 |
| Transfers from other basins | - | - |
| Return flow from irrigation | - | - |
| Treated effluent discharged back to river | 2,920 | 1,360 |
| **Sub-total** | **3,479,500** | **942,500** |
| **Usage** | | |
| Urban diversions | 4,680 | 5,440 |
| Licensed diversions from regulated streams | 4,300 | 8,700 |
| Licensed diversions from unregulated streams | 400 | 6,700 |
| Small-catchment dams | 15,900 | 15,900 |
| **Sub-total** | **25,300** | **36,700** |
| **Losses** | | |
| Evaporation losses from major storages | 2,400 | 3,200 |
| Evaporation from small-catchment dams[2] | 4,500 | 4,500 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation[3] | 19,300 | 19,300 |
| **Sub-total** | **26,200** | **27,000** |
| **Water passed at outlet of basin** | | |
| Ovens basin outflow to River Murray | 3,428,800 | 873,700 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(3) Loss estimate is based on the average annual losses from the Ovens River REALM.

### 8.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 8-4 are estimated by DSE, as outlined in Chapter 5.

### Table 8-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 14,700 | 7,400 | n/a |
| Registered commercial and irrigation | 10,100 | 8,500 | n/a |
| **Total** | **24,800** | **15,900** | **20,400** |

n/a: No information available

### 8.6.3 Water entitlement trades

Surface water was traded into, out of, and within the Ovens basin in 2010–11 through water share transfers and variations, allocation trade, and permanent and temporary transfer of bundled entitlement..

Table 8-5 summarises the movement of water shares into and out of the Ovens basin delivery systems in 2010–10. There was a net export of high-reliability water shares out of the basin, and a net import of low-reliability water shares into the basin, in 2010–11.

#### Table 8-5 Transfers and variations of water shares in the Ovens basin 2010–11 (1), (2)

| Delivery system | High-reliability water shares | | | Low and spill reliability water shares | | |
|---|---|---|---|---|---|---|
| | Source(3) (ML) | Destination (3) (ML) | Net into basin (ML) | Source(3) (ML) | Destination(3) (ML) | Net into basin (ML) |
| Ovens River | 1,440 | 1,200 | -240 | 583 | 570 | 13 |
| **Total 2010–11** | **1,440** | **1,200** | **-240** | **583** | **570** | **13** |
| Total 2009–10 | **1,869** | **1,968** | **-99** | **903** | **926** | **-23** |

Notes:

(1) This table summarises all recorded water share transfers and variations in the Ovens basin delivery systems in 2010–11. Trades that were in progress at the end of the year will be finalised in 2011–12.

(2) Transfer applications result in a change of ownership. In some cases, the ownership change occurs with a transfer of land. Transfers of ownership that are part of a water or land sale are also included in this table. Variations do not involve a change of ownership.

(3) The Source column is the use location of the water share before the trade or variation: the Destination column is the use location afterwards. Use locations are reported here as grouped nominated delivery systems. A positive number for Net into basin means that a greater volume of water shares have nominated that use location than have nominated a use location outside the group.

Table 8-6 summarises the trade of allocation in Victoria's share of the Ovens basin in 2010–11. A total of 10 ML of allocation was traded within the Ovens basin. No water was traded with other Victorian or interstate basins. As all the water was traded within the basin in 2010–11, there was no net movement of water into or out of the basin.

#### Table 8-6 Allocation trade in the Ovens basin(1), (2)

| Allocation trade type | Volume traded 2010–11 (ML) | Volume traded 2009–10 (ML) |
|---|---|---|
| Trade within Ovens basin | 10 | 782 |
| Trade from other Victorian basins | 0 | 0 |
| Trade to other Victorian basins | 0 | 0 |
| Interstate trade – inbound | 0 | 0 |
| Interstate trade – outbound | 0 | 0 |
| **Total trade into the Ovens basin** | **10** | **782** |
| **Net trade into the Ovens basin** | **0** | **0** |

Notes:

(1) This table summarises allocation trades approved into, out of and within the Ovens basin trading zones (Zone 9A Ovens River and Zone 9B King River) compared to trade in other Victorian and interstate basins. Data on allocation trade between New South Wales and South Australian basins is not relevant to this report and therefore not included.

(2) In a pool exchange, some sellers (say 20) sell to some buyers (say 15) at the pool price. Administratively, this is implemented in the water register as 20 trades to a clearing account and then 15 trades from that clearing account. To avoid double counting, only the seller side is counted (that is, it counts as 20 trades).

Table 8-7 summarises transfers of surface water bundled entitlement volume in the Ovens basin in 2010–11. There was no net transfer of water into or out of the basin for permanent and temporary trades in 2010–11.

#### Table 8-7 Surface water bundled entitlement volume transfers in the Ovens basin 2010–11

| Trading zone | Permanent transfers | Temporary transfers(1) |
|---|---|---|
| Ovens and King unregulated | 2 | 322 |
| **Total 2010–11** | **2** | **322** |
| **Total 2009–10** | 27 | 490(1) |

Note:

(1) In 2009-10, there was a net temporary transfer of 98 ML into the basin.

### 8.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 8-8. Compliance with individual bulk entitlement volumes is deemed to have occurred if water diverted did not exceed the maximum volume allowed to be diverted in 2010–11.

The Ovens River system bulk entitlement held by Goulburn-Murray Water is a climatically varying cap, which changes annually depending on the prevailing conditions as outlined in the bulk entitlement order.

**Table 8-8 Volume of water diverted under surface water entitlements in the Ovens basin**

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML)(1) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance?(2)(3) |
|---|---|---|---|---|---|
| *North East Water* | | | | | |
| Beechworth | 1 | 1,100 | 0 | 366 | Yes |
| Bright | 1 | 704 | 0 | 567 | Yes |
| Chiltern (4) | 1 | 180 | 0 | 0 | Yes |
| Glenrowan | 1 | 90 | 0 | 33 | Yes |
| Harrietville | 1 | 91 | 0 | 54 | Yes |
| Myrtleford | 2 | 1,212 | 0 | 483 | Yes |
| Ovens System – Moyhu, Oxley, Wangaratta – North East Water | 1 | 7,932 | 0 | 3,143 | Yes |
| Porepunkah | 1 | 166 | 0 | 0 | Yes |
| Springhurst | 1 | 36 | 0 | 20 | Yes |
| Whitfield | 1 | 34 | 0 | 10 | Yes |
| *Goulburn-Murray Water* | | | | | |
| Ovens System – Goulburn-Murray Water | 1 | 46,582 | 0 | 4,329 | Yes |
| **Total annual volume of bulk entitlements 2010–11** | | **58,127** | 0 | **9,005** | |
| Total annual volume of bulk entitlements 2009–10 | | 58,413 | 8 | 14,129 | |
| *Licensed diversions from unregulated streams 2010–11* | | *28,195* | | *400* | |
| *Licensed diversions from unregulated streams 2009–10* | | *25,040* | | *6,700* | |

Notes:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one-year) period in the bulk entitlement, divided by the number of years in that period.

(2) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

(3) Compliance with River Murray bulk entitlements is also assessed against the Murray–Darling basin annual cap target for the Murray, Kiewa and Ovens basins. Details of this are contained in the MDBA's *Water audit monitoring report 2009–10*.

(4) North East Water has not diverted any water under this bulk entitlement since February 2008, following the connection of Chiltern to the Wodonga supply system.

## 8.7 Groundwater resources

Licensed groundwater entitlements and use for the GMUs in the Ovens basin, excluding domestic and stock use, are shown in Table 8-9.

The Ovens basin contains the whole Barnawartha GMA, Upper Ovens WSPA and Lower Ovens GMA. In 2007–08, Murmungee GMA was replaced with the Upper Ovens WSPA and Lower Ovens GMA. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

There were no metered groundwater extractions from the Barnawartha GMA for 2010–11. Metered groundwater use from the Upper Ovens WSPA and Lower Ovens GMA for 2010–11 was 1,429 ML. Groundwater will be managed in the Upper Ovens as a connected system with the surface waters, with both included in the one management plan (currently in draft). Groundwater levels in the area are generally stable to increasing.

### Table 8-9 Licensed groundwater volumes, Ovens basin 2010–11

| WSPA/GMA[1] | GMA/ WSPA depth limits[2] (m) | Entitlement limit[3] (ML/year) | Licensed entitlement[4] (ML/year) | Metered use (ML) | Estimated use in unmetered bores[5] (ML) | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Barnawartha GMA (100%) | All depths | 2,100 | 645 | 0 | - | 0 | 0 |
| Upper Ovens WSPA (100%) | All depths | 4,010 | 3,295 | 86 | - | 86 | 411 |
| Lower Ovens GMA (100%) | All depths | 25,200 | 17,959 | 1,344 | - | 1,344 | 2,684 |
| **Total[6]** | | **31,310** | **21,899** | **1,429** | **-** | **1,429** | **3,095** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11.

(4) Entitlement volume includes domestic and stock usage in cases where it is part of an existing licence.

(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.

(6) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 8-10.

### Table 8-10 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | Number of domestic and stock bores[1][2] | Estimated domestic and stock use (assuming 2 ML per bore) (ML)[3] |
|---|---|---|
| Barnawartha GMA (100%) | 27 | 54 |
| Upper Ovens WSPA (100%) | 302 | 604 |
| Lower Ovens GMA (100%) | 1,909 | 3,818 |
| **Total** | **2,238** | **4,476** |

Notes:

(1) 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 8-9.

(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data before rounding.

Groundwater is used within the Ovens basin 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. The volume of licensed entitlements and metered use for these groundwater supplies are provided in Table 8-11.

In 2010–11, no groundwater was supplied to the towns of Moyhu, Myrtleford and Chiltern. Urban groundwater supply to Wangaratta was significantly increased in 2010–11, compared to 2009–10.

### Table 8-11 Urban groundwater usage

| Town supplied [1] | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Barnawartha | 293 | 3 | 2 |
| Moyhu | 15 | 0 | 0 |
| Myrtleford | 75 | 0 | 0 |
| Springhurst | 20 | 2 | 3 |
| Wangaratta | 675 | 50 | 12 |
| Chiltern | 25 | 0 | 0 |
| **Total** | **1,103** | **54** | **17** |

Note:

(1) A new bore was constructed at Bright in 2010 for emergency town water supply. The bore is yet to be commissioned or used, and a license is pending.

## 8.8 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban use and regulated diversions are shown in Table 8-12. Only Bundalong and Springhurst were subject to urban water restrictions in 2010–11. North East Water implemented restrictions for these towns during periods when water carting was required. Rural diverters from some streams within the Ovens basin were subject to restrictions and irrigation bans at the beginning of the year. These were all lifted in August 2010.

### Table 8-12 Seasonal allocations and restrictions on water use in Ovens basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Urban | Bundalong | Stage 4 restrictions from 7 September 2010 to 21 September 2010, Stage 4 restrictions from 4 May 2011 to 30 June 2011 |
| | Springhurst | Stage 3 restrictions from 1 July 2010 to 21 September 2010 |
| Unregulated diversions | Roberts Creek | Irrigation ban during July and August 2010 |
| | Hodgsons Creek | Irrigation ban during July and August 2010 |
| | Reedy Creek (above Yellow Creek confluence) | Irrigation ban during August 2010 |
| | Hurdle Creek | Stage 3 restriction during August 2010 |

## 8.9 Recycled water

North East Water operates all wastewater treatment plants in the Ovens basin. Approximately 17% of the wastewater passing through treatment plants in the basin in 2010–11 was recycled. This has decreased from 38% that was estimated in 2010–11.

Table 8-13 below shows the volumes of water recycled in the Ovens basin in 2010–11.

### Table 8-13 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 (ML)(3) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation(1) | Within process(2) | | |
| Barnawartha | 40 | 40 | 100% | 0 | 40 | 0 | 0 | 0 | 0 |
| Beechworth | 383 | 7 | 2% | 0 | 7 | 0 | 0 | 376 | 0 |
| Bright / Porepunkah | 363 | 10 | 3% | 10 | 0 | 0 | 0 | 353 | 0 |
| Chiltern | 50 | 50 | 100% | 0 | 50 | 0 | 0 | 0 | 0 |
| Myrtleford | 374 | 0 | 0% | 0 | 0 | 0 | 0 | 374 | 0 |
| Rutherglen / Wahgunyah | 246 | 246 | 100% | 39 | 207 | 0 | 0 | 0 | 0 |
| Wangaratta | 2,066 | 253 | 12% | 4 | 250 | 0 | 0 | 1,812 | 0 |
| **Total 2010–11** | **3,521** | **606** | **17%** | **52** | **554** | **0** | **0** | **2,915** | **0** |
| Total 2009–10 | 2,195 | 835 | 38% | 77 | 758 | 0 | 0 | 1,361 | 0 |

Notes:

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

(2) 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.

## 8.10 Water for the environment

### 8.10.1 Environmental Water Reserve

The Lower Ovens River, which contains heritage and icon reaches, is an important environmental asset that depends on the EWR in the Ovens basin. Water from the Ovens basin also feeds into the Murray basin, helping to maintain environmental assets within that basin. In 2010–11 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
- all other water in the basin not allocated for consumptive use; that is, water above cap.

### 8.10.2 Passing flow compliance

Some bulk entitlements require passing flows to be met at points in a waterway. Others detail flow-sharing arrangements, which restrict the volume of water an authority can take, depending on streamflows.

All passing flow requirements were complied with for the Ovens Basin in 2010–11. Table 8-14 shows passing flow compliance in the Ovens basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest. The locations of these compliance points are presented in Figure 8-2.

**Table 8-14 Selected passing flow compliance in the Ovens basin**

| River | Passing flow | |
|---|---|---|
| Ovens River | Instrument where flow-sharing rules are specified | Bulk Entitlement (Bright) Conversion Order 2000 |
| | Responsible authority | North East Water |
| | Compliance point | Bright diversion weir (shown as 1 in Figure 8-2) |
| | Passing flow compliance | • All flows were passed for flows less than 2 ML per day<br>• A minimum flow of 2 ML per day was passed for flows between 2 and 3.6 ML per day<br>• A minimum flow of 2 ML per day plus 20% of the total of flow less 3.6 ML per day was passed for flows between 3.6 and 39.5 ML per day<br>• 9.5 ML per day was passed for flows of 39.5 ML per day or greater |
| Buckland River | Instrument where flow-sharing rules are specified | Bulk Entitlement (Porepunkah) Conversion Order 1999 |
| | Responsible authority | North East Water |
| | Compliance point | Porepunkah Pump Station (shown as 2 in Figure 8-2) |
| | Passing flow compliance | • Half the flow was passed for flows less than 2.6 ML per day<br>• The entire flow, less 1.3 ML per day was passed for flows of 2.6 ML per day or greater |
| Buffalo River, King River, confluence to River Murray | Instrument where passing flows are specified | Bulk Entitlement (Ovens System – Goulburn-Murray Water) Conversion Order 2004 |
| | Responsible authority | Goulburn-Murray Water |
| | Compliance point | Catchment upstream of Cheshunt (King River between Cheshunt and Lake William Hovell) (shown as 3 in Figure 8-2) |
| | Passing flow compliance | • The lesser of 20 ML per day or natural flow was passed from November to May inclusive<br>• The lesser of 30 ML per day or natural flow was passed from June to October inclusive |

### 8.10.3 Water management plan

The Upper Ovens WSPA has been declared and this influences licensed entitlement trade flexibility. The associated Upper Ovens River Integrated Water Management Plan was in development throughout 2010–11. It has now been completed and as at the end of 2011 was awaiting final approval. The Upper Ovens WSPA plan, which defines water sharing between users and the environment, will cover both groundwater and streamflows in the first integrated management plan in the state.

# 9 Broken basin

This chapter sets out the accounts for the Broken basin. For detailed information about how they were compiled, refer to Chapter 5.

## 9.1 Broken basin summary

Inflows to the Broken basin in 2010–11 were more than double the long-term average, and were more than 10 times greater than inflows in 2009–10.

The year began with Lake Nillahcootie holding less than 30% of capacity and a 0% allocation for Broken system irrigators. By the beginning of September 2010, Lake Nillahcootie had recovered to full capacity and the allocation against high-reliability water shares had increased to 100%. The allocation for low-reliability water shares reached 100% in November 2010. This was the first time in five years that full allocations were made for high-reliability and low-reliability entitlements.

An irrigation ban for private diverters on Boosey Creek that was first introduced in January 2007 was able to be lifted at the end of August 2010.

Goorambat was the only town in the Broken basin subject to urban water restrictions in 2010–11. The town began the year on Stage 3 restrictions, which were gradually lifted by May 2011 in response to improved groundwater levels.

Licenced groundwater extractions from the Katunga WSPA were significantly less than in 2009–10.

## 9.2 Responsibilities for management of water resources

Table 9-1 shows the responsibilities of various authorities within the Broken basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 9-1 Responsibilities for water resources management within the Broken basin, 2010–11

| 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 [(2)]<br>Obliged to meet passing flow requirements |
| North East Water | | | Supplies towns across most of the Broken basin, including Benalla | Operates Loombah-McCall Say Reservoir<br>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 |

Notes:

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

(2) Lake Mokoan was decommissioned as an active storage reservoir in February 2010.

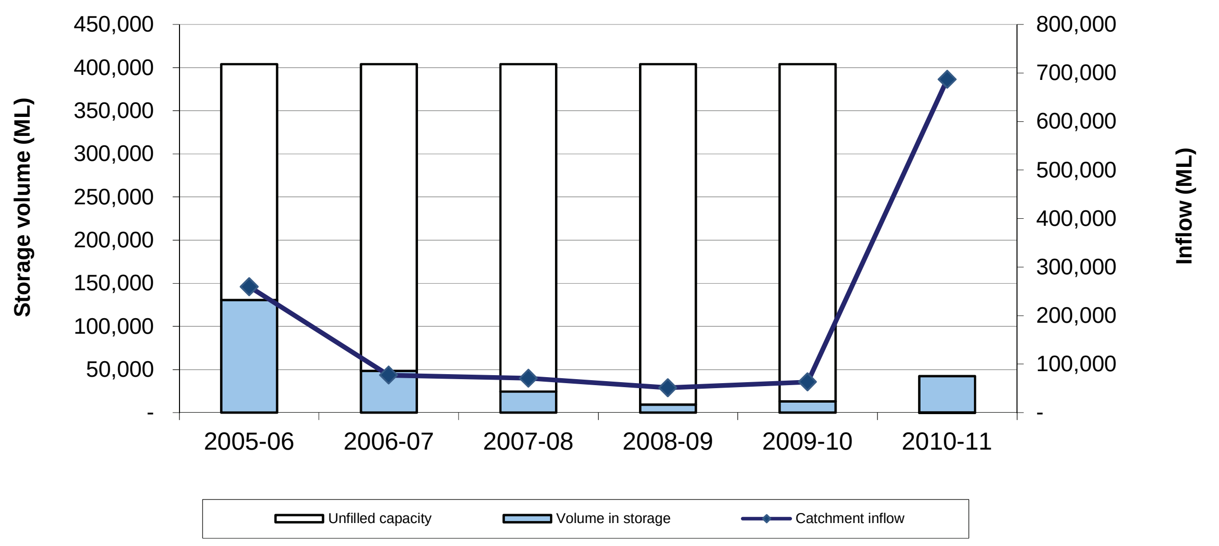
## 9.3 Rainfall, flows and storages in 2010–11

In 2010–11, rainfall across the Broken basin ranged between 125% and 200% of the long-term average. Wet catchment conditions resulted in total inflows of 223% of the long-term average (of 308,000 ML), making it the first time in five years where inflows were well above the long-term average.

The amount of water flowing from the Broken basin into the River Murray increased to 592,300 ML in 2010–11. This represented 86% of the total inflows into the basin, compared to 36% in 2009–10.

The volume of water held in major storages (greater than 1,000 ML capacity) in the Broken basin increased by approximately 29,190 ML in 2009–10 to 42,400 ML, or 100% of the total storage capacity. This included Lake Nillahcootie and Loombah-McCall Say Reservoir.

**Figure 9-1 All major storages and catchment inflows in the Broken basin**




## 9.4 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 9-2.

**Table 9-2 Summary of total water resources and water use in the Broken basin, 2010–11**

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | 693,600 | 17,600 |
| Groundwater(2) | 5,280 | 1,110 |
| Recycled water | 200 | 200 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in .
Table 9-8 and the estimated domestic and stock use as presented in Table 9-9.

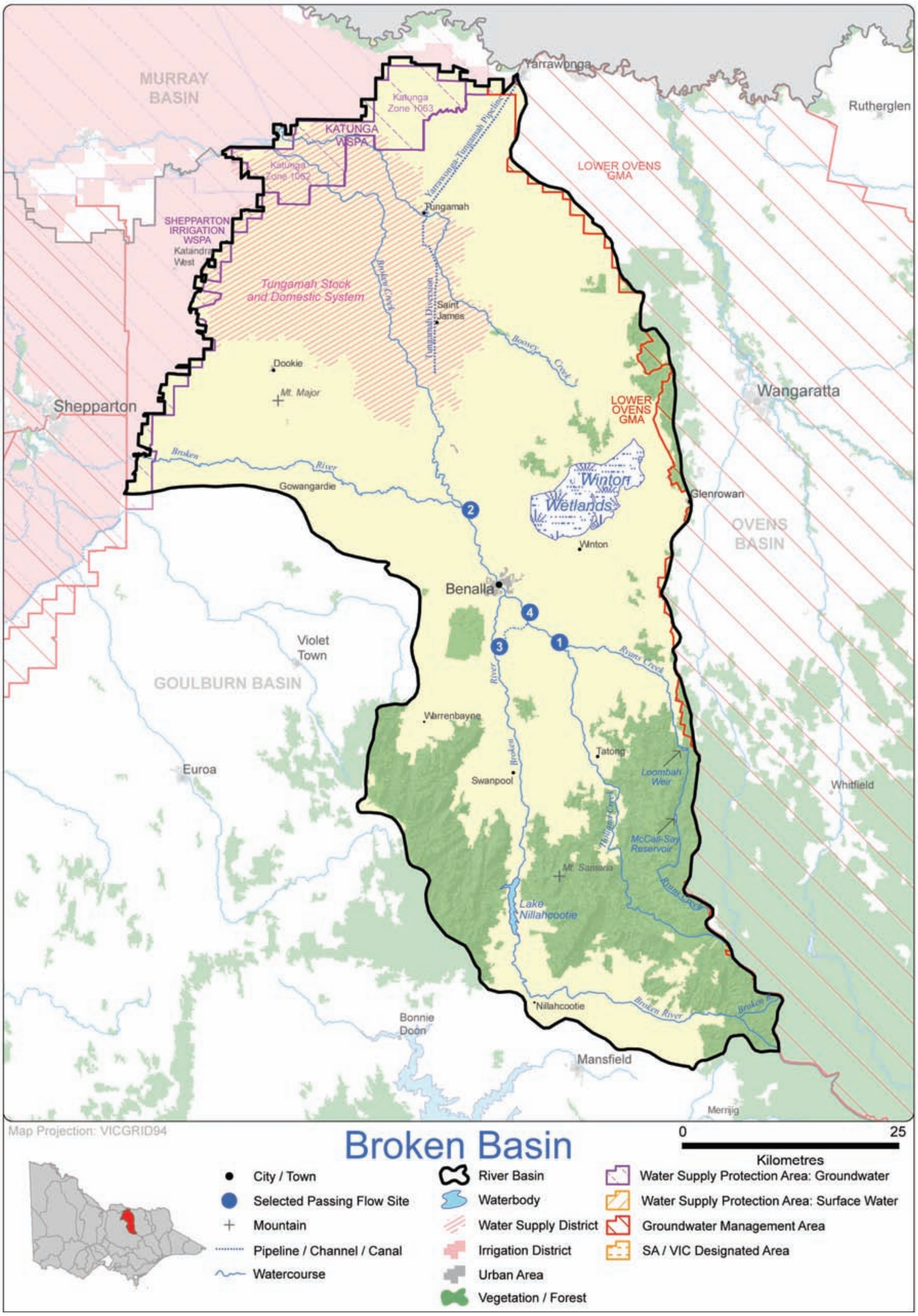
(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

### 9.4.1 Infrastructure projects to improve water availability

There were no infrastructure projects to improve water availability within the Broken River basin in 2010–11.

## 9.5 Location of water resources

### Figure 9-2 Map of the Broken basin



# 9.6 Surface water resources

## 9.6.1 Water balance

A surface-water balance for the Broken basin is shown in Table 9-3. Note that only those storages greater than 1,000 ML capacity have been included in the water balance.

### Table 9-3 Balance of surface water in the Broken basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | 13,200 | 9,200 |
| Volume in storage at end of year | 42,400 | 13,200 |
| **Change in storage** | **29,200** | **4,000** |
| **Inflows** | | |
| Catchment inflow(1) | 686,800 | 63,200 |
| Rainfall on major storages | 6,800 | 2,000 |
| Transfers from other basins | - | - |
| Return flow from irrigation | - | - |
| Treated effluent discharged back to river | - | - |
| **Sub-total** | **693,600** | **65,200** |
| **Usage** | | |
| Urban diversions | 1,140 | 1,390 |
| Licensed diversions from regulated streams(2) | 510 | 4,080 |
| Licensed diversions from unregulated streams(3) | 100 | 1,000 |
| Environmental water diversions | - | - |
| Small-catchment dams(4) | 15,800 | 15,800 |
| **Sub-total** | **17,600** | **22,300** |
| **Losses** | | |
| Evaporation losses from major storages | 3,700 | 1,900 |
| Evaporation from small-catchment dams(4) | 7,200 | 7,200 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(5) | 43,600 | 7,100 |
| **Sub-total** | **54,500** | **16,200** |
| **Water passed at outlet of basin** | | |
| Broken River at Gowangardie to Goulburn basin | 488,000 | 22,400 |
| Boosey Creek at Tungamah to Murray basin | 81,100 | 0 |
| Broken Creek at Katamatite to Murray basin | 23,200 | 300 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Includes Tungamah domestic and stock system.

(3) Licensed diversions from unregulated streams are derived from an estimate based on the total licensed volume.

(4) Data for water usage from small-catchment dams is provided by DSE. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(5) 2010–11 loss data was derived from the Goulburn Simulation Model.

## 9.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 9-4 are based on the estimates from DSE as outlined in Chapter 5.

### Table 9-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 15,400 | 7,700 | n/a |
| Registered commercial and irrigation | 9,600 | 8,100 | n/a |
| **Total** | **25,000** | **15,800** | **23,000** |

n/a: No information available

## 9.6.3 Water entitlement trades

Surface water was traded into, out of, and within the Broken basin in 2010–11 through water share transfers and variations, and allocation trade. There was no trade of permanent or temporary bundled entitlements in 2010–11.

Table 9-5 summarises the trade of water shares into and out of the Broken basin delivery systems in 2010–11. There was a net export of high-reliability water shares out of the basin in 2010–11, with approximately 341 ML of water traded out of the basin in 2010–11. There were no net imports or exports of low-reliability water shares within the basin in 2010–11. The volume of water trades in the Broken basin decreased, compared to 2009–10.

### Table 9-5 Transfers and variations of water shares in the Broken basin 2010–11 (1), (2)

| Delivery system | High-reliability water shares | | | Low-Reliability Water Shares | | |
|---|---|---|---|---|---|---|
| | Source(3) (ML) | Destination (3) (ML) | Net into basin (ML) | Source(3) (ML) | Destination(3) (ML) | Net into basin (ML) |
| Broken unregulated | 748 | 408 | -341 | 79 | 79 | 0 |
| **Total 2010–11** | **748** | **408** | **-341** | **79** | **79** | **0** |
| Total 2009–10 | 1,270 | 8,864 | -7,594 | 284 | 1,831 | -1,547 |

Notes:

(1) This table summarises all recorded water share transfers and variations in the Broken basin delivery systems in 2010–11. Trades that were in progress at the end of the year will be finalised in 2011–12.

(2) Transfer applications result in a change of ownership. In some cases, the ownership occurs with a transfer of land. Transfers of ownership that are part of a water and land sale are also included in this table. Variations do not involve a change of ownership.

(3) The Source column is the use location of the water share before the trade or variation: the Destination column is the use location afterwards. Use locations are reported here as grouped nominated delivery systems. A positive number for Net into basin means that a greater volume of water shares have nominated that use location than have nominated a use location outside the group.

Table 9-6 summarises the trade of allocation within the Broken basin in 2010–11. A total of 30 ML of allocation was traded within the Broken basin. No water was traded with other Victorian regions or interstate.

### Table 9-6 Allocation trade in the Broken basin (1), (2)

| Allocation trade type | Volume traded 2010–11 (ML) | Volume traded 2009–10 (ML) |
|---|---|---|
| Trade within Broken basin | 30 | 728 |
| Trade from other Victorian basins | 0 | 0 |
| Trade to other Victorian basins | 0 | 0 |
| Interstate trade - inbound | 0 | 0 |
| Interstate trade - outbound | 0 | 55 |
| **Total trade into the Broken basin** | **30** | **728** |
| **Net trade into the Broken basin** | **0** | **-55** |

Notes:

(1) This table summarises allocation trades approved into, out of and within the Broken basin trading zones ( Zone 2A , 2B and 6B) compared to trade in other Victorian and interstate basins. Data on allocation trade between New South Wales and South Australian basins is not relevant to this report and therefore not included.

(2) In a pool exchange, some sellers (say 20) sell to some buyers (say 15) at the pool price. Administratively, this is implemented in the water register as 20 trades to a clearing account and then 15 trades from that clearing account. To avoid double counting, only the seller side is counted (that is, it counts as 20 trades).

## 9.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 9-7.

Compliance with individual bulk entitlement volumes was deemed to have occurred if water diverted did not exceed the maximum volume allowed to be diverted in 2010–11.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Goulburn-Murray Water.

The Broken River system bulk entitlement volume held by Goulburn-Murray Water is a climatically varying annual cap in which compliance is determined under the MDBA cap compliance process.

### Table 9-7 Volume of water diverted under surface water entitlements in the Broken basin

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance?(1) |
|---|---|---|---|---|---|
| *North East Water* | | | | | |
| Loombah-McCall Say | 1 | 2,324 | 0 | 1,142 | Yes |
| Tungamah, Devenish and St James(2) | 1 | 135 | 0 | 0 | Yes |
| *Goulburn-Murray Water* | | | | | |
| Broken River System | 1 | 23,145 | 0 | 506 | Yes |
| **Total annual volume of bulk entitlements 2010–11** | | **25,604** | 0 | **1,648** | |
| Total annual volume of bulk entitlements 2009–10 | | 25,952 | 0 | 5,471 | |
| Licensed diversions from unregulated streams 2010–11 | | *12,085* | | *100* | |
| Licensed diversions from unregulated streams 2009–10 | | *9,749* | | *1,000* | |

Notes:

(1) Compliance with River Murray bulk entitlements is also assessed against the Murray-Darling basin annual cap target for the Goulburn, Loddon and Broken basins. Details of this are contained in the MDBA's Water audit monitoring report 2010–11.

(2) 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. These towns were supplied via a pipeline from Yarrawonga in 2010–11.

## 9.7 Groundwater resources

Licensed groundwater entitlements and use for the GMUs in the Broken basin, excluding domestic and stock use, are shown in Table 9-8. The Broken basin contains 9% of the Katunga WSPA by surface area. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

Extractions from Katunga WSPA were restricted to 70% allocation in 2010–11. The volume extracted from the Katunga WSPA in 2010–11 was significantly less than that extracted in 2009–10.

### Table 9-8 Licensed groundwater volumes, Broken basin 2010–11

| WSPA/GMA(1) | GMA/ WSPA depth limits(2) (m) | Entitlement limit(3) (ML/year) | Licensed entitlement (4) (ML/year) | Metered use (ML) | Estimated use in unmetered bores (ML)(5) | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Katunga WSPA (9%)(6) | >25 | 3,609 | 5,160 | 993 | - | 993 | 2,614 |
| **Total(7)** | | **3,609** | **5,160** | **993** | **-** | **993** | **2,614** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11. The entitlement limit in the Katunga WSPA is represented by 70% PCV due to restrictions in place in 2010–11.

(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.

(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.

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

(7) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 9-9.

### Table 9-9 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | Number of domestic and stock bores(1)(2) | Estimated domestic and stock use (assuming 2 ML per bore) (ML)(3) |
|---|---|---|
| Katunga WSPA (9%) | 59 | 119 |
| **Total** | **59** | **119** |

Notes:

(1) 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 9-8.

(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(3) Total volumes are based on the sum of management unit data before rounding.

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 9-10.

### Table 9-10 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Goorambat | 24 | 14 | 12 |
| **Total** | **24** | **14** | **12** |

## 9.8 Qualification of rights

The qualification of rights in the Broken water system continued into 2010–11 to ensure essential needs could be met if dry conditions continued. The year commenced with Lake Nillahcootie at just 29% of capacity and a zero allocation for Broken system water shares. The qualification ensured that water corporations could supply water to towns and essential domestic and stock needs while reserves remained low. Where qualifications of rights occur, a risk assessment is undertaken and environmental contingency plans developed to mitigate potential environmental risks.

By September 2010, Lake Nillahcootie had recovered to full capacity and the allocation against high-reliability water shares increased to 100% on 1 September 2010. The Minister revoked the qualification in October 2010.

### Table 9-11 Qualifications of rights

| Legal instruments | Dates | Qualification type | Qualification description | Triggers for resuming normal sharing rules | Date trigger reached |
|---|---|---|---|---|---|
| Temporary Qualification of Rights in the Broken Water System July 2009 | 1 July 2010 to 8 October 2010 | Differential access by priority entitlements | Enabled domestic and stock users to take the volume of water necessary for essential needs (such as household purposes and fire fighting), and commercial and industrial users were able to take water for limited purposes. | 50% allocation or higher for high-reliability water shares on the Broken system. | 1 September 2010 |
| | | | Allocation for North East Water's Tungamah, Devenish & St James bulk entitlement suspended. | When the Broken system allocation is above zero. | 16 August 2010 |
| | | | Goulburn-Murray Water’s obligation to supply water to Tungamah domestic and stock customers suspended. | | |
| | | Volume carried over | Removed obligation of Goulburn-Murray Water to release water for passing flows on Broken River and Holland Creek. | Expiry date: 30 June 2011. | 16 August 2010 |

## 9.9 Seasonal allocations and restrictions on water use, diversions and extractions

Seasonal allocations and restrictions applying to urban use, licensed diversions from unregulated streams and groundwater extractions are presented in Table 9-12. Goorambat was the only town in the Broken basin subject to urban water restrictions in 2010–11. The town began the year on Stage 3 restrictions, which were gradually lifted by May 2011 in response to improved groundwater levels.

The Broken system irrigation season began with a zero allocation. Allocations for high-reliability water shares reached 100% on 1 September 2010, with low-reliability water shares reaching 100% allocation on 15 November 2010. This was the first time in five years that allocations reached 100% for both high and low-reliability entitlements.

An irrigation ban for private diverters on Boosey Creek that was first introduced in January 2007 was able to be lifted at the end of August 2010.

Groundwater extractions from the Katunga WSPA were restricted to 70% of licence volume in 2010–11.

### Table 9-12 Seasonal allocations and restrictions on water use in Broken basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Urban | Goorambat | Stage 3 restrictions from 1 July 2010 to 8 February 2011, Stage 2 restrictions from 9 February 2011 to 17 May 2011 |
| Irrigation and regulated diversions | Broken System | High-reliability water share allocations started the year at 0% and reached 100% on 1 September 2010. Low-reliability water share reached 100% on 15 November 2010. |
| Unregulated diversions | Boosey Creek | Irrigation ban in July and August 2010 |
| Groundwater | Katunga WSPA | Extractions from Katunga WSPA were restricted to 70% of licence volume in 2010–11. |

## 9.10 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 reduced from 213 ML in 2009–10 to 198 ML in 2010–11. As in 2009–10, 100% of the wastewater produced in 2010–11 was recycled. Table 9-13 below details the recycling undertaken at Benalla in 2010–11.

### Table 9-13 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 (ML)(3) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation(1) | Within process(2) | | |
| Benalla | 198 | 198 | 100% | 0 | 198 | 0 | 0 | 0 | 0 |
| **Total 2010–11** | **198** | **198** | **100%** | 0 | **198** | 0 | 0 | 0 | 0 |
| Total 2009–10 | 213 | 213 | 100% | 0 | 213 | 0 | 0 | 0 | 0 |

Notes:

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

(2) 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.

## 9.11 Water for the environment

### 9.11.1 Environmental Water Reserve

Important environmental assets such as the Murray Cod and Trout Cod and significant areas of intact riparian and floodplain vegetation depend on the Broken basin EWR. Water from the Broken basin also feeds into the Murray basin, helping to maintain internationally significant environmental assets within that basin. These sites include Broken Creek and Lower Broken Creek which contains native fish habitat and a wetland of national significance.

In 2010–11 the Broken 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 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: that is, water above cap.

### 9.11.2 Passing flow compliance

Some bulk entitlements require passing flow requirements to be met at some points in the basin.

All passing flow requirements were complied with for the Broken Basin in 2010–11.

Table 9-14 shows passing flow compliance in the Broken basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest. The locations of these compliance points are presented in Figure 9-2.

#### Table 9-14 Selected passing flow compliance in the Broken basin

| River | Passing flow | |
|---|---|---|
| Ryan's Creek | Instrument where passing flows are specified | Bulk Entitlement (Loombah – McCall Say) Conversion Order 2001 |
| | Responsible authority | North East Water |
| | Compliance point | Loombah Reservoir (shown as 1 in Figure 9-2) |
| | Passing flow compliance | • The lesser of 2.75 ML per day or natural flow was passed<br>• 3.5 KL per day was passed from February to May when the combined storage volume was greater than a specified amount at the beginning of the month |
| Broken River, Holland Creek | Instrument where passing flows are specified | Bulk Entitlement (Broken System – Goulburn-Murray Water) Conversion Order 2004 |
| | Responsible authority | Goulburn-Murray Water |
| | Compliance point | Catchment upstream of Moorngag (Broken River upstream of Casey Weir) (shown as 2 in Figure 9-2) |
| | Passing flow compliance | Failed at times to pass the lesser of 30 ML per day or natural flow from June to November inclusive |
| | Compliance point | Broken River between Broken Weir and Casey Weir (shown as 3 in Figure 9-2) |
| | Passing flow compliance | Failed at times to pass the lesser of 22 ML per day or natural flow from December to May inclusive |
| | Compliance point | Holland Creek downstream of Holland Weir (shown as 4 in Figure 9-2) |
| | Passing flow compliance | • Failed at times to pass the lesser of 22 ML per day or natural flow when water is diverted from Broken River and/or Holland Creek to Lake Mokoan<br>• The prevailing flow was deemed as meeting environmental flows when water was not being diverted from Broken River and/or Holland Creek to Lake Mokoan |

# 10 Goulburn basin

This chapter sets out the accounts for the Goulburn basin. For detailed information about how they were compiled, refer to Chapter 5.

## 10.1 Goulburn basin summary

Inflows to the Goulburn basin in 2010–11 were 72% greater than the long-term average, and up to seven times greater than annual catchment inflows experienced over the previous five years.

The major storage in the basin, Lake Eildon, increased from 27% to 87% of capacity over the year.

The seasonal allocation for high-reliability water shares reached 100% on 15 November 2010. This was the first time since 2005-06 that irrigators received a full allocation against high-reliability entitlements.

Coliban Water was able to remove Stage 1 restrictions for its Goulburn system towns at the end of September 2010, No other towns in the Goulburn basin were subject to restrictions in 2010–11.

With the significant improvement in water availability, the Minister for Water revoked qualifications of rights to water in the Goulburn basin in October 2010.

Licenced groundwater extractions in the Goulburn basin reduced significantly in 2010–11 compared to 2009–10, likely as a result of higher rainfall and increased surface water availability.

## 10.2 Responsibilities for management of water resources

Table 10-1 shows the responsibilities of various authorities within the Goulburn basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 10-1 Responsibilities for water resources management within the Goulburn basin, 2010–11

| 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<br>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 |
| Minister for Environment | | | | Manages release of Snowy Environmental Reserve to the Murray for irrigation use as part of arrangements to supply Snowy environmental flows, also Living Murray Environmental Entitlement |
| Goulburn Broken Catchment Management Authority | | | | Manages waterways for the whole of the Goulburn basin |

## 10.3 Rainfall, flows and storages in 2010–11

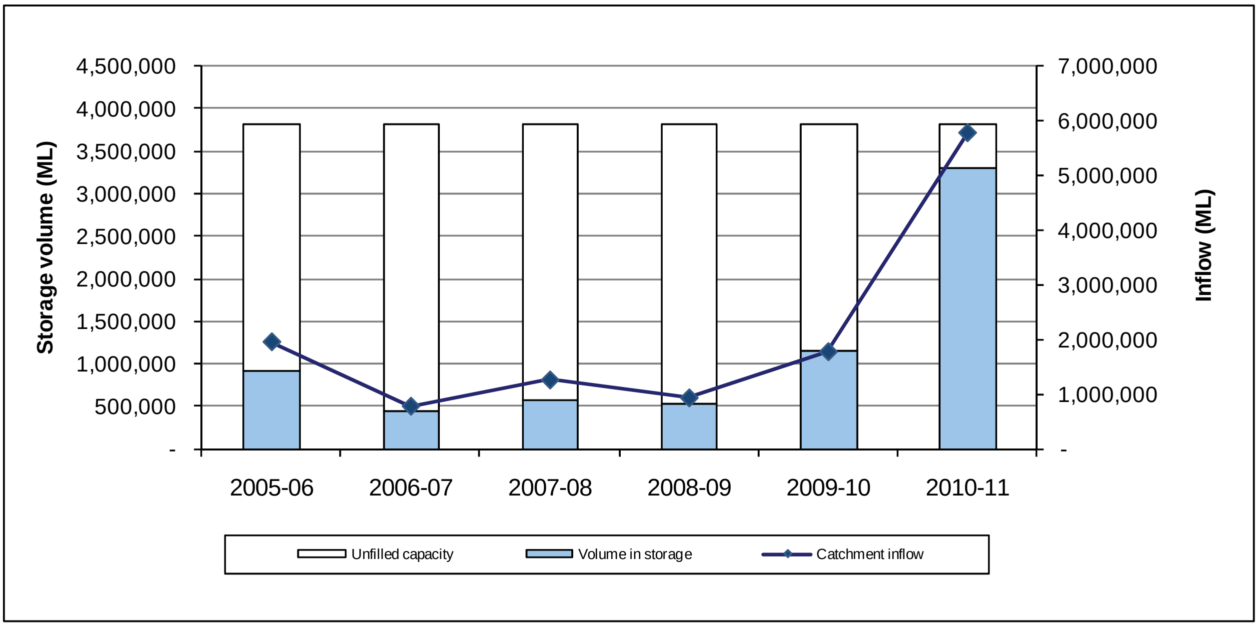
In 2010–11, rainfall across the Goulburn basin ranged between 125% and 200% of the long-term average. Catchment inflows were 72% greater than the long-term average of 3,363,000 ML, and up to seven times greater than annual catchment inflows experienced in the previous five years.

The amount of water flowing from the Goulburn basin into the River Murray increased to 3,193,100 ML in 2010–11. This represented 60% of the total inflows into the basin, an increase from 12% in 2009–10.

Storage levels for all major storages (greater than 1,000 ML capacity) in the basin increased from 942,600 ML at the start of July 2010 to 2,938,800 ML by the end June 2011, or 87% of the total storage capacity.

Only volumes for major on-stream storages have been included in the water balance, and as such, major off-stream storages such as Waranga Basin and Greens' Lake have not been included. The volume of water in the three major on-stream storages in the basin—Lake Eildon, Lake Nagambie (Goulburn Weir) and Sunday Creek Reservoir—increased by 1,996,200 ML in 2010–11.

### Figure 10-1 All major storages and catchment inflows in the Goulburn basin




## 10.4 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 10-2.

### Table 10-2 Summary of total water resources and water use in the Goulburn basin, 2010–11

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | 5,924,000 | 623,800 |
| Groundwater(2)(3) | 144,500 | 15,000 |
| Recycled water | 9,750 | 3,750 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in .

Table 10-9 and the estimated domestic and stock use as presented in Table 10-10.

(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

(3) Groundwater entitlements in Shepparton are generally high as groundwater has traditionally been pumped for salinity control. The total licence entitlements may therefore not be the total water resource.

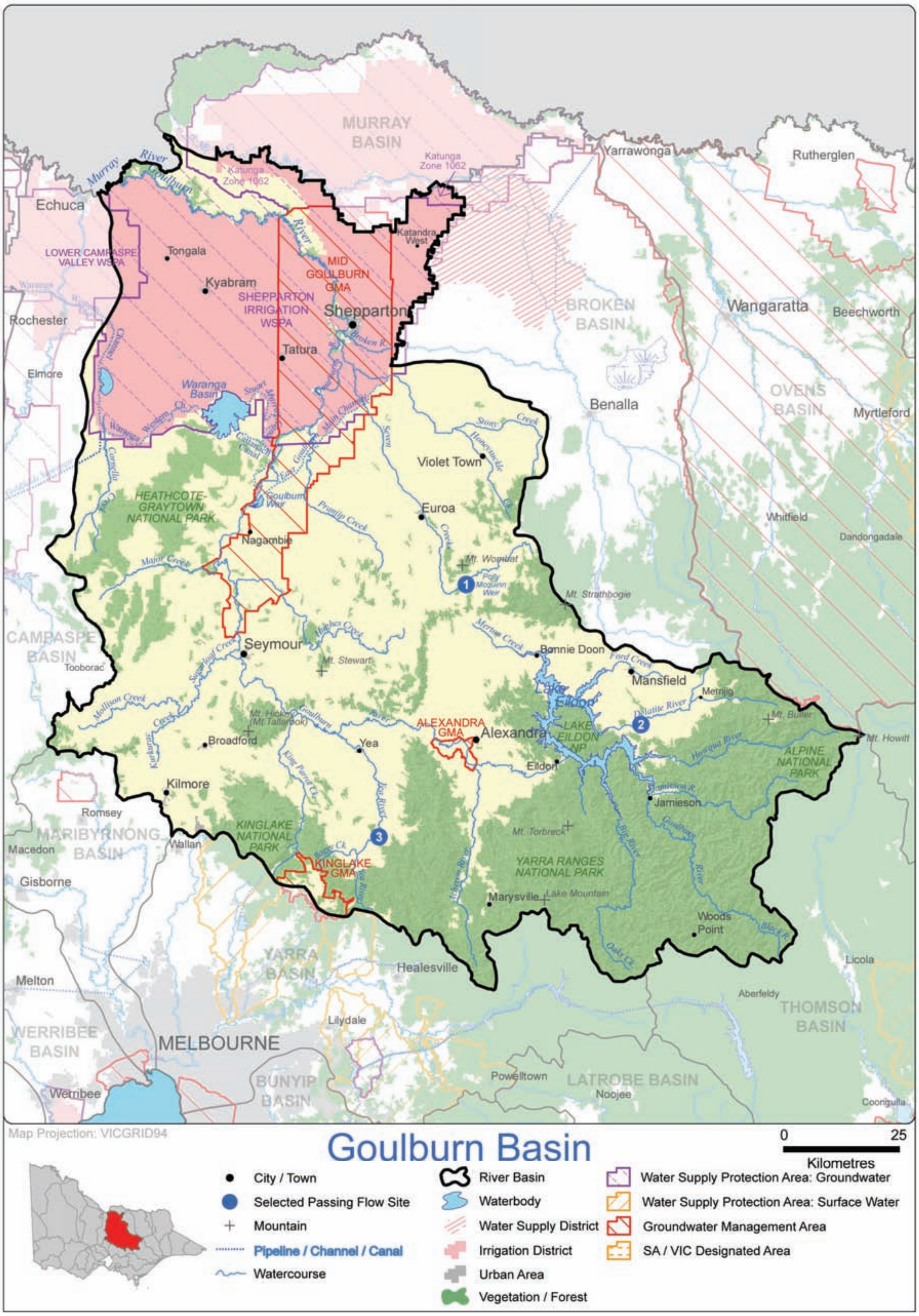
### 10.4.1 Infrastructure projects to improve water availability

Ongoing major infrastructure projects in the Goulburn basin include the Northern Victorian Irrigation Renewal Project, which commenced in 2007 and is expected to be completed in 2014. Works involve replacing the existing irrigation infrastructure to improve operation efficiency, including works to reduce channel outfalls, leakage and seepage, and rationalising the distribution system.

In December 2005, Goulburn Valley Water began constructing the Upper Goulburn Water Supply Project. The project will transfer treated water from Alexandra water treatment plant to Thornton and Eildon to provide better water quality. This includes the construction of a 7-km pipeline to Thornton and a 25-km pipeline to Eildon. It is expected that this project will be completed by September 2011.

## 10.5 Location of water resources

### Figure 10-2 Map of the Goulburn basin



## 10.6 Surface water resources

### 10.6.1 Water balance

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

Table 10-3. Note that only on-stream storages with capacity greater than 1,000 ML have been included in the water balance.

### Table 10-3 Balance of surface water in the Goulburn basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | 942,600 | 458,500 |
| Volume in storage at end of year | 2,938,800 | 942,600 |
| **Change in storage** | **1,996,200** | **484,100** |
| **Inflows** | | |
| Catchment inflow(1) | 5,289,400 | 1,755,100 |
| Rainfall on major storages | 140,300 | 57,000 |
| Inflow from Broken River at Gowangardie | 488,000 | 22,400 |
| Return flow from irrigation | - | - |
| Treated effluent discharged back to river(2) | 6,330 | 760 |
| **Sub-total** | **5,924,000** | **1,835,300** |
| **Usage** | | |
| Urban diversions | 20,100 | 25,480 |
| Irrigation district diversions | 476,200 | 844,100 |
| Licensed diversions from regulated streams | 25,200 | 25,100 |
| Licensed diversions from unregulated streams | 3,000 | 9,900 |
| Silver and Wallaby creeks to Yarra basin | 11,300 | 5,300 |
| Transfers to Melbourne via North-South pipeline(3) | 7,476 | 16,744 |
| Environmental water diversions | 33,000 | |
| Small-catchment dams(4) | 47,500 | 47,500 |
| **Sub-total** | **623,800** | **974,100** |
| **Losses** | | |
| Evaporation losses from major storages | 81,800 | 60,100 |
| Losses from small-catchment dams(4) | 10,100 | 10,100 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(5) | 19,000 | 91,000 |
| **Sub-total** | **110,900** | **161,200** |
| **Water passed at outlet of basin** | | |
| Goulburn River to Campaspe River via Waranga Western Channel | - | 3,800 |
| Goulburn River outflow to River Murray | 3,185,300 | 183,900 |
| Goulburn River outflow to River Murray via Broken Creek | 7,800 | 28,200 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Includes 328 ML of water returned to rivers within the basin from Mount Buller alpine resorts in 2010–11.

(3) Transfers were made until 28 October 210 under a supply agreement

(4) Evaporation losses are calculated by subtracting estimated usage from total water harvested.

(5) Losses were estimated using loss functions from the Goulburn Simulation Model.

### 10.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in .

Table 10-4 are estimated by DSE, as outlined in Chapter 5.

### Table 10-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 35,900 | 17,900 | n/a |
| Registered commercial and irrigation | 35,200 | 29,600 | n/a |
| **Total** | **71,100** | **47,500** | **57,600** |

n/a: No information available

### 10.6.3 Water entitlement trades

Surface water trade in the Goulburn Basin in 2010–11 occurred through water share transfers and variations, allocation trade and both temporary and permanent transfers of bundled entitlement volume.

Table 10-5 summarises transfers and variations in high-reliability and low-reliability water shares in 2010–11. During this year the Goulburn basin was a net source of water, with 35,461 ML of high-reliability and 602 ML of low-reliability water share holders.

#### Table 10-5 Transfers and variations of water shares in the Goulburn basin 2010–11[1, 2]

| Delivery system | High-reliability water shares | | | Low- reliability water shares | | |
|---|---|---|---|---|---|---|
| | Source[(3)] (ML) | Destination [(3)] (ML) | Net into basin (ML) | Source[(3)] (ML) | Destination[(3)] (ML) | Net into basin (ML) |
| Central Goulburn Irrigation Area | 52,388 | 35,770 | -16,619 | 22,895 | 24,039 | 1,144 |
| Rochester Irrigation Area | 21,591 | 10,810 | -10,781 | 7,675 | 6,601 | -1,074 |
| Shepparton Irrigation Area | 24,014 | 16,411 | -7,603 | 9,468 | 8,675 | -793 |
| Goulburn River | 2,587 | 2,128 | -459 | 657 | 778 | 121 |
| Shepparton Groundwater | 0 | 0 | 0 | 0 | 177 | 177 |
| **Total 2010–11** | **100,580** | **65,119** | **-35,461** | **40,696** | **40,094** | **-602** |
| Total 2009–10 | 70,998 | 114,394 | -43,396 | 37,243 | 47,423 | -10,180 |

Notes:

(1) This table summarises all recorded water share transfers and variations in the Goulburn basin delivery systems in 2010–11. Trades that were in progress at the end of the year will be finalised in 2011–12.

(2) Transfer applications result in a change of ownership. In some cases, the ownership change occurs with a transfer of land. Transfers of ownership that are part of a water and land sale are also included in this table. Variations do not involve a change of ownership.

(3) The Source column is the use location of the water share before the trade or variation: the Destination column is the use location afterwards. is the use location afterwards. Use locations are reported here as grouped nominated delivery systems. A positive number for Net into basin means that a greater volume of water shares have nominated that use location than have nominated a use location outside the group.

Table 10-6 summarises trades in allocation within the Goulburn basin, and with other basins in both Victoria and interstate. A total of 408,473 ML of water allocation was traded into the basin in 2010–11, with approximately two thirds of the volume traded within the basin. There was also a net import of water from interstate basins, with 66,822 ML of water entering the basin from interstate basins, compared to 35,882 ML of water being sold to interstate users. In total, there was a net import of 6,293 ML of water allocation into the basin in 2010–11.

#### Table 10-6 Allocation trade in the Goulburn basin [1, 2]

| Allocation trade type | Volume traded 2010–11 (ML) | Volume traded 2009–10 (ML) |
|---|---|---|
| Trade within Goulburn basin | 259,708 | 191,450 |
| Trade from other Victorian basins | 81,943 | 82,929 |
| Trade to other Victorian basins | 106,590 | 41,122 |
| Interstate trade – inbound | 66,822 | 56,168 |
| Interstate trade – outbound | 35,882 | 48,417 |
| **Total trade into the Goulburn basin** | **408,473** | **330,546** |
| **Net trade into the Goulburn basin** | **6,293** | **49,557** |

Notes:

(1) This table summarises allocation trades approved into, out of and within the Goulburn basin trading zones (Zone 1A Greater Goulburn, Zone 1B Boort and Zone 3 Lower Goulburn) compared to trade in other Victorian and interstate basins. Data on allocation trade between New South Wales and South Australian basins is not relevant to this report and therefore not included.

(2) In a pool exchange, some sellers (say 20) sell to some buyers (say 15) at the pool price. Administratively, this is implemented in the water register as 20 trades to a clearing account and then 15 trades from that clearing account. To avoid double counting, only the seller side is counted (that is, it counts as 20 trades).

Table 10-7 summarises transfers of surface water bundled entitlement volume in the Goulburn basin in 2010–11. Permanent transfers of bundled water entitlement volume occurred within the Goulburn unregulated and Yea River unregulated systems in 2010–11. Temporary transfers took place within the Goulburn unregulated in 2010–11. No transfers took place within the Lower Goulburn unregulated and King Parrot Creek unregulated systems in 2010–11.

### Table 10-7 Surface-water bundled entitlement volume transfers in the Goulburn basin 2010–11

| Trading zone | Permanent transfers | | | Temporary transfers | | |
|---|---|---|---|---|---|---|
| | Sold (ML) | Bought (ML) | Net into basin (ML) | Sold (ML) | Bought (ML) | Net into basin (ML) |
| Goulburn unregulated | 6 | 6 | 0 | 2 | 2 | 0 |
| King Parrot Creek unregulated | 0 | 0 | 0 | 0 | 0 | 0 |
| Lower Goulburn unregulated | 0 | 0 | 0 | 0 | 0 | 0 |
| Yea River unregulated | 5 | 5 | 0 | 0 | 0 | 0 |
| **Total 2010–11** | 11 | 6 | 0 | 2 | 2 | 0 |
| Total 2009–10 | 82 | 82 | 0 | 25 | 20 | -5 |

Trade is not specifically represented in this table but the impact of trade may be seen in volumes of usage and water passed at the outlet of the basin

### 10.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 10-8. Compliance with individual bulk entitlement volumes was deemed to have occurred if water diverted did not exceed the maximum volume allowed to be diverted in 2010–11. For multi-year entitlements, compliance is assessed based on the total volume of water diverted over the term of the entitlement. It is therefore possible that an authority will still comply, even though the volume diverted in any given year exceeds the average bulk entitlement volume.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Goulburn-Murray Water.

### Table 10-8 Volume of water diverted under surface water entitlements in the Goulburn basin

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML)(1) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance?(2)(3) |
|---|---|---|---|---|---|
| *Coliban Water* | | | | | |
| Boort | 1 | 425 | 0 | 102 | Yes |
| Dingee | 1 | 50 | 0 | 7 | Yes |
| Lockington | 1 | 130 | 0 | 75 | Yes |
| Macorna | 1 | 40 | 0 | 2 | Yes |
| Mitiamo | 1 | 60 | 0 | 10 | Yes |
| Mysia | 1 | 15 | 0 | 1 | Yes |
| Pyramid Hill | 1 | 300 | 0 | 86 | Yes |
| Rochester | 1 | 1,400 | 0 | 992 | Yes |
| *Goulburn Valley Water* | | | | | |
| Alexandra | 1 | 916 | (700) | 303 | Yes |
| Bonnie Doon | 1 | 112 | (100) | 41 | Yes |
| Buxton | 1 | 110 | 0 | - | Yes |
| Colbinabbin | 1 | 89 | (100) | 15 | Yes |
| Corop | 1 | 44 | 0 | 6 | Yes |
| Dookie | 1 | 160 | (192) | 83 | Yes |
| Eildon | 1 | 471 | (300) | 123 | Yes |
| Euroa System | 1 | 1,990 | 0 | 541 | Yes |
| Girgarre | 1 | 100 | (100) | 30 | Yes |
| Katandra West | 1 | 64 | 0 | 30 | Yes |
| Kyabram | 1 | 2,000 | (900) | 1,032 | Yes |
| Longwood | 1 | 120 | 0 | 41 | Yes |
| Mansfield | 2 | 1,300 | 0 | 456 | Yes |
| Marysville | 1 | 462 | 0 | 157 | Yes |
| Mooroopna | 1 | 300 | (400) | 22 | Yes |
| Murchison | 1 | 350 | (200) | 164 | Yes |
| Nagambie | 1 | 825 | (300) | 471 | Yes |
| Pyalong | 1 | 75 | 0 | 55 | Yes |
| Rushworth | 1 | 530 | (400) | 202 | Yes |
| Seymour | 1 | 5,340 | (3,800) | 1,582 | Yes |
| Shepparton | 1 | 17,970 | (6,979) | 9,738 | Yes |

| | | | | | |
|---|---|---|---|---|---|
| Stanhope | 1 | 200 | (150) | 58 | Yes |
| Broadford Kilmore and Wallan | 10 | 2,238 | 0 | 680 | Yes |
| Tatura | 1 | 2,600 | (700) | 2,068 | Yes |
| Thornton | 1 | 120 | 0 | 45 | Yes |
| Tongala | 1 | 1,404 | (800) | 566 | Yes |
| Upper Delatite | 1 | 235 | 0 | 63 | Yes |
| Violet Town | 1 | 20 | 0 | - | Yes |
| Woods Point | 1 | 30 | 0 | 13 | Yes |
| Yea | 1 | 438 | 0 | 175 | Yes |
| *GWMWater* | | | | | |
| Quambatook – Grampians Wimmera-Mallee Water | 1 | 100 | 0 | 65 | Yes |
| *Melbourne metropolitan retailers* | | | | | |
| Silver and Wallaby Creek | 1 | 22,000 | 0 | 11,300 | n/a |
| *Minister for Environment* | | | | | |
| Goulburn System – Snowy Environmental Reserve (4) | 1 | 16,812 | 0 | 16,812 | Yes |
| Environmental Entitlement Goulburn System – Living Murray | 1 | 196,605 | 0 | 33,000 | Yes |
| Silver and Wallaby Creeks Environmental Entitlement | 3 | n/a | 0 | n/a | Yes |
| *Goulburn-Murray Water* | | | | | |
| Eildon – Goulburn Weir | 10 | 1,919,000 | 0 | 508,903 | Yes |
| *AGL Hydro Ltd* | | | | | |
| Rubicon – Southern Hydro Ltd(5) | 1 | 0 | 0 | 0 | Yes |
| **Total annual volume of bulk entitlements 2010–11** | | **2,197,550** | **(16,121)** | **590,115** | |
| Total annual volume of bulk entitlements 2009–10 (6) | | 2,204,271 | (31,688) | 927,324 | |
| *Licensed diversions from unregulated streams 2010–11* | | *47,369* | | *3,000* | |
| *Licensed diversions from unregulated streams 2009–10* | | *40,089* | | *9,900* | |

Notes:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one-year) period in the bulk entitlement, divided by the number of years in that period.

(2) Compliance is also assessed against the Murray-Darling basin annual cap target for the Goulburn, Loddon and Broken basins. Details of this are contained in the MDBA's Water audit monitoring report 2010–11.

(3) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

(4) The volume diverted under this bulk entitlement is passed to the Murray as a substitute for Snowy River water formerly released to the Murray.

(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.

(6) The bulk entitlements and transfers for 2009–10 differ from the values reported in the Victorian Water Accounts 2009–2010 due to updated data.

n/a: No information available

## 10.7 Groundwater resources

A summary of the licensed entitlements and use from GMUs within the Goulburn basin, excluding domestic and stock use, is presented in Table 10-9.

The Goulburn basin contains the whole Alexandra GMA and Mid-Goulburn GMA as well as parts of the Shepparton WSPA, Katunga WSPA and Kinglake GMA. Lower Campaspe Valley WSPA replaced Campaspe Deep Lead WSPA in 2010–11, and is no longer reported in the Goulburn basin. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

Reported groundwater usage in the Goulburn basin reduced significantly in 2010–11 compared to 2009–10, largely due to decreased extraction in the Mid-Goulburn GMA, Katunga GMA and Shepparton WSPA.

Groundwater levels in this basin are generally declining to stable. Extractions from the Katunga WSPA were reduced to 70% allocation in 2010–11.

### Table 10-9 Licensed groundwater volumes, Goulburn basin 2010–11

| WSPA/GMA[1] | GMA/ WSPA depth limits[2] (m) | Entitlement limit[3] (ML/year) | Licensed entitlement [4] (ML/year) | Metered use (ML) | Estimated use in unmetered bores[5] (ML) | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) [6] 2009–10 |
|---|---|---|---|---|---|---|---|
| Alexandra GMA (100%) | All depths | 1,937 | 1,714 | 138 | - | 138 | 238 |
| Mid-Goulburn GMA (100%) | Zone 1070 – >25 Zone 1071 all depths | 14,900 | 12,356 | 895 | - | 895 | 3,725 |
| Kinglake GMA (78%) | All depths | 1,569 | 1,448 | 110 | - | 110 | 164 |
| Katunga WSPA (12%)[7] | >25 | 4,861 | 6,949 | 1,338 | - | 1,338 | 3,446 |
| Shepparton WSPA (57%) | ≤25 | 119,078 | 119,078 | 9,557 | - | 9,557 | 28,393 |
| **Total[8]** | | **142,345** | **141,545** | **12,037** | **-** | **12,037** | **35,966** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.
(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11. The entitlement limit in the Katunga WSPA is represented by 70% PCV due to restrictions in place in 2010–11.
(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.
(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.
(6) Campaspe Deep Lead WSPA was removed as a WSPA in the Goulburn basin in 2010–11 and has not been included in the historical totals from 2009–10 in Table 10-9.
(7) PCV exceeded due to the issue of entitlement under the Dairy Shed Water Licence Transition Program. PCV to be amended.
(8) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 10-10. Groundwater does not supplement the urban water supply in the Goulburn basin.

### Table 10-10 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | Number of domestic and stock bores[1][2] | Estimated domestic and stock use (assuming 2 ML per bore) (ML)[3] |
|---|---:|---:|
| Alexandra GMA (100%) | 16 | 32 |
| Kinglake GMA (78%) | 209 | 418 |
| Katunga WSPA (12%) | 80 | 160 |
| Mid-Goulburn GMA (100%) | 206 | 412 |
| Shepparton WSPA (57%) | 988 | 1,976 |
| **Total** | **1,499** | **2,998** |

Notes:
(1) 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 10-9.
(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(3) Total volumes are based on the sum of management unit data before rounding.

## 10.8 Qualification of rights

Two qualifications of rights in the Goulburn water system continued into 2010–11, to ensure essential needs could be met if dry conditions continued. The year commenced with major storages at 30% of capacity and a zero allocation for Goulburn system water shares.

The qualification ensured that water corporations could supply water to towns and essential domestic and stock needs while reserves remained low. Water reserves had recovered sufficiently to announce a 26% allocation on 16 August 2010, at which time water users were allocated water in line with their entitlements.

Following further improvement in storage levels and allocations in early spring, the Minister for Water revoked qualifications of rights to water in the Goulburn basin in October 2010. Normal passing flow arrangements resumed at this time for the Goulburn River at Goulburn Weir and McCoys Bridge when the Minister for Water revoked the qualifications of rights.

### Table 10-11 Qualifications of rights

| Legal instruments | Dates | Qualification type | Qualification description | Triggers for resuming normal sharing rules | Date trigger reached |
|---|---|---|---|---|---|
| Temporary Qualification of Rights in the Goulburn Water System July 2009 | 1 July 2010 to 8 October 2010 | Differential access by priority entitlements | Enabled domestic and stock users to take the volume of water necessary for essential needs (such as household purposes and fire fighting), and commercial and industrial users were able to take water for limited purposes. | 20% allocation or higher for high-reliability shares on the Goulburn system. | 16 August 2010 |
| | | Differential access by priority entitlements | Supplies to East and West Loddon Waterworks District reduced. | 1% allocation or higher for high-reliability water shares on the Goulburn system. | 2 August 2010 |
| | | Reduced passing flow requirements | Goulburn-Murray Water's passing flow requirements for Goulburn River at Goulburn Weir and McCoys Bridge gauging station reduced. | Expiry date: 30 June 2011 | Revoked 8 October 2010 |
| | | Differential access by priority entitlements | Passing flow account created once allocations were >1% to record volume of water that would otherwise be passed, and this volume made available for release at the discretion of the Goulburn-Broken Catchment Management Authority in 2010–11. | Expiry date: 30 June 2011 | Revoked 8 October 2010 |
| | | Differential access by priority entitlements | 10,000 ML of water set aside (under provisions in Bulk Entitlement (Eildon – Goulburn Weir) Conversion Order 1995) for water quality releases in the Goulburn River and lower Broken Creek was made available to supply Melbourne in 2009–10 and 2010–11. | Expiry date: 30 June 2011 | Revoked 8 October 2010 |
| Further Temporary Qualification of Rights in the Goulburn Water System 2010 | 12 March 2010 to 30 June 2010 | Access to unallocated water provided | Allows Goulburn-Murray Water to reserve modernisation water savings from Stage 1 of NVIRP for supply to Melbourne, the environment and irrigators. | Expiry date: 30 June 2011 | Revoked 8 October 2010 |

## 10.9 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers and licensed groundwater extractions are presented in Table 10-12.

Coliban Water was able to remove restrictions for its Goulburn system towns at the end of September 2010. No other towns in the Goulburn basin were subject to restrictions in 2010–11.

The seasonal allocation for high-reliability water shares reached 100% on 15 November 2010. This was the first time since 2005-06 that irrigators received a full allocation against high-reliability entitlements.

Groundwater extractions from the Katunga WSPA were restricted to 70% of licence volume in 2010–11.

### Table 10-12 Seasonal allocations and restrictions on water use in Goulburn basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Urban | Boort, Dingee, Lockington, Macorna, Mitiamo, Mysia, Pyramid Hill, Rochester | Stage 1 restrictions from 1 July 2010 to 30 September 2010. |
| Irrigation and regulated diversions | Goulburn System | Allocation began the year at 0% for high-reliability water shares and reached 100% on 15 November 2010. Low-reliability water shares remained at 0% allocation all year. |
| Groundwater | Katunga WSPA | Extractions from the Katunga WSPA were restricted to 70% of licence volume in 2010–11. |

## 10.10 Recycled water

Goulburn Valley Water operates all wastewater treatment plants in the Goulburn basin. Approximately 38% of the volume of wastewater passing through treatment plants in the basin was recycled (Table 10-13), a decrease of 53% compared to 2009–10. The percentage of wastewater that was recycled varied at each treatment plant.

### Table 10-13 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 (ML)(3) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation(1) | Within process(2) | | |
| Alexandra | 355 | 136 | 38% | 0 | 136 | 0 | 0 | 219 | 0 |
| Avenel | 42 | 14 | 33% | 0 | 14 | 0 | 0 | 28 | 0 |
| Bonnie Doon | 21.270 | 21.270 | 100% | 0 | 21 | 0 | 0 | 0 | 0 |
| Broadford | 256 | 96 | 37% | 0 | 96 | 0 | 0 | 160 | 0 |
| Eildon | 190 | 0 | 0% | 0 | | 0 | 0 | 190 | 0 |
| Euroa | 373 | 70 | 19% | 12 | 58 | 0 | 0 | 303 | 0 |
| Girgarre | 7 | 7 | 100% | 0 | 7 | 0 | 0 | | 0 |
| Kilmore | 558 | 93 | 17% | 0 | 93 | 0 | 0 | 465 | 0 |
| Kyabram / Merrigum | 329 | 329 | 100% | 0 | 329 | 0 | 0 | 0 | 0 |
| Mansfield | 339 | 132 | 39% | 29 | 104 | 0 | 0 | 207 | 0 |
| Marysville | 85 | 85 | 100% | 29 | 56 | 0 | 0 | 0 | 0 |
| Mooroopna | 497 | 497 | 100% | 0 | 497 | 0 | 0 | 0 | 0 |
| Murchison | 0 | 0 | 0% | 0 | | 0 | 0 | 0 | 0 |
| Nagambie | 165 | 70 | 42% | 0 | 70 | 0 | 0 | 95 | 0 |
| Seymour | 582 | 246 | 42% | 12 | 233 | 0 | 0 | 337 | 0 |
| Shepparton | 4,689 | 1,375 | 29% | 0 | 1,375 | 0 | 0 | 3,313 | 0 |
| Stanhope / Rushworth | 82 | 0 | 0% | 0 | | 0 | 0 | 82 | 0 |
| Tatura | 811 | 383 | 47% | 0 | 383 | 0 | 0 | 428 | 0 |
| Tongala | 113 | 113 | 100% | 0 | 113 | 0 | 0 | 0 | 0 |
| Upper Delatite | 51 | 19 | 38% | 0 | 19 | 0 | 0 | 32 | 0 |
| Violet Town | 22 | 22 | 100% | 0 | 22 | 0 | 0 | 0 | 0 |
| Yea | 179 | 38 | 21% | 18 | 20 | 0 | 0 | 142 | 0 |
| **Total 2010–11** | **9,745** | **3,746** | **38%** | **100** | **3,646** | **0** | **0** | **6,000** | 0 |
| Total 2009–10 | 6,734 | 6,153 | 91% | 188 | 5,965 | 0 | 0 | 582 | -1 |

Notes:

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

(2) 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.

## 10.11 Water for the environment

### 10.11.1 Environmental Water Reserve

Important environmental assets, such as wetlands of state significance, significant areas of intact riparian and floodplains vegetation, and endangered flora and fauna species including Trout Cod and Murray Cod, depend on the 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 on the Goulburn that rely on 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, which is 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, which is the largest river red gum forest in the world and a RAMSAR and Living Murray Icon site, a national park and a site where native fish breed.

In 2010–11 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 Minister for Environment
- the Goulburn system – Snowy Environmental Reserve bulk entitlement of 16,812 ML held by the Minister for Environment
- the Goulburn River – Environmental Water Reserve 2010
- the Goulburn Environmental Water Savings Supply Deed, which is the instrument to which 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
- all other water in the basin not allocated for consumptive use: that is, water above cap
- the Silver and Wallaby Creeks Environmental Entitlement, which provides passing flow rules on Silver and Wallaby creeks.

### 10.11.2 Entitlements for the environment

A number of environmental watering actions took place in the Goulburn system in 2010–11. This included delivery of Victorian, Living Murray and Commonwealth environmental water.

A total of 8,873 ML of Victorian entitlement, combined with 33,000 ML of Living Murray entitlement, was delivered over summer 2010–11 in an attempt to alleviate water quality issues on the Goulburn and Murray rivers. These deliveries were also traded to South Australia to contribute to the meeting of environmental demand in the Lower Lakes.

A number of trades are made under Victorian environmental entitlements held in trust for other programs, such as the Living Murray program. The program holds entitlement across the Murray-Darling basin. Depending on annual environmental watering priorities and management of their portfolio across the Murray-Darling basin, trades are undertaken both into and out of Victoria, on instruction from the program.

Commonwealth environmental water was traded into Victorian entitlement in the Goulburn system in 2010–11 to facilitate the delivery of water through the Goulburn River to meet environmental demand in the Lower Lakes in South Australia. A total of 54,277 ML was traded into Victorian entitlement for this action, with 52,440 ML delivered in 2010–11.

### 10.11.3 Passing flow compliance

Some bulk entitlements require passing flows to be met at some points in the basin.

All passing flow requirements were complied with for the Goulburn Basin in 2010–11.

Table10-14 shows passing flow compliance in the Goulburn basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest. The location of these compliance points is presented in Figure 10-2.

### Table 10-14 Selected passing flow compliance in the Goulburn basin

<table>
<tr><th>River</th><th colspan="2">Passing flows</th></tr>
<tr><td rowspan="4">Seven Creeks</td><td>Instrument where passing flows are specified</td><td>Bulk Entitlement (Euroa System) Conversion Order 2001</td></tr>
<tr><td>Responsible authority</td><td>Goulburn Valley Water</td></tr>
<tr><td>Compliance point</td><td>Polly McQuinns Reservoir (shown as 1 in Figure 10-2)</td></tr>
<tr><td>Passing flow compliance</td><td>The lesser of 10 ML per day or observed flow was passed</td></tr>
<tr><td rowspan="4">Delatite River</td><td>Instrument where flow-sharing rules are specified</td><td>Bulk Entitlement (Mansfield) Conversion Order 1995</td></tr>
<tr><td>Responsible authority</td><td>Goulburn Valley Water</td></tr>
<tr><td>Compliance point</td><td>Upstream of Tonga Bridge Gauging Station (shown as 2 in Figure 10-2)</td></tr>
<tr><td>Passing flow compliance</td><td><ul><li>all flows were passed for flows less than 18 ML per day</li><li>18 ML per day was passed for flows between 18 and 20.2 ML per day</li><li>the entire flow, less 2.2 ML per day was passed for flows between 20.2 and 30 ML per day</li><li>27.8 ML per day was passed for flows between 30 and 32.2 ML per day</li><li>the entire flow, less 4.4 ML per day was passed for flows greater than 32.2 ML per day</li></ul></td></tr>
<tr><td rowspan="4">Yea River</td><td>Instrument where flow-sharing rules are specified</td><td>Bulk Entitlement (Yea) Conversion Order 1997</td></tr>
<tr><td>Responsible authority</td><td>Goulburn Valley Water</td></tr>
<tr><td>Compliance point</td><td>Upstream of the Yea urban offtake (shown as 3 in Figure 10-2)</td></tr>
<tr><td>Passing flow compliance</td><td><ul><li>Half the flow was passed for flows less than 7.2 ML per day</li><li>The entire flow, less 3.6 ML per day was passed for flows greater than 7.2 ML per day</li></ul></td></tr>
</table>

### 10.11.4 Streamflow management plans

Local management rules for King Parrot Creek, Yea River and Sevens Creek were recommended under the Northern Region Sustainable Water Strategy. Work has commenced to develop these. A groundwater management plan covers the Katunga WSPA.

# 11 Campaspe basin

This chapter sets out the accounts for the Campaspe basin. For detailed information about how they were compiled, refer to Chapter 5.

## 11.1 Campaspe basin summary

Rainfall across the Campaspe basin ranged from 150% to 300% of the long-term average. After successive years of extremely low inflows, inflows to the Campaspe basin in 2010–11 were close to double the long-term average.

Levels in the basin's major storages recovered significantly, increasing from 42,800 ML (11% of capacity) at the start of the year to 365,001 ML (97% of capacity) by the end of June 2011.

After five years of very low and zero allocations, the Campaspe system reached 100% for both high-reliability and low-reliability water shares in 2010–11. Licence holders in the Coliban rural system had access to 70% of their entitlement volume in 2010–11.

Restrictions were eased and then removed for almost all towns in the Campaspe basin in 2010–11. Woodend, which is supplied from the Melbourne supply system, was the only town in the basin that remained on restrictions at the end of the year.

Licenced diversions from unregulated streams were mostly unrestricted in 2010–11.

The total volume of groundwater used decreased significantly in 2010–11, compared to 2009–10. The decrease was mainly due to the removal of the Campaspe Deep Lead WSPA from the Campaspe Basin. Approximately 9,200 ML of groundwater was extracted by licensed users in 2010–11, accounting for around 15% of total water use.

## 11.2 Responsibilities for management of water resources

Table 11-1 shows the responsibilities of various authorities within the Campaspe basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 11-1 Responsibilities for water resources management within the Campaspe basin, 2010–11

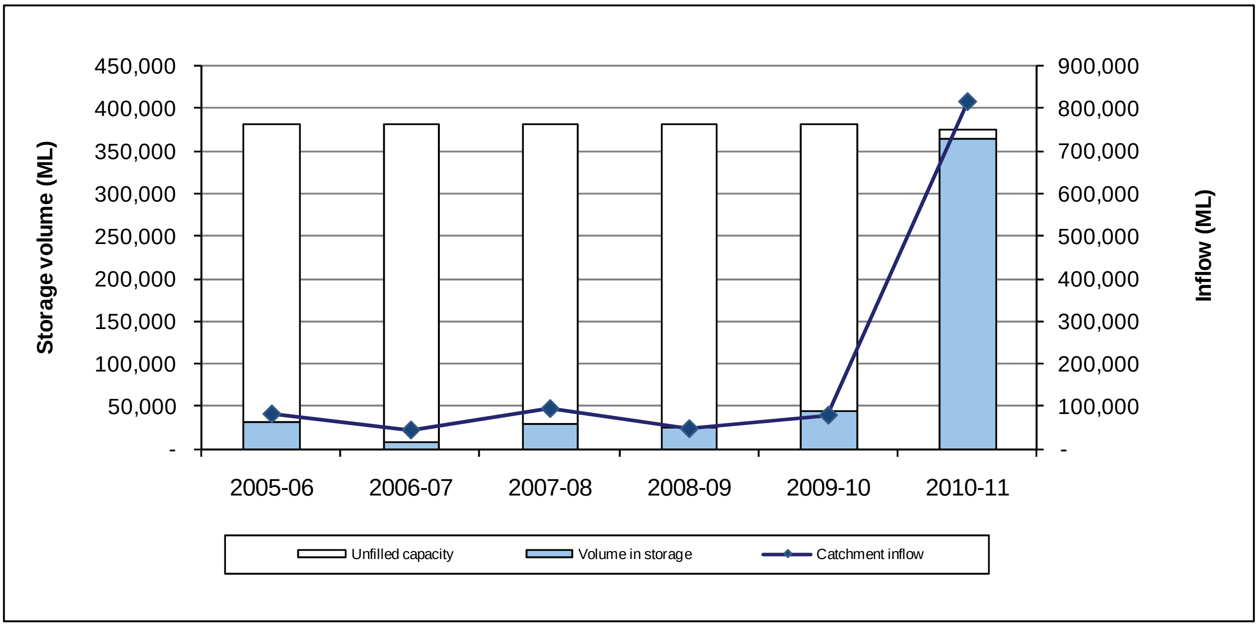
| Authority | Irrigation and rural water supply | Licensing | Urban water supply | Storage management; waterway management; environmental obligations |
|---|---|---|---|---|
| Goulburn-Murray Water | Supplies Rochester irrigation district and Campaspe irrigation district | Manages groundwater and surface water licensed diversions | Provides bulk water supply to Coliban Water | Operates Lake Eppalock<br>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<br>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 |
| North Central Catchment Management Authority | | | | Manages waterways in the whole of the Campaspe basin |

## 11.3 Rainfall, flows and storages in 2010–11

In 2010–11, rainfall across the Campaspe basin ranged from 150% to 300% of the long-term average. At 815,600 ML, catchment inflows were more than double the long-term average, and more than 20 times greater than the extremely low inflows experienced in 2006–07. The amount of water flowing from the Campaspe basin into the River Murray in 2010–11 was 426,400 ML, representing 52% of the total inflows into the basin. This is in contrast to only 5,300 ML in 2009–10, which represented 7% of the total inflows into the basin that year.

Storage levels for all major storages (greater than 1,000 ML) in the basin increased from 42,800 ML (11% of capacity) in July 2010 to 365,001 ML (97% of capacity) by the end of June 2011. In the Campaspe basin, on-stream storages greater than 1,000 ML capacity include the Upper Coliban, Lauriston and Malmsbury reservoirs, and Lake Eppalock.

**Figure 11-1 All major storages and catchment inflows in the Campaspe basin**




## 11.4 Total water resources in the basin

The total volume of water available and supplied from water resources in the Campaspe basin are shown in Table 11-2. The volume of available surface water in 2010–11 was higher than in 2009–10 (853,300 ML compared to 104,200 ML). Demand also increased from 2009–10 levels, primarily due to less restriction on diversions in the Campaspe and Coliban rural systems. Total groundwater usage in the Campaspe basin reduced in 2010–11, compared to 2009–10.

**Table 11-2 Summary of total water resources and water use in the Campaspe basin 2010–11**

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | 853,300 | 52,300 |
| Groundwater(2) | 66,900 | 9,200 |
| Recycled water | 2,170 | 580 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 11-8 and the estimated domestic and stock use as presented in Table 11-9.

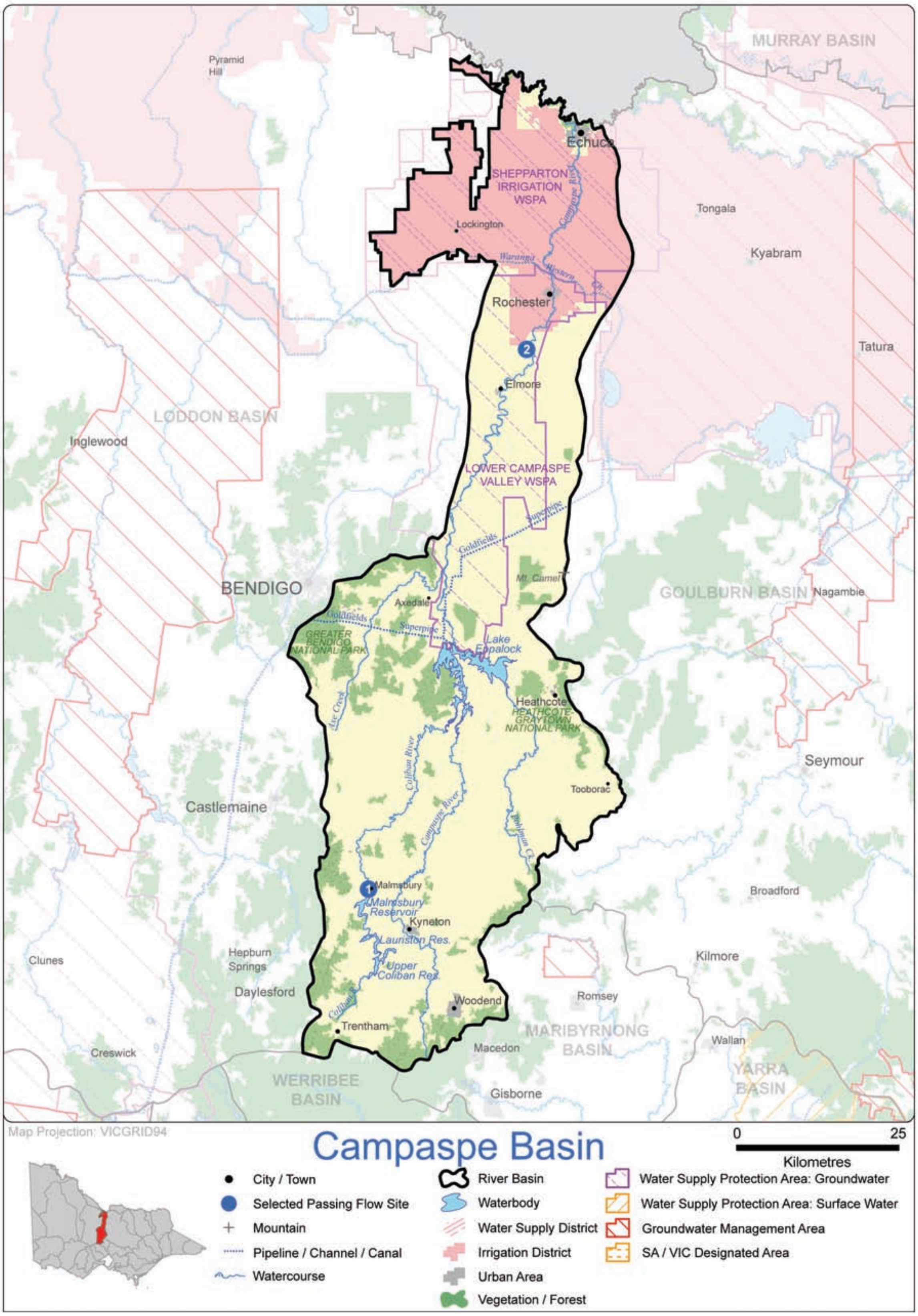
(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

### 11.4.1 Infrastructure projects to improve water availability

In 2010, the decommissioning of the Campaspe Irrigation District began to achieve water savings. This decommissioning will see irrigators supplied from other systems. In 2010–11, the Campaspe Irrigation District merged with the Goulburn-Murray Irrigation District.

## 11.5 Location of water resources

### Figure 11-2 Map of the Campaspe basin



## 11.6 Surface water resources

### 11.6.1 Water balance

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

Table 11-3. Note that only on-stream storages with capacity greater than 1,000 ML have been included in the water balance.

#### Table 11-3 Balance of surface water in the Campaspe basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | 42,800 | 24,900 |
| Volume in storage at end of year | 362,300 | 42,800 |
| **Change in storage** | **319,500** | **17,900** |
| **Inflows** | | |
| Catchment inflow(1) | 815,600 | 77,800 |
| Rainfall on major storages | 36,000 | 4,300 |
| Return flow from irrigation | - | - |
| Transfer from Waranga Western Channel to River Murray via Campaspe River | 100 | 3,800 |
| Transfer to Campaspe basin from Waranga Western Channel | - | 17,900 |
| Treated wastewater discharged back to river | 1,600 | 300 |
| **Sub-total** | **853,300** | **104,100** |
| **Usage** | | |
| Urban diversions | 10,900 | 12,100 |
| Coliban Channel rural diversions | 748 | 1,900 |
| Campaspe irrigation district diversions | 10,200 | 1,600 |
| Licensed diversions from regulated streams | 700 | 200 |
| Licensed diversions from unregulated streams | 100 | 100 |
| Small-catchment dams(2) | 28,800 | 28,800 |
| Transfer from Campaspe Basin to White Swan Reservoir(3) | 870 | 10,400 |
| **Sub-total** | **52,300** | **55,100** |
| **Losses** | | |
| Evaporation losses from major storages | 32,300 | 7,000 |
| Losses from small-catchment dams(2) | 14,800 | 14,800 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(4) | 8,000 | 4,000 |
| **Sub-total** | **55,100** | **25,800** |
| **Water passed at outlet of basin** | | |
| Campaspe River outflow to River Murray | 426,400 | 5,300 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Data for water usage from small-catchment dams is provided by DSE. Evaporation losses are calculated by subtracting estimated usage from total water harvested.

(3) As a transfer into the Barwon Basin.

(4) Losses were estimated using loss functions from the Goulburn Simulation Model.

### 11.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values provided in Table 11-4 are based on estimates by DSE as outlined in Chapter 5.

#### Table 11-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 15,000 | 7,500 | n/a |
| Registered commercial and irrigation | 25,300 | 21,300 | n/a |
| **Total** | **40,300** | **28,800** | **43,600** |

n/a: No information available

### 11.6.3 Water entitlement trades

Surface water was traded into, out of, and within the Campaspe basin in 2010–11 through water share transfers and variations and allocation trade. There were no trades of temporary or permanent bundled entitlements in 2010–11.

Table 11-5 summarises the trade of water shares into and out of the Campaspe basin delivery systems in 2010–11. There was a net movement of water shares out of the basin in 2010–11, with 15,622 ML of high-reliability water shares and 10,201 ML of low-reliability water shares leaving the basin.

#### Table 11-5 Transfers and variations of water shares in the Campaspe basin 2010–11 (1), (2)

| Delivery system | High-reliability water shares | | | Low-reliability water shares | | |
|---|---|---|---|---|---|---|
| | Source(3) (ML) | Destination (3) (ML) | Net into basin (ML) | Source(3) (ML) | Destination(3) (ML) | Net into basin (ML) |
| Campaspe irrigation district | 14,776 | 663 | -14,113 | 9,669 | 548 | -9,121 |
| Campaspe River | 1,643 | 134 | -1,509 | 1,222 | 143 | -1,079 |
| **Total 2010–11** | **16,419** | **797** | **-15,622** | **10,891** | **690** | **-10,201** |
| Total 2009–10 | 1,931 | 8,555 | -6,625 | 1,264 | 1,755 | -491 |

Notes:

(1) This table summarises all recorded water share transfers and variations in the Campaspe basin delivery systems in 2010–11. Trades that were in progress at the end of the year will be finalised in 2011–12.

(2) Transfer applications result in a change of ownership. In some cases, the ownership change occurs with a transfer of land. Transfers of ownership that are part of a water and land sale are also included in this table. Variations do not involve a change of ownership.

(3) The Source column is the use location of the water share before the trade or variation: the Destination column is the use location afterwards. Use locations are reported here as grouped nominated delivery systems. A positive number for Net into basin means that a greater volume of water shares have nominated that use location than have nominated a use location outside the group.

Table 11-6 summarises the trade of allocation in Victoria's share of the Campaspe basin in 2010–11. A total of 5,251 ML of water was traded, with most of that being trade with other Victorian basins. In total, 9,118 ML of water allocation moved out of the Campaspe basin in 2010–11.

#### Table 11-6 Allocation trade in the Campaspe basin (1), (2)

| Allocation trade type | Volume traded 2010–11 (ML) | Volume traded 2009–10 (ML) |
|---|---|---|
| Trade within Campaspe basin | 2,913 | 534 |
| Trade from other Victorian basins | 2,337 | 1,550 |
| Trade to other Victorian basins | 11,455 | 3,419 |
| Interstate trade – inbound | 0 | 1,760 |
| Interstate trade – outbound | 0 | 2 |
| **Total trade into the Campaspe basin** | **5,251** | **3,844** |
| **Net trade into the Campaspe basin** | **-9,118** | **-111** |

Notes:

(1) This table summarises allocation trades approved into, out of and within the Campaspe basin trading zones ( Zone 4C Lower Campaspe, Zone 4A Campaspe – Eppalock to Waranga Western Channel) compared to trade in other Victorian and interstate basins. Data on allocation trade between New South Wales and South Australian basins is not relevant to this report and therefore not included.

(2) In a pool exchange, some sellers (say 20) sell to some buyers (say 15) at the pool price. Administratively, this is implemented in the water register as 20 trades to a clearing account and then 15 trades from that clearing account. To avoid double counting, only the seller side is counted (that is, it counts as 20 trades).

### 11.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 11-7.

Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2010–11.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Goulburn-Murray Water.

### Table 11-7 Volume of water diverted under surface water entitlements in the Campaspe basin

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML)(1) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance?(2)(3) |
|---|---|---|---|---|---|
| *Coliban Water* | | | | | |
| Axedale and Goornong(4) | 1 | 215 | - | 58 | Yes |
| Part Rochester(4) | 10 | 134 | | - | Yes |
| Campaspe System – Coliban Water | 3 | 50,260 | - | 9,462 | Yes |
| *Western Water* | | | | | |
| Woodend | 1 | 470 | - | 192 | Yes |
| *Goulburn-Murray Water* | | | | | |
| Campaspe System | 10 | 83,590 | - | 10,895 | Yes |
| *Minister for Environment* | | | | | |
| Environmental Entitlement Campaspe River – Living Murray Initiative | 1 | 5,174 | - | - | Yes |
| **Total annual volume of bulk entitlements 2010–11** | | **139,843** | **-** | **20,607** | |
| Total annual volume of bulk entitlements 2009–10 | | 140,175 | 7,344 | 5,218 | |
| *Licensed diversions from unregulated streams 2010–11* | | *9,162* | | *100* | |
| *Licensed diversions from unregulated streams 2009–10* | | *8,698* | | *100* | |

Notes:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one-year) period in the bulk entitlement, divided by the number of years in that period.

(2) Compliance is also assessed against the Murray-Darling basin annual cap target for the Campaspe basin. Details of this are contained in the MDBA's Water audit monitoring report 2010–11.

(3) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

(4) Axedale, Goornong and part of Rochester bulk supplies are provided under the same bulk entitlement. Rochester is also supplied under Coliban Water's bulk entitlement from the Goulburn system.

## 11.7 Groundwater resources

A summary of the licensed entitlements and use from GMUs within the Campaspe basin, excluding domestic and stock use, is presented in Table 11-8.

The Campaspe basin contains part of the Shepparton WSPA and the Lower Campaspe Valley WSPA. In 2010–11, Lower Campaspe Valley WSPA replaced Campaspe Deep Lead WSPA and Southern Campaspe Plains GMA. A management plan will be drafted for this WSPA in 2012. Groundwater entitlements and use within unincorporated areas are detailed in Appendix A.

Extractions from the Lower Campaspe Valley WSPA were restricted to 75% allocation in 2010–11. Groundwater levels are declining to stable for GMUs in this area.

### Table 11-8 Licensed groundwater volumes, Campaspe basin 2010–11

| WSPA/GMA(1) | GMA/ WSPA depth limits(2) (m) | Entitlement limit(3) (ML/year) | Licensed entitlement(4) (ML/year) | Metered use (ML) | Estimated use in unmetered bores(5) (ML) | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Shepparton WSPA (12%) | ≤25 | 24,859 | 24,859 | 1,995 | - | 1,995 | 5,938 |
| Lower Campaspe Valley WSPA (72%)(6) | All depths | 25,072 | 41,002 | 6,171 | - | 6,171 | 19,202 |
| **Total(7)** | | **49,931** | **65,861** | **8,167** | **-** | **8,167** | **25,140** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11. The entitlement limit in the Lower Campaspe Valley WSPA is represented by 75% PCV due to restrictions in place in 2010–11.
(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.
(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.
(6) Lower Campaspe Valley WSPA replaced Campaspe Deep Lead WSPA and Southern Campaspe Plains GMA in 2010–11. The licensed groundwater use volume for 2009–10 for Lower Campaspe Valley WSPA includes volumes from this merger.
(7) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 11-9.

### Table 11-9 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | Number of domestic and stock bores(1)(2) | Estimated domestic and stock use (assuming 2 ML per bore) (ML)(3) |
|---|---|---|
| Shepparton WSPA (12%) | 206 | 412 |
| Lower Campaspe Valley WSPA (72%)(4) | 308 | 616 |
| **Total** | **514** | **1,028** |

Notes:
(1) 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 11-8.
(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(3) Total volumes are based on the sum of management unit data before rounding.
(4) Lower Campaspe Valley WSPA replaced Campaspe Deep Lead WSPA and Southern Campaspe Plains GMA in 2010–11.

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 11-10.

### Table 11-10 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Elmore | 284 | 104 | 130 |
| Trentham | 48 | 0 | 15 |
| **Total** | **332** | **104** | **145** |

## 11.8 Qualification of rights

The qualification of rights in the Campaspe water system continued into 2010–11 (shown in Table 11-11), to ensure essential needs could be met if dry conditions continued. The year commenced with major storages at only 10% of capacity and a zero allocation for Campaspe system water shares.

The qualification ensured that water corporations could supply water to towns and essential domestic and stock needs while reserves remained low. Water reserves had recovered sufficiently to announce a 100% allocation for Campaspe high-reliability water shares on 15 September 2010, at which time water users were allocated water in line with their entitlements.

Although the triggers to resume normal water sharing arrangements had been reached, the qualification remained in place until the end of June 2011 in order to maintain flexibility in the delivery of environmental water, to preserve access to environmental water retained in storage under the terms of the qualification, and to support an allocation on the Coliban rural system.

### Table 11-11 Qualifications of rights

| Legal instruments | Dates | Qualification type | Qualification description | Triggers for resuming normal sharing rules | Date trigger reached |
|---|---|---|---|---|---|
| Temporary Qualification of Rights in the Campaspe Water System 2009<br>Amendment to Temporary Qualification of Rights in the | 1 July 2009 to 30 June 2011 | Differential access by priority entitlements | Enable domestic and stock users to take the volume of water necessary for essential needs (such as household purposes and fire fighting), and commercial and industrial users were able to take water for limited purposes.<br>Remove obligation to supply Rochester during May, June, July, August and September. | 50% allocation or higher for high-reliability shares on the Campaspe system | 15 September 2010 |
| | | Reduced passing flow | Remove Coliban Water and Goulburn-Murray Water's obligations to provide minimum passing flow requirements below Lake Eppalock and at | 100% allocation for high-reliability water shares on the | 15 September 2010 |

| Legal instruments | Dates | Qualification type | Qualification description | Triggers for resuming normal sharing rules | Date trigger reached |
|---|---|---|---|---|---|
| Campaspe Water System June 2010 | | requirements | Rochester.<br>1,000 ML allocated for environmental flows when the volume in storage is 6,500 ML (excluding water held in an allocation bank account).<br>All other withheld flows released as directed by North Central CMA when allocation is 1% or above. | Campaspe system | |
| | | | Remove Coliban Water's obligation to provide minimum passing flow requirements below Malmsbury Reservoir. Half of the volume that would have been provided is available for Stage 4 urban supplies. The other half is reserved for environmental flows on advice from North Central CMA. | When Stage 4 restrictions are lifted for the townships of Kyneton or water is allocated to the Coliban Rural system, all withheld passing flows are available for environmental flows on advice from North Central CMA. | 1 December 2009 (Kyneton moved to Stage 3 restrictions) |
| | | Differential access by priority entitlements | Provision of emergency supplies of up to 30% of licensed volume to licence holders who meet specific conditions | 1% allocation or higher on the Coliban Rural System | 15 September 2010 |
| | | | Remove Coliban Water’s obligation to provide surface water to Coliban Rural system licence holders that can receive a volume of recycled water equivalent to the allocation | Expiry of qualification | 30 June 2011 |

## 11.9 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers, licensed diversions from unregulated streams and groundwater extractions are presented in Table 11-12.

Restrictions were eased to lower levels and removed for almost all towns in the Campaspe basin in 2010–11. Significant reductions occurred in September 2010 and January 2010. Woodend, which is supplied from the Melbourne supply system, was the only town in the basin that remained on restrictions at the end of the June 2011.

After five years of very low and zero allocations, the Campaspe system reached 100% for both high-reliability and low-reliability water shares in 2010–11.

Licence holders in the Coliban rural system had access to 70% of their entitlement volume in 2010–11.

Long-running bans on licensed diversions were removed at the end of July 2010 from the Campaspe and Little Coliban rivers; and from Axe, Jones, Smiths and Wanalta creeks. However, an irrigation ban was required again for Smiths Creek over spring and summer.

### Table 11-12 Seasonal allocations and restrictions on water use in Campaspe basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Urban | Axedale | Stage 3 restrictions from 1 July 2010 to 30 September 2010, Stage 2 restrictions from 1 October 2010 to 14 January 2011 |
| | Goornong | Stage 3 restrictions from 1 July 2010 to 30 September 2010 |
| | Echuca, Elmore, Rochester | Stage 1 restrictions from 1 July 2010 to 30 September 2010 |
| | Kyneton, Malmsbury, Tylden | Stage 3 restrictions from 1 July 2010 to 30 September 2010, Stage 1 restrictions from 1 October 2010 to 14 January 2011 |
| | Elphinstone, Taradale | Stage 3 restrictions from 1 July 2010 to 30 September 2010, Stage 1 restrictions from 1 October 2010 to 28 February 2011 |
| | Heathcote and Tooborac | Stage 3 restrictions from 1 July 2010 to14 January 2011 |
| | Woodend | Stage 3 restrictions from 1 July 2010 to 14 October 2010, Stage 2 restrictions from 15 October 2010 to 30 June 2011 |
| Irrigation and regulated diversions | Campaspe Irrigation District | Allocations started the year at 0% and reached 100% on 15 September 2010 for high-reliability water shares. Low-reliability water shares started the year at 0% and reached 100% on 15 December 2010. |
| | Coliban rural supply system | Seasonal allocation of 70% announced on 15 September 2010. |
| Licensed diversions on unregulated streams | Campaspe River, Axe Creek, Jones Creek, Little Coliban River, Wanalta Creek | Irrigation ban in July 2010 |
| | Smiths Creek | Irrigation ban in July 2010, and from September 2010 to February 2011 |
| Groundwater | Lower Campaspe Valley WSPA | Extractions were restricted to 75% of licence volume in 2010–11. |

## 11.10 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 27% of the wastewater discharged from treatment plants in the basin was recycled, mostly for agricultural use (Table 11-13).

### Table 11-13 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 (ML)(3) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation(1) | Within process(2) | | |
| Axedale | 5 | 5 | 100% | 5 | - | - | - | - | - |
| Echuca | 457 | 457 | 100% | - | 457 | - | - | - | - |
| Elmore | - | - | 0% | - | - | - | - | - | - |
| Heathcote | 231 | 78 | 34% | 78 | - | - | - | 153 | - |
| Kyneton | 967 | 33 | 3% | 8 | 25 | - | - | 934 | - |
| Lockington | - | - | 0% | - | - | - | - | - | - |
| Rochester | - | - | 0% | - | - | - | - | - | - |
| Woodend | 505 | 9 | 0% | 1 | - | - | 7 | 511 | -15 |
| **Total 2010-11** | **2,165** | **582** | **27%** | **92** | **482** | **-** | **7** | **1,598** | **-15** |
| Total 2009–10 | 1,932 | 1,525 | 79% | 237 | 1,288 | - | - | 296 | 111 |

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.

## 11.11 Water for the environment

### 11.11.1 Environmental Water Reserve

Important environmental assets, such as threatened riparian vegetation communities and endangered flora and fauna species including Murray Cod and Painted Snipe, depend on the 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 within that basin.

In 2010–11 the Campaspe basin EWR comprised:

- the Environmental Entitlement (Campaspe River – Living Murray Initiative) 2007
- water set aside for the environment under the temporary qualification of rights described in
- Table 11-11
- 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 (where qualifications did not apply)
- 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: that is, water above cap.

Commonwealth environmental water was traded into the Campaspe system in 2010–11 to deliver winter baseflows to the Campaspe River. A total of 2,300 ML of water was traded into the system, with 2,140 ML of water delivered to provide water quality benefits, connectivity and habitat for fish.

### 11.11.2 Environmental entitlements

The environment's formal entitlements in the Campaspe basin in 2010–11 comprised the Environmental Entitlement (Campaspe River – Living Murray Initiative) 2007.

### 11.11.3 Passing flow compliance

All passing flow requirements were complied with for the Campaspe Basin in 2010–2011.

As noted in Table 11-11, the passing flow requirements on the Coliban River downstream of Malmsbury Reservoir were withheld in 2010–11 under a qualification of rights. While Castlemaine and Kyneton were subject to Stage 4 restrictions, 50% of the water reserved by this action was held in Malmsbury Reservoir for later release to meet environmental objectives. Once restrictions for these towns were eased to Stage 3, all reserved passing flows were held in Malmsbury Reservoir for the environment.

Table 11-14 shows passing flow compliance in the Campaspe basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest.

## Table 11-14 Selected passing flow compliance in the Campaspe basin

| River | Passing flows | |
|---|---|---|
| Coliban River and its tributaries to confluence with Campaspe River | Instrument where passing flows are specified | Bulk Entitlement (Campaspe System – Coliban Water) Conversion Order 1999 |
| | Responsible authority | Coliban Water |
| | Compliance point | Malmsbury Reservoir (shown as 1 in Figure 11-2)) |
| | Passing flow compliance | The requirement to pass the lesser of 8 ML per day or natural inflow was qualified in 2010–11. The volume that would have been released to meet passing flow requirements was withheld in Malmsbury Reservoir and made available for release at the direction of North Central CMA once specified storage triggers were met. |
| Campaspe River | Instrument where passing flows are specified | Bulk Entitlement (Campaspe System – Goulburn-Murray Water) Conversion Order |
| | Responsible authority | Goulburn-Murray Water |
| | Compliance point | Between Lake Eppalock and Campaspe Weir pool (shown as 2 in Figure 11-2) |
| | Passing flow compliance | Passing flow requirements listed below were qualified in 2010–11. The volume that would have been released to meet these requirements was withheld in Lake Eppalock and made CMA once specified storage and allocation triggers were met.<br>• 1 July to 30 November inclusive:<br>• if Lake Eppalock volume is less than 150,000 ML, the lesser of 10 ML per day or natural inflow<br>• if Lake Eppalock volume is between 150,001 ML and 200,000 ML, the lesser of 50 ML per day or natural inflow<br>• if Lake Eppalock volume is between 200,001 ML and 250,000 ML, the lesser of 80 ML per day or natural inflow.<br>• if Lake Eppalock volume is greater than 250,001 ML:<br>• in January, March, May, June and December, the lesser of 90 ML per day or natural inflow<br>• in February and April, the lesser of 80 ML per day or natural inflow<br>• in July and November, the lesser of 150 ML per day or natural inflow<br>• in August, September and October, the lesser of 200 ML per day or natural inflow. |

# 12 Loddon basin

This chapter sets out the accounts for the Loddon basin. For detailed information about how they were compiled, refer to Chapter 5.

## 12.1 Loddon basin summary

In 2010–11, rainfall across the Loddon basin ranged between 150% and 300% of the long-term average. After five consecutive years of catchment inflows lower than 30% of the long-term average, inflows were more than five times the long-term average in 2010–11.

The volume of water held in major storages increased from 16,600 ML (7% of capacity) at the beginning of the year to 217,444 ML (91% of capacity) by the end of June 2011.

After five years of very low and zero allocations, both the Loddon and Bullarook systems reached 100% for high-reliability water shares in 2010–11. While the allocation for low-reliability entitlements remained at zero in the Loddon system, the Bullarook system had a 100% allocation for low-reliability entitlements for the first time since 2005-06.

While many towns in the Loddon basin were subject to Stage 3 and Stage 4 water restrictions at the beginning of 2010–11, restrictions were gradually eased then removed for almost all towns by January 2011. Only Raywood and Sebastian and towns in the Forrest Hill and Daylesford systems remained on restrictions at the end of June 2011.

Bans on licenced diversions from unregulated streams had all been removed by the end of February 2011.

Groundwater usage in the basin was significantly lower than 2009–10, and only accounted for approximately 10% of total water use.

## 12.2 Responsibilities for management of water resources

Table 12-1 shows the responsibilities of various authorities within the Loddon basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 12-1 Responsibilities for water resources management within the Loddon basin, 2010–11

| 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 | |
| Minister for Environment | | | | Holds the Loddon Environmental Reserve |
| North Central Catchment Management Authority | | | | Manages waterways for the whole of the Loddon basin |

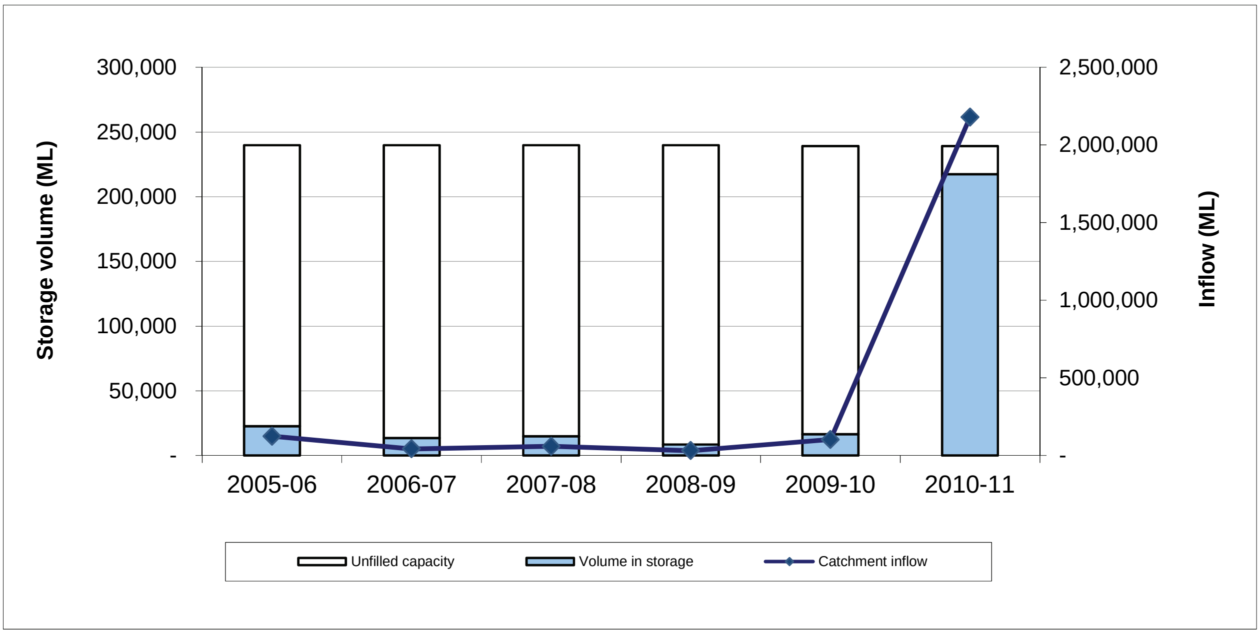
## 12.3 Rainfall, flows and storages in 2010–11

In 2010–11, rainfall across the Loddon basin ranged between 150% and 300% of the long-term average. After five consecutive years of catchment inflows lower than 30% of the long-term average, inflows were more than five times the long-term average in 2010–11. The amount of water flowing from the Loddon basin was 1,864,600 ML in 2010–11. This represents 86% of the total Loddon basin inflows.

The volume of water held in major storages (greater than 1,000 ML capacity) increased from 16,600 ML (7% of capacity) at the beginning of the year to 217,444 ML (91% of capacity) by the end of June 2011.

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) increased by 199,700 ML over the year, from 13,300 ML to 213,000 ML. Cairn Curran Reservoir, which comprises nearly two-thirds of the storage capacity in the basin, finished the year with 131,480 ML in storage (89% of capacity).

### Figure 12-1 All major storages and catchment inflows in the Loddon basin




## 12.4 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 12-2.

Table 12-2. Total surface water use in 2009–10 increased by 28,200 ML compared to 2008–09, while groundwater use declined by 6,100 ML.

### Table 12-2 Summary of total water resources and water use in the Loddon basin, 2010–11

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | 2,210,600 | 64,400 |
| Groundwater(2) | 70,600 | 9,000 |
| Recycled water | 8,580 | 1,760 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 12-8 and the estimated domestic and stock use as presented in Table 12-9.

(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

### 12.4.1 Infrastructure projects to improve water availability

A number of infrastructure projects were completed in the Loddon basin in 2010–11.

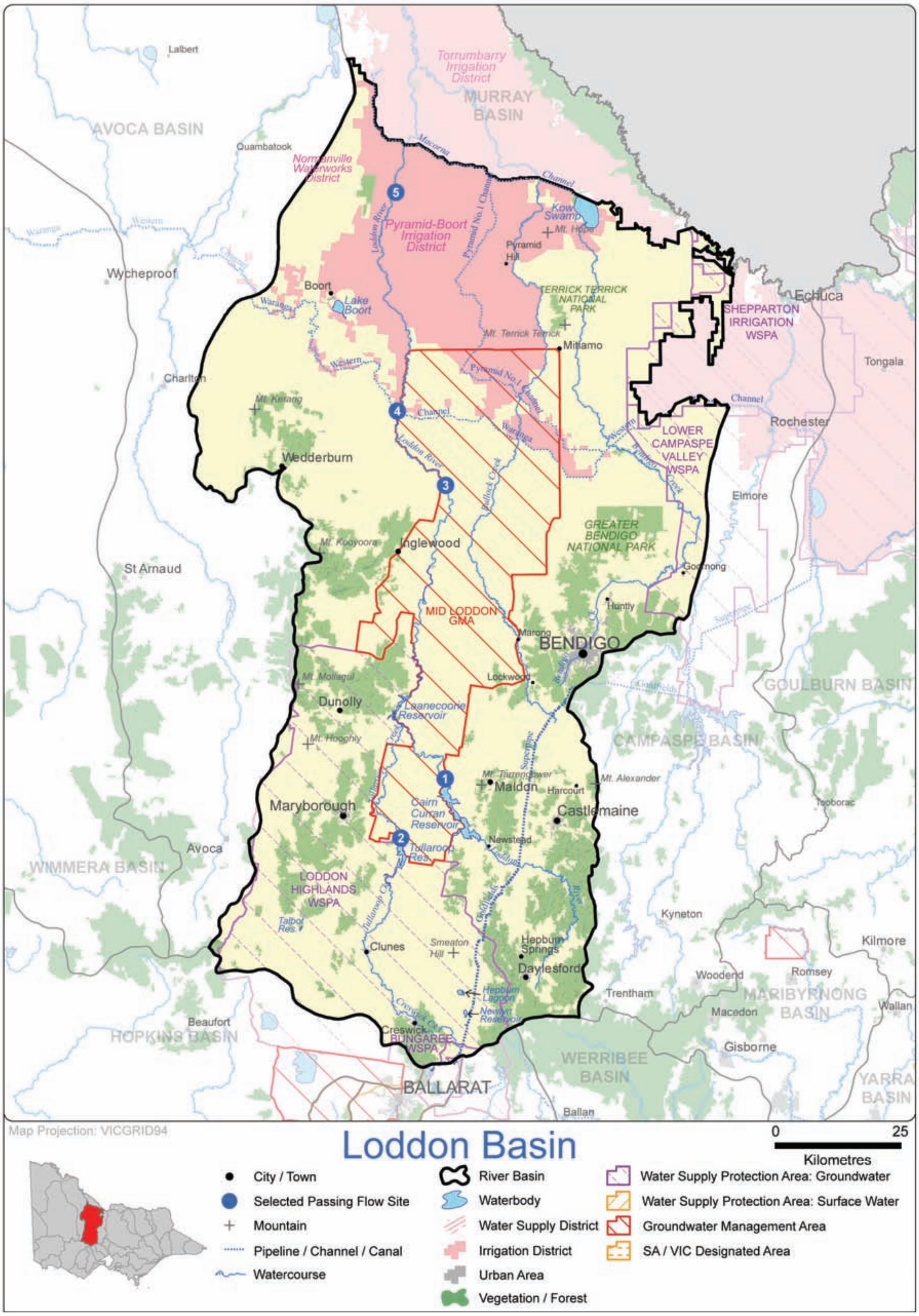
Central Highlands Water continued investigations to improve water quality for the Lexton water supply system by locating a suitable groundwater resource and piping water to Lexton Treatment Plant. In 2010–11, drilling investigations were undertaken to determine a suitable groundwater site. Planning and assessment for the pipeline route also began.

Coliban Water continued work on the Raywood-Sebastian Pipeline Project. This project aims to improve water security and water quality to urban customers by connecting the towns of Raywood and Sebastian to the Bendigo water supply system. The project commenced in March 2009 and is expected to be completed by July 2012. Stage 1 of the project was completed in 2010–11, and Stage 2 is underway.

To provide efficient year-round water supply for customers around Serpentine and Jarklin, Goulburn-Murray Water is constructing the East Loddon pipeline. The 145km pipeline project also involves the construction of a pump station at the off-take from the Waranga Western Channel. This project is expected to be completed in 2011–12. Works undertaken in 2010–11 included a preliminary survey and design, expression of interest for construction of pipeline, and starting of construction of the pipeline.

## 12.5 Location of water resources

### Figure 12-2 Map of the Loddon basin



# 12.6 Surface water resources

## 12.6.1 Water balance

A surface-water balance for the Loddon basin is shown in Table 12-3. Only storages with capacities greater than 1,000 ML have been included in the water balance. This includes Laanecoorie, Cairn Curran, Tullaroop and Newlyn reservoirs and Hepburn Lagoon. Diversions from regulated and unregulated streams increased in 200–11, compared to 2009–10.

### Table 12-3 Balance of surface water in the Loddon basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| Major on-stream storage | | |
| Volume in storage at start of year | 13,300 | 6,200 |
| Volume in storage at end of year | 213,000 | 13,300 |
| **Change in storage** | **199,700** | **7,100** |
| **Inflows** | | |
| Catchment inflow(1) | 2,178,600 | 102,500 |
| Rainfall on major storages | 25,800 | 2,600 |
| Transfers from other basins | - | - |
| Return flow from irrigation | - | - |
| Treated effluent discharged back to river | 6,240 | 2,130 |
| **Sub-total** | **2,210,600** | **107,200** |
| **Usage** | | |
| Urban diversions | 2,430 | 1,690 |
| Licensed diversions and irrigation diversions from regulated streams | 11,300 | 1,100 |
| Licensed diversions from unregulated streams | 700 | 100 |
| Small-catchment dams(2) | 50,000 | 50,000 |
| **Sub-total** | **64,400** | **52,900** |
| **Losses** | | |
| Evaporation losses from major storages | 26,000 | 5,600 |
| Losses from small-catchment dams | 29,600 | 29,600 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(2) | 26,300 | 9,800 |
| **Sub-total** | **81,900** | **45,000** |
| **Water passed at outlet of basin** | | |
| Loddon River outflow to River Murray (Appin South) | 474,100 | 0 |
| Wandella Creek at Fairley(4) | 67,400 | n/a |
| Mount Hope Creek at Mitiamo | 185,800 | 2,200 |
| Bullock Creek, Calivil and Nine Mile Creek(4) | 1,137,300 | n/a |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Losses were estimated using the Goulburn Simulation Model, and exclude losses from the Loddon River downstream of Loddon Weir and the Wandella Creek system (which were not readily available).

(4) Outflows for these creeks have not been included at this time.

n/a: No information available

## 12.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2009–10 is not readily available. The values in Table 12-4 are based on the methodology outlined in Chapter 5.

### Table 12-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 31,600 | 15,800 | n/a |
| Registered commercial and irrigation | 40,700 | 34,200 | n/a |
| **Total** | **72,300** | **50,000** | **79,600** |

n/a: No information available

### 12.6.3 Water entitlement trades

Surface water was traded into, out of, and within the Loddon basin in 2010–11 through water share transfers and variations and allocation trade. No temporary or permanent trade of bundled water entitlements occurred in 2010–11 in the Loddon basin.

Table 12-5 summarises the transfers and variations in both high-reliability and low-reliability water shares in 2010–11. In total, there was a net export of water shares from the Loddon basin, with 12,433 ML of high-reliability water shares, and a net import of 82 ML of low-reliability water shares, traded out of the basin.

#### Table 12-5 Transfers and variations of water shares in the Loddon basin 2010–11 (1), (2)

| Delivery system | High-reliability water shares | | | Low-reliability water shares | | |
|---|---|---|---|---|---|---|
| | Source(3) (ML) | Destination(3) (ML) | Net into basin (ML) | Source(3) (ML) | Destination(3) (ML) | Net into basin (ML) |
| Pyramid-Boort | 24,834 | 12,928 | -11,906 | 6,778 | 6,915 | 137 |
| Loddon River | 1,441 | 914 | -527 | 475 | 419 | -55 |
| Bullarook | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total 2010–11** | **26,275** | **13,842** | **-12,433** | **7,253** | **7,335** | **82** |
| Total 2009–10 | 20,395 | 49,478 | -29,083 | 14,612 | 16,049 | -1,437 |

Notes:

(1) This table summarises all recorded water share transfers and variations in the Loddon basin delivery systems in 2010–11. Trades that were in progress at the end of the year will be finalised in 2011–12.

(2) Transfer applications result in a change of ownership. In some cases, the ownership change occurs with a transfer of land. Transfers of ownership that are part of a water and land sale are also included in this table. Variations do not involve a change of ownership.

(3) The Source column is the use location of the water share before the trade or variation: the Destination column is the use location afterwards. Use locations are reported here as grouped nominated delivery systems. A positive number for Net into basin means that a greater volume of water shares have nominated that use location than have nominated a use location outside the group.

Table 12-6 summarises the trade of allocation in the Loddon basin in 2010–11. A total of 843 ML of allocation was traded into the Loddon basin, with the majority traded within the basin. There was a net export of 1,116 ML from the basin.

#### Table 12-6 Allocation trade in the Loddon basin (1), (2)

| Allocation trade type | Volume traded 2010–11(ML) | Volume traded 2009–10 (ML) |
|---|---|---|
| Trade within Loddon basin | 543 | 20 |
| Trade from other Victorian basins | 300 | 0 |
| Trade to other Victorian basins | 1,416 | 22 |
| Interstate trade – inbound | 0 | 0 |
| Interstate trade – outbound | 0 | 0 |
| **Total trade into the Loddon basin** | **843** | **20** |
| **Net trade into the Loddon basin** | **-1,116** | **-22** |

Notes:

(1) This table summarises allocation trades approved into, out of and within the Loddon basin trading zones (Zone 5A Loddon Cairn Curran and Tullaroop reservoirs to Loddon Weir Pool & Zone 5B Bullarook) compared to trade in other Victorian and interstate basins. Data on allocation trade between New South Wales and South Australian basins is not relevant to this report and therefore not included.

(2) In a pool exchange, some sellers (say 20) sell to some buyers (say 15) at the pool price. Administratively, this is implemented in the water register as 20 trades to a clearing account and then 15 trades from that clearing account. To avoid double counting, only the seller side is counted (that is, it counts as 20 trades).

### 12.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 12-7. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2009–10.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Goulburn-Murray Water.

### Table 12-7 Volume of water diverted under surface water entitlements in the Loddon basin

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance?[1] |
|---|---|---|---|---|---|
| *Central Highlands Water* | | | | | |
| Creswick | 1 | 500 | 0 | 257 | Yes |
| Daylesford – Hepburn Springs | 1 | 916 | 0 | 553 | Yes |
| Lexton | 1 | 45 | 0 | 13 | Yes |
| Loddon System (part Maryborough) | 1 | 1,200 | 0 | 215 | Yes |
| Evansford and Talbot System (part Maryborough) | 1 | 3,000 | 0 | 1,065 | Yes |
| *Coliban Water* | | | | | |
| Loddon system | 1 | 820 | 0 | 327 | Yes |
| *Goulburn-Murray Water* | | | | | |
| Bullarook System | 1 | 1,657 | 0 | 152 | Yes |
| Loddon | 1 | 36,566 | 0 | 11,174 | Yes |
| *Minister for Environment* | | | | | |
| Loddon River – Environmental Reserve | 1 | 12,045 | 0 | 427 | Yes |
| Birch Creek – Bullarook System [2] | - | - | - | - | - |
| **Total annual volume of bulk entitlements 2010–11** | | **56,749** | **0** | **14,183** | |
| **Total annual volume of bulk entitlements 2009–10** [3] | | **49,647** | **1** | **3,589** | |
| *Licensed diversions from unregulated streams* 2010–11 | | *34,256* | | *700* | |
| *Licensed diversions from unregulated streams* 2009–10 | | *30,240* | | *100* | |

Notes:

(1) Compliance is also assessed against the Murray-Darling basin annual cap target for the Goulburn, Loddon and Broken basins, which is reported in the MDBA's Water audit monitoring report 2010–11.

(2) The Environmental Entitlement Birch Creek – Bullarook System provides a right to minimum passing flows and up to 100 ML of storage reserve in Newlyn Reservoir, subject to restriction rules. The volume diverted is water released from the Newlyn Reservoir reserve.

(3) The bulk entitlements and transfers for 2009–10 differ from the values reported in the Victorian Water Accounts 2009–2010 due to an error in reporting Goulburn-Murray Water's Loddon bulk entitlement.

## 12.7 Groundwater resources

A summary of the licensed entitlements and use from GMUs within the Loddon basin, excluding domestic and stock use, is presented in Table 12-8.

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. In 2010–11, Lower Campaspe Valley WSPA replaced Campaspe Deep Lead WSPA and Southern Campaspe Plains GMA, and Loddon Highlands WSPA replaced Spring Hill WSPA and Upper Loddon WSPA. Mid-Loddon WSPA also changed from a WSPA to a GMA in 2010–11. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

Extractions from the Lower Campaspe Valley WSPA and Loddon Highlands WSPA were restricted to a 75% and 80% allocation respectively in 2010–11. Groundwater levels are generally increasing in GMUs in this area. The significant decrease in groundwater use can be attributed to wetter conditions and the availability of surface water.

## Table 12-8 Licensed groundwater volumes, Loddon basin 2010–11

| WSPA/GMA(1) | GMA/ WSPA depth limits(2) (m) | Entitlement limit(3) (ML/year) | Licensed entitlement(4) (ML/year) | Metered use (ML) | Estimated use in unmetered bores (ML)(5) | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Bungaree WSPA (9%)(6) | All depths | 485 | 485 | 67 | - | 67 | 256 |
| Mid-Loddon GMA (100%)(7) | All depths | 37,200 | 34,036 | 2,738 | - | 2,738 | 14,528 |
| Loddon Highlands WSPA (91%)(8) | All depths | 17,450 | 18,179 | 1,545 | - | 1,545 | 5,262 |
| Lower Campaspe Valley WSPA (28%)(9) | All depths | 9,555 | 15,625 | 2,352 | - | 2,352 | 3,184 |
| **Total(10)** | | **64,690** | **68,325** | **6,702** | **-** | **6,702** | **23,230** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11. The entitlement limit in the Lower Campaspe Valley WSPA and Loddon Highlands WSPA are represented by 75% and 80% PCV respectively due to restrictions in 2010–11.

(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.

(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.

(6) The licensed entitlement volume for Bungaree WSPA includes a 70 ML mineral water levy, gazetted on 20 June 2009.

(7) Mid-Loddon WSPA became a GMA in 2010–11 and is now known as Mid-Loddon GMA.

(8) Loddon Highlands WSPA replaced Spring Hill WSPA and Upper Loddon WSPA in 2010–11.

(9) Lower Campaspe Valley WSPA replaced Campaspe Deep Lead WSPA and Southern Campaspe Plains GMA in 2010–11.

(10) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 12-9.

## Table 12-9 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores(1)(2) | Estimated domestic and stock use (assuming 2 ML per bore(3)) (ML)(4) |
|---|---|---|
| Bungaree WSPA (9%) | 23 | 35 |
| Mid-Loddon GMA (100%)(5) | 353 | 706 |
| Loddon Highlands WSPA (91%)(6) | 650 | 1,300 |
| Lower Campaspe Valley WSPA (28%)(7) | 117 | 234 |
| **Total** | **1,143** | **2,275** |

Notes:

(1) 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 12-8.

(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Estimated domestic and stock use is calculated using a factor of 2 ML per bore all for GMUs listed, other than Bungaree WSPA which uses a factor of 1.5 ML per bore.

(4) Total volumes are based on the sum of management unit data before rounding.

(5) Mid-Loddon WSPA became a GMA in 2010–11 and is now known as Mid-Loddon GMA.

(6) Loddon Highlands WSPA replaced Spring Hill WSPA and Upper Loddon WSPA in 2010–11.

(7) Lower Campaspe Valley WSPA replaced Campaspe Deep Lead WSPA and Southern Campaspe Plains GMA in 2010–11.

The licensed entitlements and metered use for urban groundwater supplies in the Loddon catchment are provided inTable 12-10.

### Table 12-10 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Clunes | 350 | 155 | 175 |
| Dean | 30 | 21 | 18 |
| Forest Hill(1) | 350 | 140 | 142 |
| Learmonth | 100 | 32 | 47 |
| Waubra | 100 | 23 | 43 |
| Maryborough | 1,336 | 222 | 922 |
| Smeaton | 48 | 0 | 0 |
| **Total** | **2,314** | **592** | **1,347** |

Notes:

(1) The town Forest Hill is an amalgamation of the towns of Forest Hill System (Forest Hill bore field), Allendale – Clunes and Spring Hill Supply System.

(2) The town Maryborough is an amalgamation of the towns of Maryborough System (Moolort bore field) and Maryborough System (Stoney Creek/ Evansford bore field).

## 12.8 Qualifications of rights

Two qualification of rights in the Loddon water system continued into 2010–11 (shown in Table 12-11), to ensure essential needs could be met if dry conditions continued. The year commenced with major storages at only 5% of capacity and a zero allocation for Loddon system water shares. Where qualifications of rights occur, a risk assessment is undertaken and environmental contingency plans developed to mitigate potential environmental risks.

The qualification ensured that water corporations could supply water to towns and essential domestic and stock needs while reserves remained low. By the end of September 2010, major storages had recovered to almost 90% of capacity and reserves were sufficient to announce a 67% allocation for high-reliability water shares. After this time, water users were allocated water in line with their entitlements.

Although the triggers to resume normal water sharing arrangements had been reached, the qualifications remained in place until the end of June 2011 in order to maintain flexibility in the delivery of environmental water and preserve access to environmental water retained in storage under the terms of the qualification.

### Table 12-11 Qualifications of rights

| Legal instruments | Dates | Qualification type | Qualification description | Triggers for resuming normal sharing rules | Date trigger reached |
|---|---|---|---|---|---|
| Temporary Qualification of Rights in the Loddon Water System July 2009<br><br>Amendment to Temporary Qualification of Rights in the Loddon Water System June 2010 | 1 July 2009 to 30 June 2011 | Differential access by priority entitlements | Enabled domestic and stock users to take the volume of water necessary for essential needs (such as household purposes and fire fighting), and commercial and industrial users were able to take water for limited purposes | 50% allocation or higher for high-reliability shares on the Loddon system | 15 September 2010 |
| | | | Remove Goulburn-Murray Water's obligation to supply entitlements only after meeting environmental entitlement | Expiry date: 30 June 2011 | |
| | | | Goulburn-Murray Water's obligation to provide East Loddon Waterworks district removed | 10% allocation or higher for high-reliability shares on the Loddon system | 16 August 2010 |
| | | Reduced passing flow requirements | Passing flow requirements for Creswick Creek suspended, downstream of Cosgrove Reservoir | Stage 4 restrictions removed in Creswick | 1 January 2010 (Creswick eased to Stage 3) |
| | | | Remove obligation to provide minimum passing flow requirements and river freshening flows below Cairn Curran Dam, Laanecoorie Reservoir, Serpentine Weir and Loddon Weir:<br>• when allocations reach 1%, store withheld environmental flows in the Loddon System Withheld Flows account, and 50% of the withheld flows can be released on advice from North Central CMA.<br>• When allocations reach 5% all withheld environmental flows can be released on advice from North Central CMA | Expiry date: 30 June 2011<br><br>(1% and 5% allocations exceeded on 16 August 2010) | |
| | | Differential access by priority entitlements | Create a Loddon System Withheld Flow Account to be used by North Central CMA | Expiry date: 30 June 2011 | |
| | | | The maximum volume which may be stored in the deficit and reimbursement account in the Loddon River (Environmental Reserve) | Expiry date: 30 June 2011 | |

| Legal instruments | Dates | Qualification type | Qualification description | Triggers for resuming normal sharing rules | Date trigger reached |
|---|---|---|---|---|---|
| | | | entitlement increased from 20,000 ML to 25,000 ML, and 6,000 ML is available for release from this account when allocations reach 100% | (100% allocation reached on 15 November 2010) | |
| | | Differential access by priority entitlements | Allow 2,000 ML of water to be transferred from the Loddon System Withheld Flows account to the Wetland Entitlement. Water from this entitlement may be delivered to Little Lake Boort | Expiry date: 30 June 2011 | |
| Temporary Qualification of Rights in Reach Two of the Loddon Water System June 2009<br><br>Amendment to Temporary Qualification of Rights in Reach Two of the Loddon Water System June 2010 | 1 July 2009 to 30 June 2011 | Reduced passing flow requirements | Environmental flows in Tullaroop Creek suspended and retained in storage.<br>When allocations reach 1%, the volume that would have been provided as passing flows can be released on advice from North Central CMA. | Expiry date: 30 June 2011<br><br>(1% allocation exceeded on 16 August 2010) | |
| | | Differential access by priority entitlements | Enable domestic and stock users to take the volume of water necessary for essential needs (such as household purposes and fire fighting), and commercial and industrial users were able to take water for limited purposes when Goulburn-Murray Water advises that water is available for delivery | When the Loddon system seasonal allocation is 50% or higher | 15 September 2010 |
| | | Differential access by priority entitlements | Remove obligation for Goulburn-Murray Water to supply Central Highlands Water with a minimum of 50% of entitlement volume for Maryborough | Expiry date: 30 June 2011 | |
| | | | Remove obligation for Goulburn-Murray Water to supply entitlements only after meeting environmental entitlement | Expiry date: 30 June 2011 | |
| | | | Goulburn-Murray Water is entitled to 210 ML a year to meet its customers' essential needs | Expiry date: 30 June 2011 | |
| | | Differential access by priority entitlements | When the volume in Tullaroop Reservoir on 1 July 2010, and inflows to the storage after that date, reach:<br>• 710 ML, then the North Central CMA has access to the next 875 ML in storage<br>• 3,185 ML, then Central Highlands Water has access to any water allocated to it in 2009-10 that remained unused at 30 June 2010 and G-MW must retain the next 1,585 ML in reserve to meet critical needs in 2011-12<br>• 4,112 ML, then the North Central CMA has access to any water allocated to it in 2009-10 that remained unused at 30 June 2010<br>• 4,770 ML, then G-MW may allocate future inflows to water shares held in Tullaroop Creek | Expiry date: 30 June 2011<br><br>(Levels in Tullaroop Reservoir recovered to full capacity by end September 2010) | |
| | | | When the allocation for water shares held in Tullaroop Creek is between 1% and 20%, an equivalent volume of water will be allocated to Central Highlands Water.<br>When the allocation for water shares held in Tullaroop Creek is 20% or greater, any additional water available to Central Highlands Water shall be determined according to the normal rules in the bulk entitlement. | Expiry date: 30 June 2011<br><br>(1% and 20% allocation exceeded on 16 August 2010) | |

## 12.9 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers, licensed diversions from unregulated streams and groundwater extractions are presented inTable 12-12.

While many towns in the Loddon basin were subject to Stage 3 and Stage 4 water restrictions at the beginning of 2010–11, restrictions were gradually eased then removed for almost all towns by the end of the year. Only Raywood and Sebastian and towns in the Forrest Hill and Daylesford systems remained on restrictions at the end of June 2011.

For several urban areas including the towns of Maryborough, and the Forest Hill system, Stage 4 restrictions were required for the first one to four months of the year. However, restriction levels were reduced as the year progressed to restriction levels between Stage 2 and Permanent Water Saving Rules. Both the Bullarook and Loddon systems began the year with an allocation of 0% for high-reliability water shares, but reached 100% by mid-August and mid-November respectively.

Diverters from some unregulated streams within the Loddon basin were subject to restrictions and bans at the beginning of the year, which were progressively lifted by the end of February 2011.

### Table 12-12 Seasonal allocations and restrictions on water use in Loddon basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Urban | Maryborough, Adelaide, Lead, Alma/Moonlight, Simson/Bet Bet, Timor/Bowenvale, Carisbrooke, Daisy Hill, Havelock, Mojorca, Rodborough, Talbot | Stage 4 restrictions (with exemptions) from 1 July 2010 to 30 July 2010, Stage 3 restrictions from 1 August 2010 to 31 October 2010, Stage 1 restrictions from 1 November 2010 to 31 December 2010. |
| | Creswick | Stage 3 restrictions from 1 July 2010 to 31 July 2010, Stage 1 restrictions from 1 August 2010 to 31 December 2010. |
| | Learmonth, Waubra, Dean | Stage 1 restrictions from 1 July 2010 to 31 October 2010 |
| | Forest Hill system (Allendale, Broomfield, Kingston, Newlyn, Smeaton, Springmont) | Stage 4 restrictions from 1 July 2010 to 31 October 2010, Stage 3 restrictions from 1 November 2010 to 3 March 2011, Stage 2 restrictions from 4 March 2011 to 30 June 2011. |
| | Clunes | Stage 1 restrictions from 1 July 2010 to 31 October 2010. |
| | Daylesford, Hepburn Springs, Hepburn | Stage 2 restrictions from 1 July 2010 to the 30 June 2011. |
| | Lexton | Stage 1 restrictions from 1 July 2010 to the 3 March 2011. |
| | Bendigo, Eaglehawk, Epsom, Huntly, Junortoun, Kangaroo Flat, Maiden Gully, Marong, Strathfieldsaye | Stage 3 restrictions from 1 July 2010 to 30 September 2010, Stage 2 restrictions from 1 October 2010 to 14 January 2011. |
| | Bridgewater, Inglewood, Laanecoorie, Bealiba, Dunolly, Tarnagulla, Jarklin, Serpentine | Stage 4 restrictions from 1 July 2010 to 31 August 2010, Stage 3 restrictions from 1 September 2010 to 30 September 2010, Stage 1 restrictions from 1 October 2010 to 14 January 2011. |
| | Borung, Korong Vale, Wedderburn, Wychitella | Stage 1 restrictions from 1 July 2010 to 14 January 2011. |
| | Boort, Pyramid Hill, Lockington, Mysia, Mitiamo, Dingee, Macorna | Stage 1 restrictions from 1 July 2010 to 30 September 2010. |
| | Goornong | Stage 3 restrictions from 1 July 2010 to 30 September 2010. |
| | Castlemaine, Campbells Creek, Fryerstown, Guildford, Harcourt, Maldon, Newstead, Yapeen | Stage 3 restrictions from 1 July 2010 to 30 September 2010, Stage 1 restrictions from 1 October 2010 to 28 February 2010. |
| | Raywood, Sebastian | Stage 4 (with exemptions) restrictions from 1 July 2010 to 30 September 2010, Stage 3 restrictions from 1 October 2010 to 30 June 2011. |
| Unregulated diversions | Barkers Creek, Campbells Creek, Joyces Creek, Leitchs Creek, Sailors Creek, Wombat Creek | Irrigation ban in July 2010. |
| | Lower Loddon River below Fernihurst Weir, McCallum Creek | Irrigation ban in July and August 2010. |
| | Green Gully Creek, Muckleford Creek, Lake Meran, Coghills Creek, | Irrigation ban from July 2010 to February 2011. |
| | Rocky Lead Creek, Bullock Creek above Newlyn, Langdons Creek above Hepburns Lagoon, Pinchgut Creek, Kangaroo Creek | Winterfill suspension in July 2010. |
| | Back Creek (tributary of Tullaroop Creek) | Winterfill suspension from July to October 2010. |
| Irrigation and regulated diversions | Loddon system | Allocation for high-reliability water shares started the year at 0% and reached 100% on 15 November 2010. There was no allocation for low-reliability water shares. |
| | Bullarook system | Allocation for high-reliability water share started the year at 0% and reached 100% on 16 August 2010. There was no allocation for low-reliability water shares. |
| | Loddon system | Extractions were restricted to 75% of licence volume in 2010–11. |
| | Loddon Highlands WSPA | Extractions were restricted to 80% of licence volume in 2010–11. |

## 12.10 Recycled water

Coliban Water and Central Highlands Water operate wastewater treatment plants in the Loddon basin. The total volume of wastewater produced in 2010–11 increased, compared to 2009–10. The proportion of wastewater recycled in 2010–11 decreased to 21%, compared to 65% in 2009–10. This is presented in Table 12-13.

### Table 12-13 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 (ML)(3) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation(1) | Within process(2) | | |
| Bendigo | 5,815 | 1,162 | 20% | 1,077 | 85 | 0 | 0 | 4,653 | 0 |
| Boort(4) | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| Bridgewater / Inglewood | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| Castlemaine | 1,296 | 5 | 0% | 5 | 0 | 0 | 0 | 1,291 | 0 |
| Clunes | 24 | 19 | 78% | 0 | 19 | 0 | 0 | 5 | 0 |
| Creswick | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| Daylesford | 327 | 243 | 74% | 25 | 218 | 0 | 0 | 85 | 0 |
| Dunolly(4) | 5 | 5 | 100% | 0 | 5 | 0 | 0 | 0 | 0 |
| Kerang | 579 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 579 |
| Maryborough | 503 | 292 | 58% | 61 | 231 | 0 | 0 | 211 | 0 |
| Pyramid Hill(4) | 9 | 9 | 100% | 0 | 9 | 0 | 0 | 0 | 0 |
| Wedderburn(4) | 27 | 27 | 100% | 0 | 27 | 0 | 0 | 0 | 0 |
| **Total 2010–11** | **8,585** | **1,761** | **21%** | **1,167** | **594** | **0** | **0** | **6,245** | **579** |
| Total 2009–10 | 6,945 | 4,511 | 65% | 1,429 | 3,082 | 0 | 0 | 2,132 | 303 |

Notes:

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

(2) 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.

(4) All effluent at these treatment plants was evaporated on-site.

## 12.11 Water for the environment

### 12.11.1 Environmental Water Reserve

Important environmental assets, such as endangered flora and fauna species (including Murray Cod and Painted Snipe) and threatened riparian vegetation communities depend on the 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 within that basin. Specifically, Gunbower Forest has Ramsar-listed wetlands which supports 37 threatened and endangered flora and fauna species, and are rare wetland types (shallow freshwater marshes and freshwater meadows). Tullaroop Creek in the Loddon River system also has a population of regionally significant black fish.

In 2010–11 the Loddon basin EWR comprised:

- the Bulk Entitlement (Loddon River – Environmental Water Reserve) Order 2005, of 2,000 ML high-reliability, 2,105 ML low-reliability and 7490 ML of provisional reliability water entitlements held by the Minister for Environment
- 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 under the temporary qualification of rights described in
- Table 12-11
- 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 (where qualifications did not apply)
- 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: that is, water above cap.

### 12.11.2 Entitlements for the environment

The environment's formal entitlements in the Loddon basin in 2010–11 comprised the Bulk Entitlement (Loddon River – Environmental Reserve) Order 2005 and the Environmental Entitlement (Birch Creek – Bullarook System) 2009 held by the Minister for Environment.

Environmental water was delivered to the Loddon system in 2010–11 from water available under the Environmental bulk entitlement (deficit and reimbursement account), in addition to Commonwealth environmental water that was traded into the Loddon system. A total of 749 ML of environmental water was delivered down the Loddon River providing water quality benefits, maintaining instream and riparian vegetation and habitat for fish and macro-invertebrates.

### 12.11.3 Passing flow compliance

Some bulk entitlements require passing flows to be met at some points in the basin.

Table 12-14 shows passing flow compliance in the Loddon basin for selected bulk-entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest. The location of these compliance points is presented in Figure 12-2.

The passing flow requirements listed in Table 12-11 were qualified in 2010–11. The volume that would have been released to meet passing flow requirements was retained in storages and made available for release at the direction of North Central Catchment Management Authority, once specified storage triggers were met.

#### Table 12-14 Selected passing flow compliance in the Loddon basin

| River | Passing flows | |
|---|---|---|
| Loddon River | Instrument where passing flows are specified | Bulk Entitlement (Loddon River – Environmental Reserve) Order 2005 |
| | Responsible authority | Minister for Environment |
| | Compliance point | Loddon River, between Cairn Curran and Laanecoorie reservoirs (shown as 1 in Figure 12-2) |
| | Passing flow compliance | Passing flow requirements listed below were qualified in 2010–11, with Goulburn-Murray Water meeting the qualified requirements:<br>• from November to April inclusive, the lesser of 20 ML per day or natural flow<br>• from May to October inclusive, if the combined storage volume in Cairn Curran and Tullaroop reservoirs is:<br>• - greater than 60,000 ML, the authority must pass 35 ML per day<br>• - less than or equal to 60,000 ML, the authority must pass 20 ML per day<br>• river freshening (three flows of 35 ML per day for seven consecutive days between November and April) |
| | Compliance point | Tullaroop Creek, between Tullaroop Dam and Laanecoorie Reservoir (shown as 2 in Figure 12-2) |
| | Passing flow compliance | Passing flow requirements listed below were qualified in 2009–10, with Goulburn-Murray Water meeting the qualified requirements:<br>• the lesser of 10 ML per day or natural flow<br>• river freshening (four flows of 13.5 ML per day for seven consecutive days between November and April) |
| | Compliance point | Loddon River, between Laanecoorie Weir and Serpentine Weir (shown as 3 in Figure 12-2) |
| | Passing flow compliance | Passing flow requirements listed below were qualified in 2009–10, with Goulburn-Murray Water meeting the qualified requirements:<br>• from November to July inclusive, the lesser of 15 ML per day or natural flow<br>• from August to October inclusive, if the combined storage volume in Cairn Curran and Tullaroop reservoirs is:<br>• - greater than 60,000 ML, the authority must pass 52 ML per day<br>• - less than or equal to 60,000 ML, the authority must pass 15 ML per day<br>• river freshening (3 flows of 52 ML per day for 7 consecutive days between November and April) |
| | Compliance point | Loddon River, between Serpentine Weir and Loddon Weir (shown as 4 in Figure 12-2) |
| | Passing flow compliance | Passing flow requirements listed below were qualified in 2009–10, with Goulburn-Murray Water meeting the qualified requirements:<br>• from November to April inclusive, the lesser of 19 ML per day or natural flow<br>• from May to October inclusive, if the combined storage volume in Cairn Curran and Tullaroop reservoirs is:<br>• - greater than 60,000 ML, the authority must pass 61 ML per day<br>• - less than or equal to 60,000 ML, the authority must pass 19 ML per day<br>• river freshening (3 flows of 61 ML per day for 7 consecutive days between November and April) |

| | | |
|---|---|---|
| | Compliance point | Loddon River, between Loddon Weir and Kerang Weir (shown as 5 in Figure 12-2) |
| | Passing flow compliance | Passing flow requirements listed below were qualified in 2009–10, with Goulburn-Murray Water meeting the qualified requirements:<br>• from November to April inclusive, cyclical over two weeks: rise from 7 to 12 ML per day in one week, followed by fall from 12 to 7 ML per day the next week<br>• from May to October inclusive, if the combined storage volume in Cairn Curran and Tullaroop reservoirs is:<br>• - greater than 60,000 ML, the authority must pass 61 ML per day plus flow equal to calculated in-stream loss<br>• - less than or equal to 60,000 ML, the authority must pass 10 ML per day plus flow equal to calculated in-stream loss<br>• river freshening (flow of 50 ML per day plus flow equal to calculated in-stream loss for 14 consecutive days between January and February) |

# 13 Avoca basin

This chapter sets out the accounts for the Avoca basin. For detailed information about how they were compiled, refer to Chapter 5.

## 13.1 Avoca basin summary

Inflows of 188,200 ML into the Avoca basin in 2010–11 were above the long-term average of 136,200 ML. During the year, water flowed into and overflowed from the Terminal Lakes located in the north of the basin.

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.

Long-running bans on diversions from unregulated streams were removed in August.

## 13.2 Responsibilities for management of water resources

Table 13-1 shows the responsibilities of various authorities within the Avoca basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 13-1 Responsibilities for water resources management within the Avoca basin, 2010–11

| 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 |

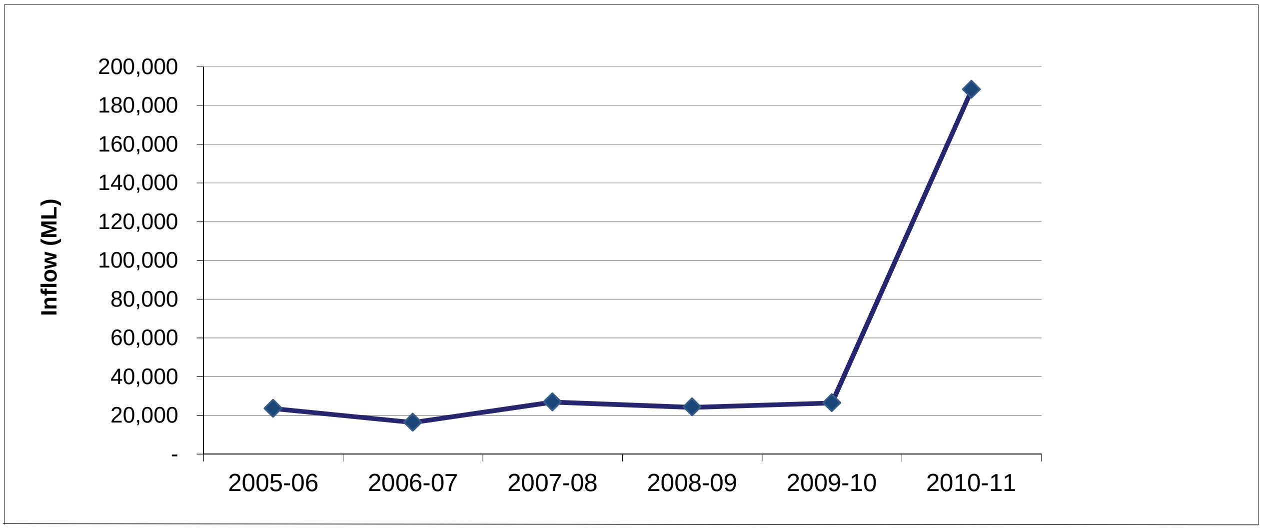
Note:
(1) Water for these towns is sourced from outside the Avoca basin.

## 13.3 Rainfall, flows and storages in 2010–11

In 2010–11, rainfall across the Avoca basin ranged between 150% and 300% of the long-term average. The catchment inflows were 138% of the long-term average of 136,200 ML. This is significantly higher than the previous three years of inflow. For the first time in six years, 101,600 ML of water flowed into the terminal lakes (Lake Bael Bael and Marchers). Overflow from the terminal lakes to the Kerang Lakes was recorded as being 43,500 ML.

There are no storages with capacity greater than 1,000 ML in the Avoca basin.

**Figure 13-1 Catchment inflows in the Avoca basin**




## 13.4 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 13-2. Total surface water availability increased significantly in 2010–11 compared to the previous years, while use decreased slightly. The total resource available for groundwater use doubled compared to 2009–10, but total use fell.

**Table 13-2 Summary of total water resources and water use in the Avoca basin, 2010–11**

| Water source | Total water resource (ML) | Total use (ML) |
|---|---|---|
| Surface water | 188,200 | 12,800 |
| Groundwater(1) | 590 | 70 |
| Recycled water | 170 | 90 |

Note:

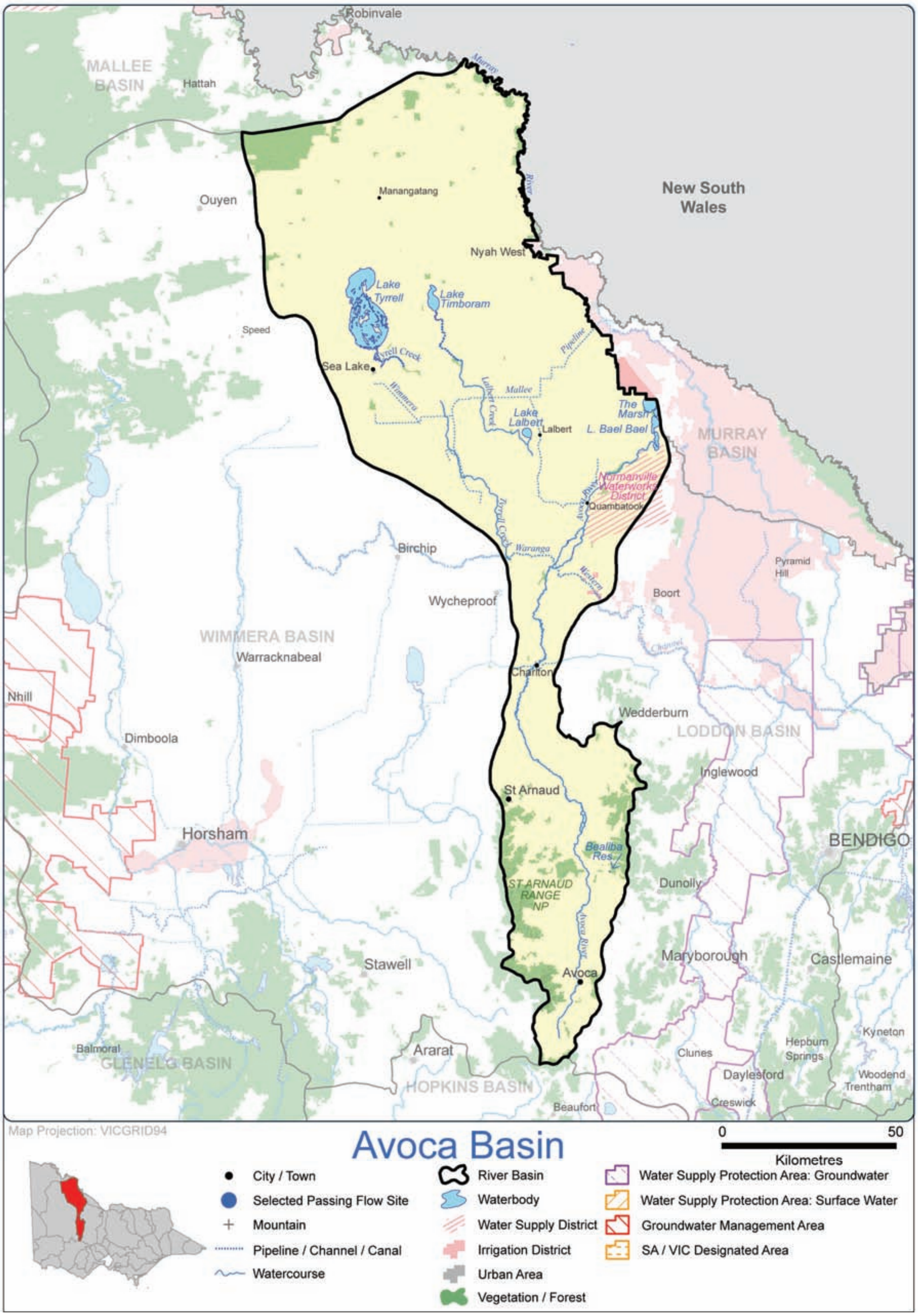
(1) Although there are no WSPAs or GMAs in the Avoca basin, the towns of Avoca, Redbank, Amphitheatre and Daylesford are supplied by groundwater located in an unincorporated area. The groundwater resource and use includes the licensed volume and use for these towns.

### 13.4.1 Infrastructure projects to improve water availability

Central Highlands Water continued its Avoca Groundwater Desalinisation Project to secure reliable drinking-quality water supply for the Avoca water supply system through the desalination of groundwater. In 2010–11, works completed included construction and commissioning of water treatment facilities. The project was due for completion in July 2011.

## 13.5 Location of water resources

### Figure 13-2 Map of the Avoca basin



# 13.6 Surface water resources

## 13.6.1 Water balance

A surface-water balance for the Avoca basin is shown in Table 13-3. There are no storages greater than 1,000 ML in the Avoca basin. Catchment inflow was the main source of water supply in the catchment.

### Table 13-3 Balance of surface water in the Avoca basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| Major on-stream storage[(1)] | | |
| Volume in storage at start of year | - | - |
| Volume in storage at end of year | - | - |
| **Change in storage** | - | - |
| **Inflows** | | |
| Catchment inflow | 188,200 | 26,400 |
| Rainfall on major storages | - | - |
| Transfers from other basins | - | - |
| Return flow from irrigation | - | - |
| Treated wastewater discharged back to river | - | - |
| **Sub-total** | **188,200** | **26,400** |
| **Usage** | | |
| Urban diversions | 40 | 30 |
| Licensed diversions from unregulated streams | 100 | 1,600 |
| Small-catchment dams[(2)] | 12,700 | 12,700 |
| **Sub-total** | **12,800** | **14,300** |
| **Losses** | | |
| Evaporation losses from major storages | - | - |
| Losses from small-catchment dams[(2)] | 9,800 | 9,800 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation [(3)] | 64,000 | 2,300 |
| **Sub-total** | **73,800** | **12,100** |
| **Water passed at outlet of basin** | | |
| Avoca River flow at Sandhill Lake Road (= outflow to terminal lakes) | 101,600 | 0 |
| Avoca River overflow from the terminal lakes to the Kerang Lakes | 43,500 | n/a |

Notes:

(1) Excludes wetlands in the Avoca basin.

(2) Data for water usage from small-catchment dams is provided by DSE. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(3) Losses represent the flow volume at the Avoca River gauge at Coonooer that did not enter the Avoca basin's terminal lakes.

n/a: No information available

## 13.6.2 Small-catchment dams

Specific information on small catchment-dam usage and losses for 2010–11 is not readily available. The values provided in Table 13-4 are estimated by DSE, as outlined in Chapter 5.

### Table 13-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 10,500 | 5,300 | n/a |
| Registered commercial and irrigation | 8,900 | 7,400 | n/a |
| **Total** | **19,400** | **12,700** | **22,500** |

n/a: No information available

## 13.6.3 Water entitlement trades

There were no transfers of water shares or allocations within the Avoca basin or across basin boundaries in 2010–11.

## 13.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 13-5. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2010–11. Licensed diversions from unregulated streams are estimated using irrigation-demand modelling and climate information.

### Table 13-5 Volume of water diverted under surface water entitlements in the Avoca basin

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance? |
|---|---|---|---|---|---|
| *Central Highlands Water* | | | | | |
| Amphitheatre | 1 | 25 | - | 9 | Yes |
| Avoca[(1)] | 1 | 233 | - | 34 | Yes |
| Redbank[(1)] | 1 | 20 | - | 1 | Yes |
| **Total annual volume of bulk entitlements 2010–11** | | **278** | **-** | **43** | |
| Total annual volume of bulk entitlements 2009–10 | | 278 | - | 31 | |
| *Licensed diversions from unregulated streams* 2010–11 | | *3,624* | | *100* | |
| *Licensed diversions from unregulated streams* 2009–10 | | *3,621* | | *1,600* | |

Notes:

(1) Urban water supply for the townships of Redbank and Avoca was partly sourced from groundwater in 2010–11.

## 13.7 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 Avoca, Redbank, Amphitheatre and Daylesford. The licensed entitlements and metered use for these groundwater supplies are provided in Table 13-6.

Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

### Table 13-6 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Avoca | 250 | 72 | 137 |
| Redbank | 50 | 2 | 3 |
| Amphitheatre | 20 | 0 | 1 |
| Daylesford | 273 | 0 | 0 |
| **Total** | **593** | **74** | **141** |

## 13.8 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions from unregulated streams are presented in Table 13-7. A number of towns in the basin are supplied with surface water from the Wimmera, Glenelg and Murray basins and the restriction levels implemented are those of the source systems. Restrictions for these towns were largely removed in October following significant resource improvement in the source basins.

Redbank is supplied by groundwater and remained on Stage 2 restrictions all year.

Bans on diversions from unregulated streams were removed in August.

### Table 13-7 Seasonal allocations and restrictions on water use in Avoca basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Urban | Avoca | Stage 2 restrictions 1 July 2010 to 31 October 2010 |
| | Redbank | Stage 2 restrictions from 1 July 2010 to 30 June 2011 |
| | St Arnaud | Stage 1 restrictions from 1 July 2010 to 10 October 2010 |
| | Charlton | Stage 1 restrictions from 1 July 2010 to 10 October 2010 |
| | Berriwillock, Chillingollah, Chinkapook, Culgoa, Lalbert, Manangatang, Nandaly, Nullawil, Sea Lake, Ultima, Waitchie – supplied via Northern Mallee pipeline | Stage 1 restrictions from 1 July 2010 to 10 October 2010 |
| | Nyah, Nyah West, Woorinen | Stage 1 restrictions from 1 July 2010 to 2 October 2010 |
| Unregulated licensed diversions | Avoca River, Mosquito Creek, Lake Bael Bael, Lake Lookout, Lake Marmal, Sand Hill Lake, Tchum Lake North | Irrigation ban in July and August 2010 |

## 13.9 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 2010–11 was slightly higher than that produced in 2009–10. The proportion of wastewater recycled in the Avoca basin treatment plants decreased to 53% in 2010–11. The recycled water was used for urban, industrial and agricultural purposes

### Table 13-8 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 (ML)(3) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation(1) | Within process(2) | | |
| Avoca | 10 | 10 | 100% | 0 | 10 | 0 | 0 | 0 | 0 |
| Charlton | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| Sea Lake | 27 | 27 | 100% | 0 | 27 | 0 | 0 | 0 | 0 |
| St Arnaud | 129 | 51 | 39% | 29 | 22 | 0 | 0 | 0 | 78 |
| **Total 2010–11** | **166** | **88** | **53%** | **29** | **59** | **0** | **0** | **0** | **78** |
| Total 2009–10 | 121 | 121 | 100% | 34 | 87 | 0 | 0 | 0 | 1 |

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.

## 13.10 Water for the environment

### 13.10.1 Environmental Water Reserve

In 2010–11 the Avoca basin EWR 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: that is, water above cap.

### 13.10.2 Passing flow compliance

The Avoca River is essentially unregulated, with no significant storages in the basin. All passing flow requirements were complied with for the Avoca Basin in 2010–2011.

### 13.10.3 Management plans

The Western Region Sustainable Water Strategy states that existing rules will be documented as a local management plan for the Avoca River.

# 14 Mallee basin

This chapter sets out the accounts for the Mallee basin. For detailed information about how they were compiled, refer to Chapter 5.

## 14.1 Mallee basin summary

Almost all surface water used in the Mallee basin is sourced from other basins. The Mallee basin relies heavily on groundwater: extractions decreased in 2010–11 compared to 2009–10.

## 14.2 Responsibilities for management of water resources

Table 14-1 shows the responsibilities of various authorities within the Mallee basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 14-1 Responsibilities for water resources management within the Mallee basin, 2010–11

| 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(1) | 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 |

Note:

(1) Under agreement with Lower Murray Water.

## 14.3 Rainfall, flows and storages in 2010–11

In 2010–11, rainfall across the basin generally ranged between 150% and 400% of the long-term average.

The Mallee basin has no well-defined streams other than the River Murray, 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, 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.

## 14.4 Total water resources in the basin

Table 14-2 below shows the water resources available and water resource use in the Mallee basin in 2010–11

### Table 14-2 Summary of total water resources and water use in the Mallee basin, 2010–11

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | - | - |
| Groundwater(2) | 14,100 | 4,730 |
| Recycled water | - | - |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 14-3 and the estimated domestic and stock use as presented in Table 14-4.

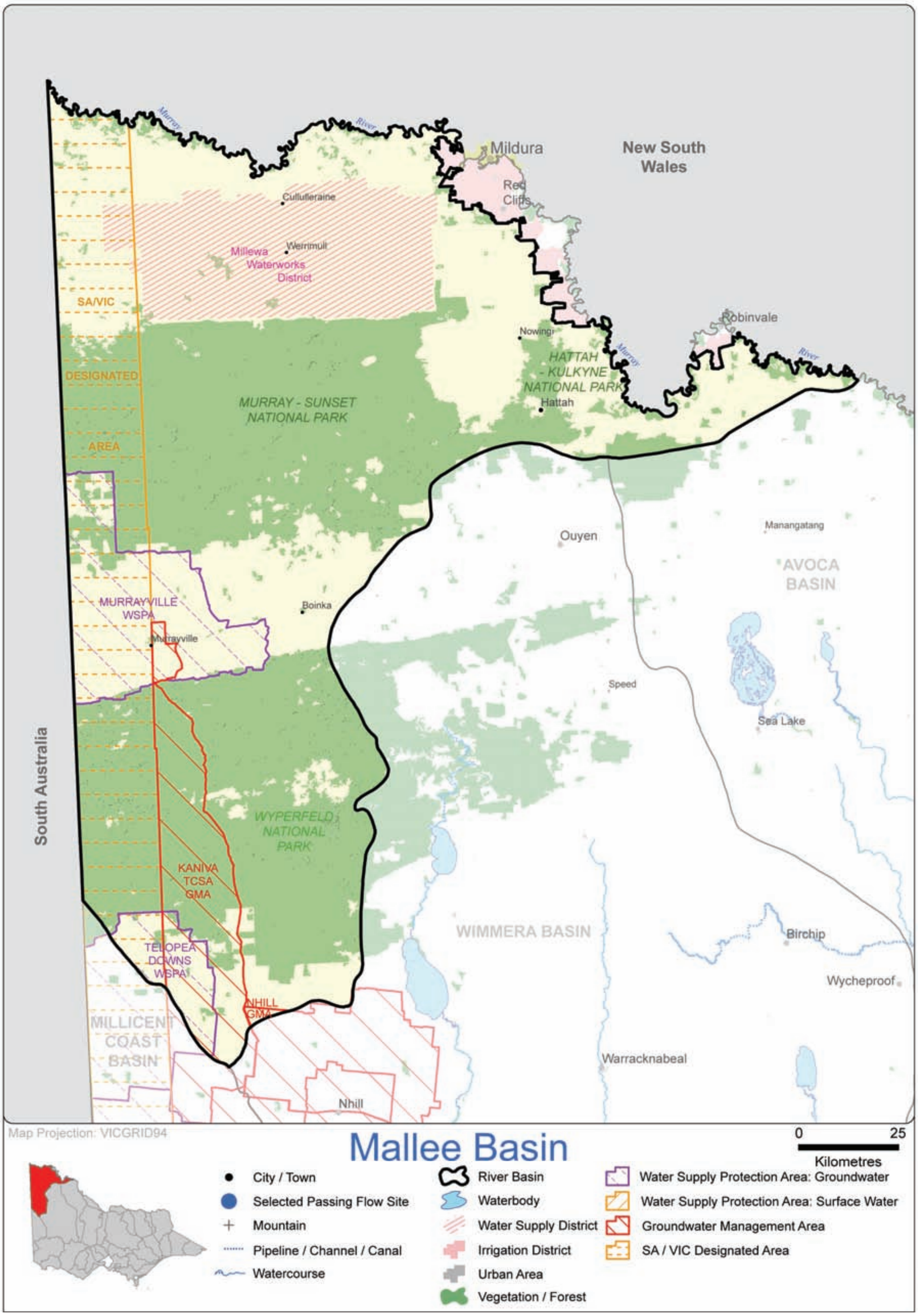
(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

### 14.4.1 Infrastructure projects to improve water availability

There were no infrastructure projects to improve water availability within the Mallee basin in 2010–11.

## 14.5 Location of water resources

### Figure 14-1 Map of the Mallee basin



# 14.6 Surface water resources

## 14.6.1 Water balance

A water balance for the Mallee basin has not been presented. All surface water supplies are sourced from outside the basin.

## 14.6.2 Small-catchment dams

There are some small-catchment dams in the Mallee basin but there is no information on them 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.

## 14.6.3 Water entitlement trades

There were no transfers of water shares or allocations within the Mallee basin or across basin boundaries in 2010–11.

## 14.6.4 Volume diverted

There are no bulk entitlements 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.

# 14.7 Groundwater resources

A summary of the licensed entitlements and use from GMUs within the Mallee basin, excluding domestic and stock use, is presented in Table 14-3.

The main water supply in the Mallee basin is groundwater. The Mallee basin contains all of the Murrayville WSPA as well as part of the Telopea Downs WSPA and Kaniva TCSA GMA. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

Reported groundwater usage in the Mallee basin reduced in 2010–11, compared to 2009–10. Groundwater levels in the Murrayville WSPA, Telopea Downs WSPA and Kaniva TCSA GMA are generally stable and in line with management objectives.

### Table 14-3 Licensed groundwater volumes, Mallee basin 2010–11

| WSPA/GMA(1) | GMA/WSPA depth limits(2) (m) | Entitlement limit(3) (ML/year) | Licensed entitlement (ML/year)(4) | Metered use (ML) | Estimated use in unmetered bores (ML)(5) | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Kaniva TCSA GMA (83%) | TCSA | 910 | - | - | - | 0 | 0 |
| Murrayville WSPA (100%) | 70-200 | 10,883 | 9,634 | 4,059 | - | 4,059 | 5,415 |
| Telopea Downs WSPA (39%)(6) | All depths | 4,117 | 4,117 | 314 | - | 314 | 904 |
| **Total(7)** | | **15,910** | **13,751** | **4,372** | **-** | **4,372** | **6,319** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11.

(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.

(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.

(6) Metered use has decreased significant in the Telopea Downs WSPA due to high rainfall during the 2010–11 irrigation seasons, in addition to a reduction in the value of clover seed and lucerne crops, resulting in many licence holders no longer growing these crops.

(7) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 14-4

### Table 14-4 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores[(1)(2)] | Estimated domestic and stock use (assuming 2 ML per bore) (ML)[(3)] |
|---|---|---|
| Kaniva TCSA GMA (83%) | 0 | 0 |
| Murrayville WSPA (100%) | 167 | 334 |
| Telopea Downs WSPA (39%) | 11 | 22 |
| **Total** | **178** | **356** |

Notes:

(1) 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 14-3.

(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data before rounding.

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 14-5.

### Table 14-5 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Cowangie | 40 | 8 | 10 |
| Murrayville | 475 | 89 | 161 |
| **Total** | **515** | **97** | **171** |

## 14.8 Recycled water

There are no wastewater treatment plants within the Mallee basin.

## 14.9 Water for the environment

### 14.9.1 Environmental Water Reserve

In 2010–11 the Mallee basin EWR comprised water outside the allocation limit for GMAs and WSPAs.

### 14.9.2 Entitlements for the environment

Environmental water requirements for the Mallee Basin are delivered through River Murray entitlements. Refer to Chapter 6 for environmental water provided to Red Gums along the River Murray floodplain that includes Hattah-Kulkyne National Park, within the Mallee Basin.

### 14.9.3 Passing flow compliance

As all surface water supplies are externally sourced in the Mallee basin, there are no passing flow requirements.

# 15 Wimmera basin

This chapter sets out the accounts for the Wimmera basin. For detailed information about how they were compiled, refer to Chapter 5.

## 15.1 Wimmera basin summary

At 758,700 ML, inflows to the Wimmera basin in 2010–11 were almost two and a half times larger than the long-term average of 316,400 ML. This was approximately 10 times the volume of inflows in 2009–10. After beginning the year at 18% capacity, storages in the Wimmera basin recovered by 114,000 ML to finish at 48% capacity at the end of June 2011.

While storage levels were still significantly lower than total capacity, the improvement in water availability, coupled with the completion of the Wimmera-Mallee pipeline in 2009-10, enabled Grampians Wimmera Mallee Water to remove restrictions on over 50 towns supplied from the pipeline in October 2010. Central Highlands Water and Coliban Water also removed restrictions for their towns in the Wimmera basin in 2010–11.

The allocation for the Wimmera irrigation area reached 100% for the first time in many years. The Wimmera Irrigation Association continued negotiations to sell irrigators' entitlements to the Commonwealth Government, and irrigation channel runs are deferred until the outcome of the sale is known. Grampians Wimmera-Mallee Water has not delivered irrigation supplies for around 10 years.

Long running bans on licenced diversions from streams across the basin were removed in spring.

## 15.2 Responsibilities for management of water resources

Table 15-1 shows the responsibilities of various authorities within the Wimmera basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 15-1 Responsibilities for water resources management within the Wimmera basin, 2010–11

| 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 | | | |
| 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 |

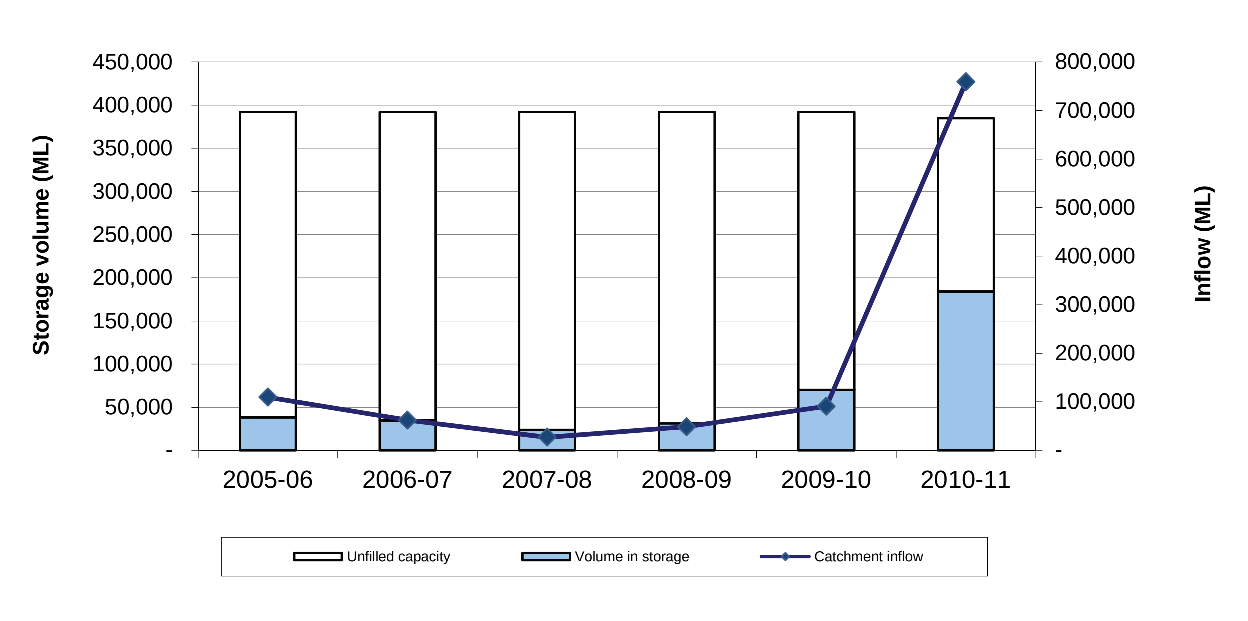
Note:
(1) Also supplies farms and towns located in the Avoca and Mallee basins.

## 15.3 Rainfall, flows and storages in 2010–11

In 2010–11, rainfall across the Wimmera basin ranged between 125% and 300% of the long-term average. Catchment inflows were 240% of the long-term average of 316,400 ML. This is significantly higher than the previous five years of inflow. The volume of water flowing from the Wimmera basin into the terminal lakes in 2010–11 was 350,200 ML. This was the first time in six years where a substantial flow entered the terminal lakes system.

Storage levels for all major storages (greater than 1,000 ML capacity) in the basin increased from 70,100 ML at the beginning of July 2010 to 184,100 ML (48% of capacity) by the end of June 2011. 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 15-1 All major storages and catchment inflows in the Wimmera basin




## 15.4 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 15-2.

### Table 15-2 Summary of total water resources and water use in the Wimmera basin, 2010–11

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | 769,100 | 24,200 |
| Groundwater(2) | 1,600 | 500 |
| Recycled water | 1,670 | 1,610 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 15-5 and the estimated domestic and stock use as presented in Table 15-6.

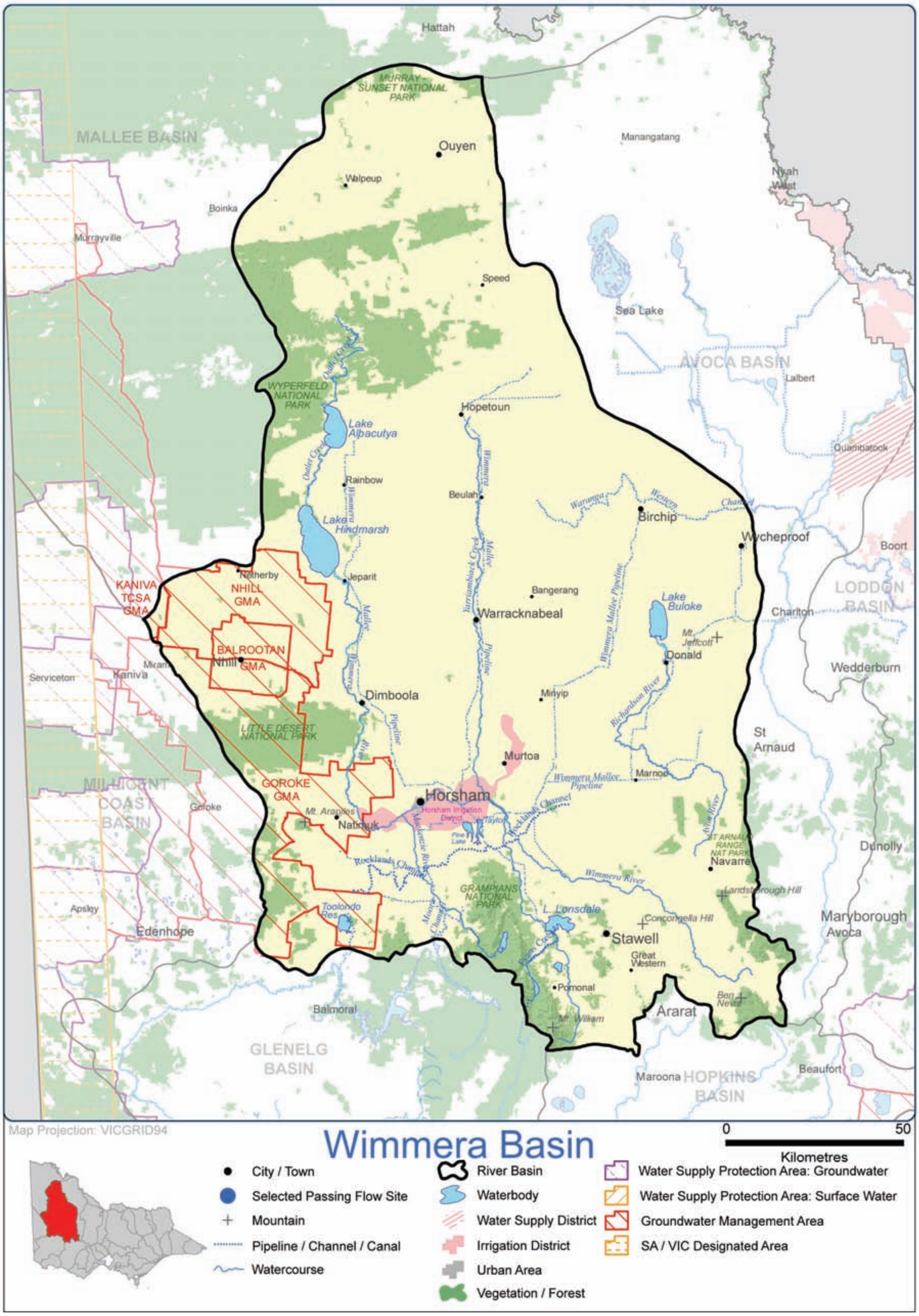
(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

### 15.4.1 Infrastructure projects to improve water availability

Central Highlands Water continued construction on a groundwater desalination plant for Landsborough to secure reliable potable drinking water. The project was expected to be complete in October 2011. In 2010–11, water treatment facilities were constructed and commissioned.

## 15.5 Location of water resources

### Figure 15-2 Map of the Wimmera basin



# 15.6 Surface water resources

## 15.6.1 Water balance

A surface-water balance for the Wimmera basin is shown in Table 15-3.

### Table 15-3 Balance of surface water in the Wimmera basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | 70,100 | 31,200 |
| Volume in storage at end of year | 184,100 | 70,100 |
| **Change in storage** | **114,000** | **38,900** |
| **Inflows** | | |
| Catchment inflow[(1)] | 646,900 | 76,400 |
| Rainfall on major storages | 6,700 | 13,500 |
| Transfer from Glenelg basin | 3,700 | 3,300 |
| Return flow from irrigation | 0 | 0 |
| Treated wastewater discharged back to river | 0 | 0 |
| **Sub-total** | **657,300** | **93,200** |
| **Usage** | | |
| Urban diversions and domestic and stock use | 9,800 | 13,000 |
| Diversions for irrigation | 0 | 0 |
| Licensed diversions from unregulated streams | 0 | 1,800 |
| Small-catchment dams[(2)] | 14,400 | 14,400 |
| **Sub-total** | **24,200** | **29,200** |
| **Losses** | | |
| Evaporation losses from major storages | 14,600 | 6,700 |
| Losses from small-catchment dams[(2)] | 8,600 | 8,600 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation[(3)] | 33,800 | 5,700 |
| **Sub-total** | **57,000** | **21,000** |
| **Water passed at outlet of basin** | | |
| River outflows to Lake Hindmarsh (measured at Tarranyurk) | 350,200 | 4,100 |
| River outflows to Lake Buloke | 111,900 | 0 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Data for water usage from small-catchment dams is provided by DSE. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(3) Losses were estimated using loss functions in the Grampians Wimmera Mallee REALM.

## 15.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values provided in Table 15-4 are estimated by DSE, as outlined in Chapter 5.

### Table 15-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 12,900 | 6,500 | n/a |
| Registered commercial and irrigation | 9,400 | 7,900 | n/a |
| **Total** | **22,300** | **14,400** | **23,000** |

n/a: No information available

## 15.6.3 Water entitlement trades

There were no transfers of water shares or allocations within the Wimmera basin or across basin boundaries in 2010–11.

## 15.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 15-5. Compliance with individual bulk entitlement volumes was deemed to have occurred if water diverted did not exceed the maximum volume allowed to be diverted in 2010–11.

Licensed diversions from unregulated streams are estimated using irrigation demand modelling and climate information.

### Table 15-5 Volume of water diverted under surface water entitlements in the Wimmera basin

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance?[(1)(2)] |
|---|---|---|---|---|---|
| *Coliban Water* | | | | | |
| Wimmera and Glenelg[(2)(3)] | 1 | 300 | 0 | 124 | Yes |
| *Central Highlands Water* | | | | | |
| Landsborough – Navarre | 1 | 60 | 0 | 4 | Yes |
| *GWMWater* | | | | | |
| Wimmera and Glenelg Rivers [(2)(3)] | 1 | 81,570 | 0 | 9,624 | Yes |
| *Wannon Water* | | | | | |
| Wimmera and Glenelg Rivers[(2) (4)] | 1 | 2,120 | 0 | 54 | Yes |
| *Minister for Environment* | | | | | |
| Wimmera and Glenelg Rivers Environmental Entitlement[(2) (3)] | 1 | 41,560 | 0 | 9,030 | 1 |
| **Total annual volume of bulk entitlements 2010–11** | | **125,610** | 0 | **18,836** | |
| Total annual volume of bulk entitlements 2009–10 | | 168,940 | 0 | 19,050 | |
| *Licensed diversions from unregulated streams 2010–11* [(5)] | | *2,551* | | *0* | |
| *Licensed diversions from unregulated streams 2009–10* | | *2,490* | | *0* | |

Notes:

(1) Compliance is also assessed against the Murray-Darling basin annual cap target for the Wimmera and Mallee basins, which is included in the MDBA's *Water audit monitoring report 2010–11*.

(2) In October 2010, the Minister for Water revoked the previous Wimmera and Glenelg rivers bulk and environmental entitlements for water from the Wimmera–Mallee system, and granted new entitlements after water savings and operational changes resulting from the completion of the Wimmera–Mallee pipeline.

(3) These bulk entitlements are also reported in the Glenelg basin, however are only included in the water balance for the Wimmera basin.

(4) This bulk entitlement is also reported in the Glenelg basin, however is only included in the water balance for the Glenelg basin.

(5) The volume diverted for licensed diversions from unregulated streams in 2009–10 was reported incorrectly as 1,800 ML.

## 15.7 Groundwater resources

A summary of the licensed entitlements and use for GMAs that overlap the Wimmera basin, excluding domestic and stock use, is presented in Table 15-5.

The Wimmera basin contains all of the Balrootan (Nhill) GMA and Nhill GMA, and the majority of the Goroke GMA. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A. Groundwater levels are generally stable in all GMUs in this area.

### Table 15-5 Licensed groundwater volumes, Wimmera basin 2010–11

| WSPA/GMA[(1)] | GMA/WSPA depth limits[(2)] (m) | Allocation limit (ML/year) [(3)] | Licensed entitlement (ML/year) [(4)] | Metered use (ML) | Estimated use in unmetered bores (ML)[(5)] | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Balrootan (Nhill) GMA (100%) | 60-125 | 1,522 | 1,522 | 462 | - | 462 | 746 |
| Goroke GMA (63%) | Tertiary sand confined aquifer | 1,384 | 0 | 0 | - | 0 | 0 |
| Nhill GMA (100%) | Tertiary sand confined aquifer | 1,200 | 0 | 0 | - | 0 | 0 |
| **Total[(6)]** | | 4,106 | **1,522** | **462** | **-** | **462** | **746** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11.

(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.

(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.

(6) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 15-6.

### Table 15-6 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores(1)(2) | Estimated domestic and stock use (assuming 2 ML per bore) (ML)(3) |
|---|---|---|
| Balrootan (Nhill) GMA (100%) | 15 | 30 |
| Goroke GMA (63%) | 1 | 2 |
| Nhill GMA (100%) | 1 | 2 |
| **Total** | **17** | **34** |

Notes:

(1) 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 15-5.

(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Total volumes are based on the sum of management unit data before rounding.

Groundwater is used as an urban water supply to the townships of Landsborough, Nhill, Kiata and Horsham Mt Zero. The licensed entitlements and metered use for these groundwater supplies are provided in Table 15-7.

### Table 15-7 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Kiata | 40 | 9 | 4 |
| Landsborough | 150 | 73 | 17 |
| Nhill | 1,000 | 267 | 520 |
| Horsham Mt Zero | 800 | 15 | 260 |
| **Total** | **1,990** | **363** | **801** |

## 15.8 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers and licensed diversions from unregulated streams are presented in Table 15-8. Grampians Wimmera-Mallee Water removed restrictions for most towns in the Wimmera basin in October, following the opening of the Wimmera-Mallee pipeline earlier in the year and significant improvement in storage levels. Central Highlands Water and Coliban Water also removed restrictions for their towns in 2010–11.

The allocation for the Wimmera irrigation area reached 100% for the first time in many years. The Wimmera Irrigation Association continued negotiations to sell irrigators' entitlements to the Commonwealth Government, and irrigation channel runs are deferred until the outcome of the sale is known. Grampians Wimmera-Mallee Water has not delivered irrigation supplies for around 10 years.

Long running bans on licenced diversions from streams across the basin were removed in spring.

### Table 15-8 Seasonal allocations and restrictions on water use in Wimmera basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Urban | Landsborough, Navarre | Stage 1 restrictions from 1 July 2010 to 31 October 2010 |
| | Korong Vale, Wedderburn, Borung and Wychitella | Stage 1 restrictions 1 July 2010 to 14 January 2011 |
| | Ouyen, Patchewollock, Speed, Tempy, Underbool, Walpeup (supplied via the Northern Mallee pipeline) | Stage 1 restrictions from 1 July 2010 to 10 October 2010 |
| | Antwerp, Beulah, Birchip, Brim, Clear Lake, Dimboola, Donald, Dooen, Glenorchy, Great Western, Halls Gap, Hopetoun, Horsham, Jeparit, Jung, Lascelles, Marnoo, Minyip, Murtoa, Natimuk, Noradjuha, Pimpinio, Pomonal, Rainbow, Rupanyup, Stawell, Tarranyurk, Warracknabeal, Watchem, Wycheproof, Woomelang, Yaapeet | Stage 1 restrictions from 1 July 2010 to 10 October 2010 |
| Irrigation diversions | Wimmera irrigation area | Allocation opened at 0% in July 2010 and reached 100% in February 2011. |
| | Avon River ,Burnt Creek, Concongella Creek, Dunmunkle Creek, Fyans Creek, Green Lake, Mackenzie River, Mt Cole Creek, Mt William Creek, Shepherds Creek, Toolondo, Wattle Creek, Wimmera River, Wimmera Tributary, Yarriambiack Creek, Lake Albacutya, Lake Batyo Catyo, Lake Wartook, Colliers Gap Creek, Spring Creek, Sweetwater Creek, Middle Creek and Unnamed Spring, Richardson River | Irrigation ban in July and August 2010 |
| | Lake Natimuk | Irrigation ban from July to November 2010 |

## 15.9 Recycled water

GWMWater operates 16 wastewater treatment plants in the Wimmera basin and reuses all wastewater at six of these plants for purposes including irrigation of pasture, horticulture and vineyards, and for urban and industrial uses (Table 15-9).

### Table 15-9 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 (ML)(3) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation(1) | Within process(2) | | |
| Birchip | 50 | 50 | 100% | 0 | 50 | 0 | 0 | 0 | 0 |
| Dimboola | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| Donald | 144 | 144 | 100% | 0 | 144 | 0 | 0 | 0 | 0 |
| Halls Gap | 230 | 106 | 46% | 16 | 90 | 0 | 0 | 0 | 124 |
| Hopetoun(4) | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| Horsham(5) | 531 | 643 | 121% | 64 | 579 | 0 | 0 | 0 | -113 |
| Jeparit(4) | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| Minyip(4) | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| Murtoa(5) | 66 | 66 | 100% | 0 | 66 | 0 | 0 | 0 | 0 |
| Natimuk(4) | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| Nhill | 86 | 28 | 32% | 0 | 28 | 0 | 0 | 0 | 58 |
| Ouyen(4) | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| Rainbow(4) | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| Stawell | 407 | 361 | 89% | 74 | 287 | 0 | 0 | 0 | 47 |
| Warracknabeal(5) | 109 | 170 | 156% | 160 | 10 | 0 | 0 | 0 | -61 |
| Wycheproof | 46 | 46 | 100% | | 46 | 0 | 0 | 0 | 0 |
| **Total 2010–11** | **1,669** | **1,613** | **97%** | **314** | **1,299** | **0** | **0** | **0** | **56** |
| Total 2009–10 | 1,428 | 1,428 | 100% | 310 | 1,118 | 0 | 0 | 0 | 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.
(4) All wastewater is evaporated on-site.
(5) The volume of water recycled exceeded the volume produced as water stored on-site carried over from the previous year.

## 15.10 Water for the environment

### 15.10.1 Environmental Water Reserve

The Wimmera River is a heritage river that depends on the EWR. Important environmental assets that depend on the Wimmera basin EWR include platypus, freshwater catfish and River Blackfish. Several priority river reaches have been identified and include:

- MacKenzie River Reach 2, which contains regionally threatened native fish (River Blackfish, Southern Pygmy Perch, Mountain Galaxias) and platypus populations (of which there are believed to be less than 10, and this to be 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 are a 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 2010–11, the Wimmera basin EWR contained the following components, as in the Wimmera and Glenelg Rivers Environmental Entitlement 2010:

- 40,560 ML of Wimmera-Mallee pipeline product
- 1,000 ML of wetland product
- 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: that is, water above cap.

### 15.10.2 Entitlements for the environment

The Wimmera and Glenelg Rivers Environmental Entitlement was granted to the Minister for the Environment in 2010, replacing the former environmental bulk entitlement. The entitlement consists of passing flows, unregulated entitlement, a 1,000 ML wetland entitlement, and 40,560 ML regulated entitlement.

The Inter Catchment Advisory Group (ICAG) determins the share of environmental allocation between the two catchments.

A total of 9,030 ML of regulated environmental water was used from the Wimmera and Glenelg Rivers Environmental Entitlement in 2010-11 (including environmental releases in the Glenelg River). Of this, 5,340 ML was released into the MacKenzie River throughout the 2010-11 water year. These releases assisted in the maintenance of water quality, and provided connectivity and habitat for native fish.

### 15.10.3 Passing flow compliance

All passing flow requirements were complied with for the Wimmera basin in 2010–2011.

### 15.10.4 Streamflow management plans

The Western Region Sustainable Water Strategy states that local management plans will be prepared for the upper Wimmera River and the Avon-Richardson River. A statutory streamflow management plan will not be prepared for the upper Wimmera River. The upper Wimmera River and Avon-Richardson River are areas where existing rules will be documented as local management plans

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# 16 East Gippsland basin

This chapter sets out the accounts for the East Gippsland basin. For detailed information about how they were compiled, refer to Chapter 5.

## 16.1 East Gippsland basin summary

Both rainfall and catchment inflows were above long-term averages in the East Gippsland basin in 2010–11. Consumptive use in the basin is very low compared to water availability. Almost 100% of inflows passed to Bass Strait.

## 16.2 Responsibilities for management of water resources

Table 16-1 shows the responsibilities of various authorities within the East Gippsland basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

**Table 16-1 Responsibilities for water resources management within the East Gippsland basin, 2009–10**

| Authority | Irrigation and rural water supply | 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 |

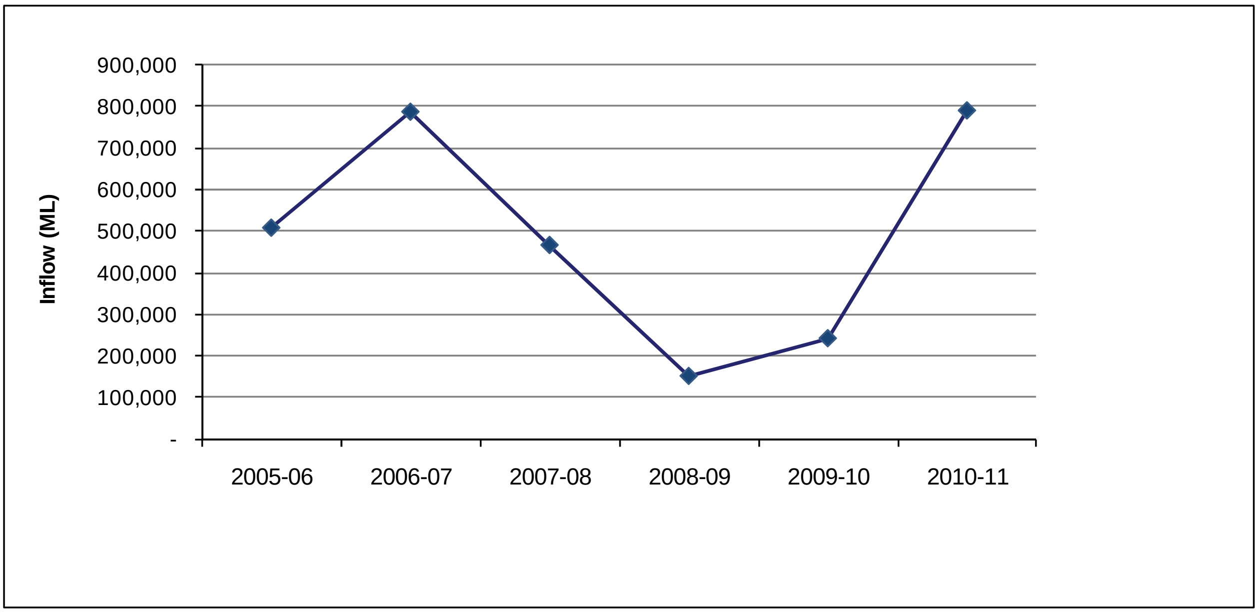
## 16.3 Rainfall and flows in 2010–11

In 2010–11, rainfall in the East Gippsland basin ranged between 80% and 125% of the long-term average. Inflows were 11% higher than the long-term average (of 714,000 ML).This was more than three times the volume of inflow in 2009–10, which was only 34% of the long-term average.

The amount of water flowing from the East Gippsland basin into Bass Strait was 789,900 ML in 2010–11, compared to 240,300 ML in 2009–10. Basin outflow was close to 100% of total inflows into the basin.

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

**Figure 16-1 Catchment inflows in the East Gippsland basin**



## 16.4 Location of water resources

### Figure 16-2 Map of the East Gippsland basin

## 16.5 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 16-2. There is very low use of surface water relative to the available resource in the basin (0.2% in 2010–11), and only limited groundwater extraction. All wastewater is recycled for productive purposes.

### Table 16-2 Summary of total water resources and water use in the East Gippsland basin, 2010–11

| Water source | Total water resource (ML) | Total use (ML) |
|---|---|---|
| Surface water | 791,600 | 1,600 |
| Groundwater[1] | 220 | 50 |
| Recycled water | 60 | 60 |

Note:

(1) Although there are no WSPAs or GMAs in the East Gippsland basin, the town of Mallacoota is supplied by groundwater located in an unincorporated area. The groundwater resource and use includes the licensed volume and use for Mallacoota.

### 16.5.1 Infrastructure projects to improve water availability

In 2010–11, East Gippsland Water completed two projects within the East Gippsland basin. Mallacoota Groundwater augmentation involved the construction of three additional production bores to secure an additional 100 ML of groundwater to meet projected demand. This project began in October 2010 and was completed in March 2011.

In 2010–11, a shade cloth cover was installed over the second of Mallacoota's two drinking water storage basins, to reduce evaporation and algal growth. The project commenced in October 2010 and was completed in February 2011.

## 16.6 Surface water resources

### 16.6.1 Water balance

The surface-water balance for the East Gippsland basin for 2010–11 is presented in Table 16-3.

No reservoir information is recorded in the water balance as there are no on-stream storages in the East Gippsland basin with a capacity greater than 1,000 ML.

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

### Table 16-3 Balance of surface water in the East Gippsland basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | - | - |
| Volume in storage at end of year | - | - |
| **Change in storage** | **-** | **-** |
| **Inflows** | | |
| Catchment inflow[1] | 791,600 | 241,800 |
| Rainfall on major storages | - | - |
| Transfers from other basins | - | - |
| Return flow from irrigation | - | - |
| Treated wastewater discharged back to river | - | - |
| **Sub-total** | **791,600** | **241,800** |
| **Usage** | | |
| Urban diversions | 150 | 130 |
| Licensed diversions from unregulated streams | 300 | 200 |
| Small-catchment dams | 1,100 | 1,100 |
| **Sub-total** | **1,600** | **1,400** |
| **Losses** | | |
| Evaporation losses from major storages | - | - |
| Evaporation from small-catchment dams[2] | 100 | 100 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation[3] | n/a | n/a |
| **Sub-total** | **100** | **100** |
| **Water passed at outlet of basin** | | |
| River outflows | 789,900 | 240,300 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(3) Assumed to be zero because data is not readily available.

n/a: No information available

### 16.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 16-4 below have been estimated by DSE as outlined in Chapter 5.

#### Table 16-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 800 | 400 | n/a |
| Registered commercial and irrigation | 900 | 700 | n/a |
| **Total** | **1,700** | **1,100** | **1,200** |

n/a: No information available

### 16.6.3 Water entitlement trades

There were no transfers of water shares or allocations within the East Gippsland basin or across basin boundaries in 2010–11.

### 16.6.4 Volume diverted

The volume of water diverted under East Gippsland Water's bulk water entitlements is shown in Table 16-5.

Compliance with individual bulk entitlement volumes was deemed to have occurred if water diverted did not exceed the maximum volume allowed to be diverted in 2010–11.

Licensed diversions from unregulated streams are estimated using irrigation demand modelling and climate information.

#### Table 16-5 Volume of water diverted under surface water entitlements in the East Gippsland basin

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance? |
|---|---|---|---|---|---|
| *East Gippsland Water* | | | | | |
| Bemm River | 1 | 100 | 0 | 12 | Yes |
| Cann River | 1 | 192 | 0 | 38 | Yes |
| Mallacoota | 1 | 330 | 0 | 97 | Yes |
| **Total annual volume of bulk entitlements 2010–11** | | **622** | **0** | **146** | |
| Total annual volume of bulk entitlements 2009–10 | | 622 | 0 | 126 | |
| *Licensed diversions from unregulated streams 2010–11* | | *775* | | *258* | |
| *Licensed diversions from unregulated streams 2009–10* | | *774* | | *222* | |

## 16.7 Groundwater resources

There are no GMAs or WSPAs located within the East Gippsland basin. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

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 2010–11, 46 ML was extracted from the bore, a significant decrease from the 117 ML extracted in 2009–10.

#### Table 16-6 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Mallacoota[(1)] | 220 | 46 | 117 |
| **Total** | **220** | **46** | **117** |

Notes:

(1) The town Mallacoota is an amalgamation of the towns of Mallacoota and Mallacoota – Betka.

## 16.8 Seasonal allocations and restrictions on water use, diversions and extractions

There were no restrictions on water use, diversion or extractions within the East Gippsland basin in 2010–11.

## 16.9 Recycled water

East Gippsland Water operates wastewater treatment plants at Mallacoota and Cann River. The volume of wastewater produced in 2010–11 was double that produced in 2009–10. All the wastewater was recycled for agricultural applications including pasture and tree plantations.

### Table 16-7 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 (ML)[3] |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation [1] | Within process[2] | | |
| Cann River | 22 | 22 | 100% | 0 | 22 | 0 | 0 | 0 | 0 |
| Mallacoota | 34 | 34 | 100% | 0 | 34 | 0 | 0 | 0 | 0 |
| **Total 2010–11** | **56** | **56** | **100%** | **0** | **56** | **0** | **0** | **0** | **0** |
| Total 2009–10 | 28 | 28 | 100% | 0 | 28 | 0 | 0 | 0 | 0 |

Notes:

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

(2) 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 on-site wastewater storage, or items affecting the annual water balance for recycled water that are not otherwise accounted for.

## 16.10 Water for the environment

### 16.10.1 Environmental Water Reserve

Environmental assets that rely on the EWR in the East Gippsland Basin include the Sydenham, Tamboon and Mallacoota inlets (nationally significant wetlands); pristine estuaries; heritage river reaches; and the Swamp Skink, Australian Grayling, Australian Bass, Tangle Orchid and Eastern Curlew. In 2010–11, the basin's EWR comprised:

- water set aside for the environment through flow-sharing arrangement conditions within consumptive 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: that is, water above cap.

### 16.10.2 Passing flow compliance

Some bulk entitlements require passing flows to be met at some points in the basin.

All passing flow requirements were complied with for the East Gippsland Basin in 2010–2011.

Table 16-8 shows passing flow compliance in the East Gippsland basin for a selected bulk entitlement compliance point. While there are other compliance points, the point below has been chosen as it was judged to be of community interest. The location of this compliance point is presented in Figure 16-2.

### Table 16-8 Selected passing flow compliance in the East Gippsland basin

| River | Passing flow | |
|---|---|---|
| Betka River | Instrument where passing flows are specified | Bulk Entitlement (Mallacoota) Conversion Order 1997 |
| | Responsible authority | East Gippsland Water |
| | Compliance point | Mallacoota Diversion Weir (shown as 1 in Figure 16-2) |
| | Passing flow compliance | • Half the flow was passed for flows less than or equal to 3.1 ML per day<br>• A minimum of 1.55 ML per day was passed for flows greater than 3.1 ML per day |

### 16.10.3 Management plans

The Gippsland Region Sustainable Water Strategy states that existing rules will be documented as a local management plan for the unregulated rivers in the East Gippsland Basin.

# 17 Snowy basin

This chapter sets out the accounts for the Snowy basin. For detailed information about how they were compiled, refer to Chapter 5.

## 17.1 Snowy basin summary

Consumptive entitlements in the Snowy basin are low compared to the total water resource. Inflows from Victoria were 30% higher than the long-term average in 2009–10. Total inflows, from NSW and Victoria, were 1,326,800 ML, and more than 99% flowed into Bass Strait.

Urban and rural water users were unrestricted throughout the year. Groundwater users were also unrestricted.

## 17.2 Responsibilities for management of water resources

Table 17-1 shows the responsibilities of various authorities within the Victorian portion of the Snowy basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 17-1 Responsibilities for water resources management within the Snowy basin, 2010–11

| 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 | | |
| East Gippsland Water | | | Supplies towns including Buchan, Orbost and Marlo | Obliged to meet passing flow requirements |
| East Gippsland Catchment Management Authority | | | | Manages waterways for the whole of the Snowy basin |

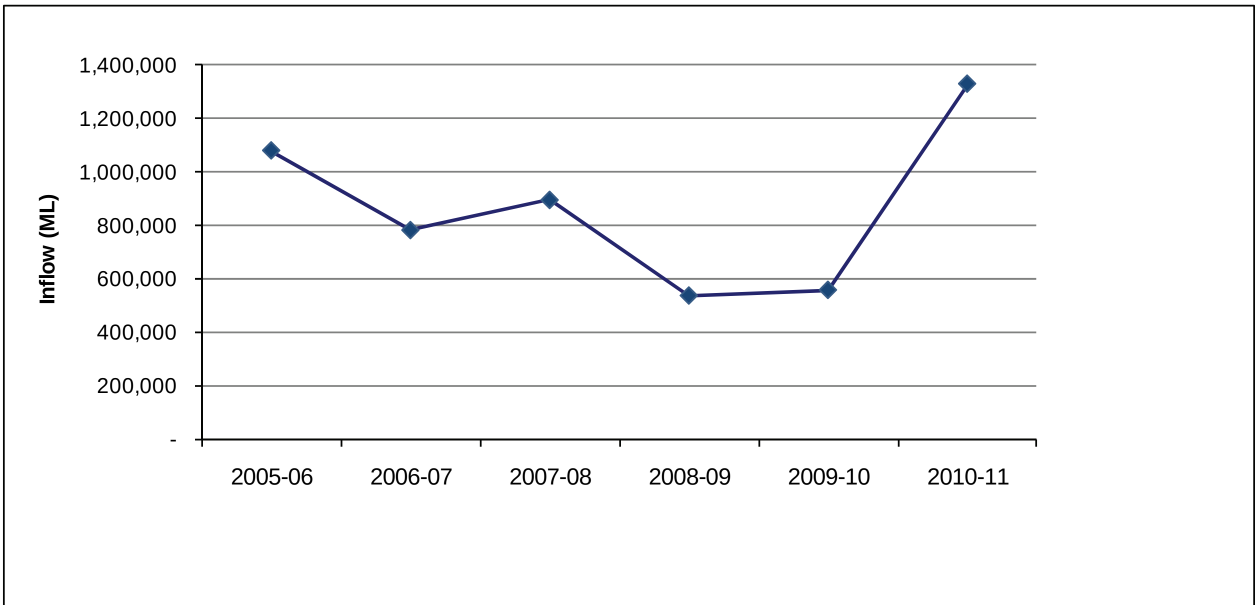
## 17.3 Rainfall, flows and storage levels in 2010–11

In 2010–11, rainfall in the Snowy basin ranged between 100% and 150% of the long-term average. Total inflows to the Victorian portion of the basin were 1,326,800 ML, or 130% of the long-term average (of 1,022,000 ML). This compared to 559,000 ML or 55% of the long-term average in 2009–10. Inflows from NSW are regulated by the Snowy Mountains Hydro Electricity Scheme. This inflow was 312,600 ML in 2010–11, up from 178,400 ML in 2009–10.

The amount of water flowing from the Snowy basin into Bass Strait was 1,321,400 ML in 2010–11. This represents over 99% of total inflows to the basin.

There are no major on-stream storages (greater than 1,000 ML capacity) located within the Victorian portion of the Snowy basin.

### Figure 17-1 Catchment inflows to the Snowy basin (including contribution from NSW)



## 17.4 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 17-2. There is a very low consumptive use of surface water relative to the available resource in the Victorian portion of the basin (0.3% in 2010–11). 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 17-2 Summary of total water resources and water use in the Snowy basin, 2010–11

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | 1,326,800 | 4,700 |
| Groundwater(2) | 1,200 | 110 |
| Recycled water | 360 | 360 |

Notes:

(1) For groundwater the total water resource is the licensed entitlement volume as presented in Table 17-7 and the estimated domestic and stock use as presented in Table 17-8.

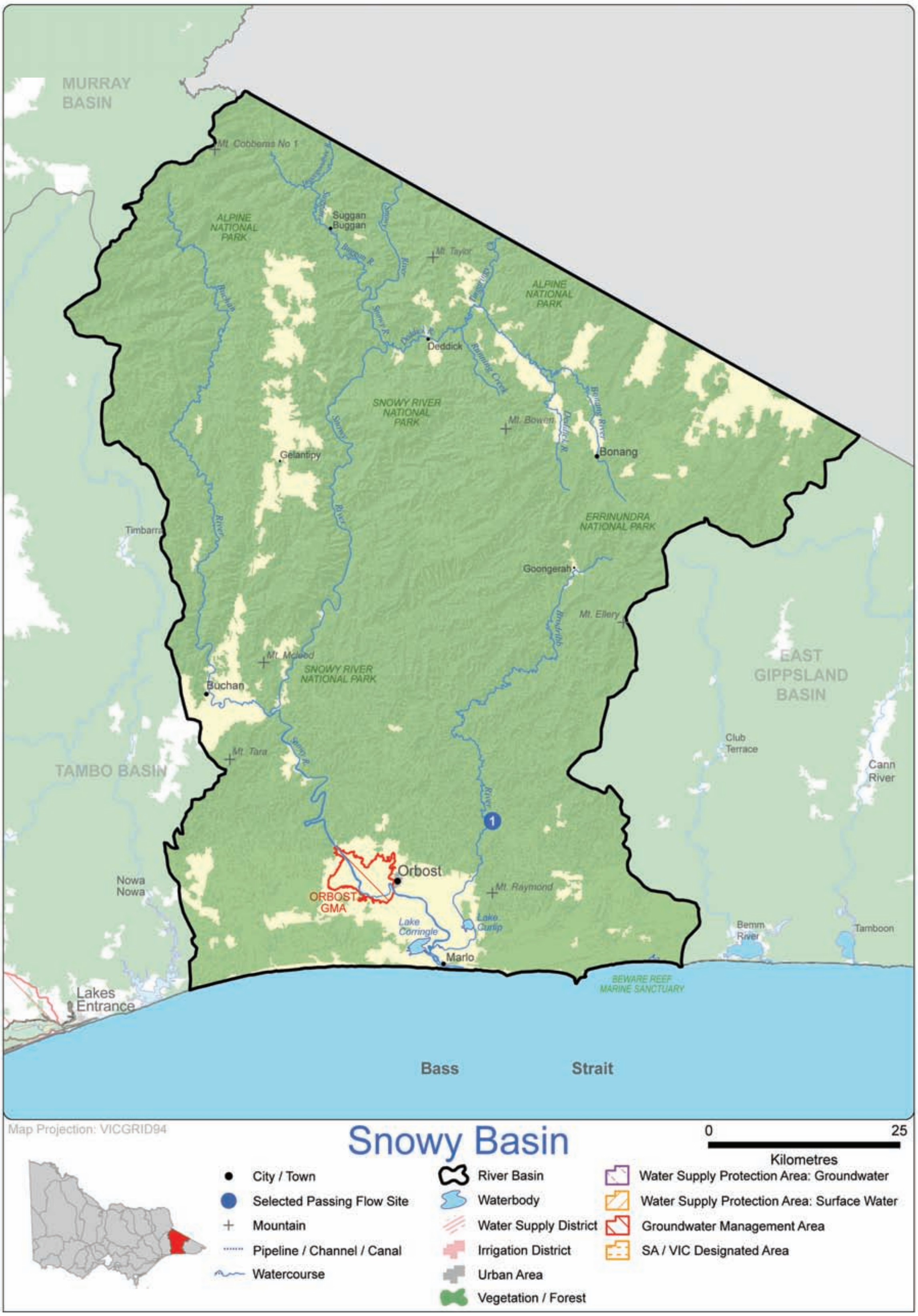
(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

### 17.4.1 Infrastructure projects to improve water availability

There were no infrastructure projects to improve water availability within the Snowy Basin in 2010–11.

## 17.5 Location of water resources

### Figure 17-2 Map of the Snowy basin



## 17.6 Surface water resources

### 17.6.1 Water balance

A surface-water balance for the Snowy basin is shown in Table 17-3. As these accounts provide a record of water availability and use across Victoria, this balance considers only the Victorian portion of the Snowy basin.

No reservoir information is recorded in the water balance as there are no on-stream storages in the Victorian portion of the Snowy basin with a capacity greater than 1,000 ML.

Victorian inflows accounted for 76% of the total inflows to the basin, compared to 69% in 2009–10. Diversions in Victoria from the Snowy basin represent less than 1% of total inflows. Small-catchment dams are estimated to be the largest source of diversions.

#### Table 17-3 Balance of surface water in the Snowy basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | - | - |
| Volume in storage at end of year | - | - |
| **Change in storage** | **-** | - |
| **Inflows** | | |
| Catchment inflow from Victoria(1) | 1,014,200 | 380,600 |
| Catchment inflow from NSW(2) | 312,600 | 178,400 |
| Rainfall on major storages | - | - |
| Return flow from irrigation | - | - |
| Treated wastewater discharged back to river | - | - |
| **Sub-total** | **1,326,800** | **559,000** |
| **Usage** | | |
| Urban diversions | 820 | 790 |
| Licensed diversions from unregulated streams | 500 | 800 |
| Small-catchment dams | 3,400 | 3,400 |
| **Sub-total** | **4,700** | **5,000** |
| **Losses** | | |
| Evaporation losses from major storages | - | - |
| Evaporation from small-catchment dams(3) | 700 | 700 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(4) | n/a | n/a |
| **Sub-total** | **700** | **700** |
| **Water passed at outlet of basin** | | |
| River outflows to the ocean | 1,321,400 | 553,300 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

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

(3) Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(4) Assumed to be zero because data is not available.

n/a: No information available

### 17.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 17-4 are estimated by DSE, as outlined in Chapter 5.

#### Table 17-4 Catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 3,100 | 1,600 | n/a |
| Registered commercial and irrigation | 2,100 | 1,800 | n/a |
| **Total** | **5,200** | **3,400** | **4,100** |

n/a: No information available

### 17.6.3 Water entitlement trades

In 2010–11, no net trade of surface water resources occurred into, or out of, the Snowy basin. Trades of temporary bundled water entitlements did occur within the basin.

Table 17-5 summarises the trade in bundled surface water entitlements in 2010–11. 59 ML of temporary transfers were made within the Snowy unregulated system in this year.

### Table 17-5 Surface water bundled entitlement volume transfers in the Snowy basin 2010–11

| Trading zone | Permanent transfers (ML) | Temporary transfers (ML) |
|---|---|---|
| Snowy unregulated | 0 | 59 |
| **Total 2010–11** | **0** | **59** |
| Total 2009–10 | 0 | 64 |

### 17.6.4 Volume diverted

The volume of water diverted under East Gippsland Water's bulk entitlements is shown in Table 17-6. Compliance with individual bulk entitlement volumes was deemed to have occurred if water diverted was not more than the maximum volume allowed to be diverted in 2010–11.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

### Table 17-6 Volume of water diverted under surface water entitlements in the Snowy basin

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance? |
|---|---|---|---|---|---|
| *East Gippsland Water* | | | | | |
| Buchan | 1 | 170 | 0 | 25 | Yes |
| Orbost System | 1 | 2,031 | 0 | 797 | Yes |
| **Total annual volume of bulk entitlements 2010–11** | | **2,201** | 0 | **822** | |
| Total annual volume of bulk entitlements *2009–10* | | 2,201 | 0 | 787 | |
| *Licensed diversions from unregulated streams 2010–11* | | *3,991* | 0 | *494* | |
| *Licensed diversions from unregulated streams 2009–10* | | *4,034* | 0 | *807* | |

## 17.7 Groundwater resources

The Snowy basin contains the entire Orbost GMA. Licensed groundwater entitlements and use for the Orbost GMA in the Snowy basin, excluding domestic and stock use, are shown in Table 17-7. Groundwater levels in Orbost GMA are increasing.

### Table 17-7 Licensed groundwater volumes, Snowy basin 2010–11

| WSPA/GMA(1) | GMA/WSPA depth limits(2) (m) | Entitlement limit(3) (ML/year) | Licensed entitlement (4) (ML/year) | Metered use (ML) | Estimated use in unmetered bores (ML)(5) | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Orbost GMA (100%)(6) | 20-45 | 1,201 | 1,201 | 95 | - | 95 | 333 |
| **Total** | | **1,201** | **1,201** | **95** | **-** | **95** | **333** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11.

(4) Licensed entitlement includes domestic and stock usage in cases where this forms part of a licensed volume.

(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.

An estimate of domestic and stock groundwater use in the Snowy basin is provided in Table 17-8. Groundwater is not used for urban supply in the Snowy basin.

### Table 17-8 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores(1)(2) | Estimated domestic and stock use (assuming 1.5 ML per bore(3)) (ML) |
|---|---|---|
| Orbost GMA (100%) | 7 | 11 |
| **Total** | **7** | **11** |

Notes:

(1) 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 17-7.

(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Estimated domestic and stock use were calculated using a factor of 1.5 ML per bore for Southern Rural Water GMUs. For other authorities, the factor was 2 ML.

## 17.8 Seasonal allocations and restrictions on water use, diversions and extractions

There were no restrictions on water use, diversion or extractions within the Snowy basin in 2010–11.

## 17.9 Recycled water

The Orbost wastewater treatment plant is the only treatment plant in the Snowy basin. In 2010–11, all of the wastewater passing through this treatment plant was recycled and used for some agricultural applications including pasture and tree plantations (Table 17-9).

### Table 17-9 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 (ML)(3) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation (1) | Within process(2) | | |
| Orbost | 359 | 359 | 100% | 0 | 359 | 0 | 0 | 0 | 0 |
| **Total 2010–11** | **359** | **359** | **100%** | 0 | **359** | 0 | 0 | 0 | 0 |
| Total 2009–10 | 243 | 243 | 100% | 0 | 243 | 0 | 0 | 0 | 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.

## 17.10 Water for the environment

### 17.10.1 Environmental Water Reserve

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

In 2010–11 the Snowy basin EWR 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: that is, water above cap.

### 17.10.2 Entitlements for the environment

The Victorian volume of environmental entitlements and water shares purchased for the Snowy basin as at June 2011 was 85,380 ML. The Snowy environmental entitlements were created through the intergovernmental agreements between the Commonwealth, Victorian and New South Wales governments, known as the Snowy Water Inquiry Outcomes Implementation Deed. The agreement is to provide for the return of 212,000 ML (21%) of the original flow to the Snowy River below Jindabyne by 2012, increasing to 28% in the longer term. The environmental water for the Snowy River will be achieved through investment in water recovery projects in the Goulburn, Murray and Murrumbidgee basins.

Efforts to meet the 2012 target of recovering 212,000 ML of water entitlements for the Snowy River are on-track.

In 2010–11, a total of 24.2 GL of water was committed by the New South Wales, Victorian and Commonwealth governments for use as additional environmental flows.

Two environmental releases were made to the Snowy River in 2010–11. The first release, in spring 2010, was the largest active environmental flow release to the Snowy River since the construction of Jindabyne Dam in 1967. A second environmental flow release was made in autumn 2011.

### 17.10.3 Passing flow compliance

Some bulk entitlements require passing flows to be met at some points in the basin.

All passing flow requirements were complied with for the Snow Basin in 2010–11.

Table 17-10 shows passing flow compliance in the Snowy basin for a selected bulk entitlement compliance point. While there are other compliance points, the point below has been chosen because it is of community interest. The location of this compliance point is presented in Figure 17-2.

#### Table 17-10 Selected passing flow compliance in the Snowy basin

| River | Passing flow | |
|---|---|---|
| Rocky River, Brodribb River | Instrument where passing flows are specified | Bulk Entitlement (Orbost) Conversion Order 1997 |
| | Responsible authority | East Gippsland Water |
| | Compliance point | Rocky River downstream of the offtake weir (shown as 1 in Figure 17-2) |
| | Passing flow compliance | The lesser of 1 ML per day or natural inflow was passed |

### 17.10.4 Management plans

The Gippsland Region Sustainable Water Strategy states that existing rules will be documented as a local management plan for the Snowy River.

# 18 Tambo basin

This chapter sets out the accounts for the Tambo basin. For detailed information about how they were compiled, refer to Chapter 5.

## 18.1 Tambo basin summary

The Tambo was one of the few basins in Victoria where 2010–11 inflows were lower than the long-term average. While only 62% of the long-term average, 2010–11 inflows were more than double those in 2009-10.

There are no large authorised diversions in the Tambo basin: its bigger towns, such as Lakes Entrance, are now supplied by the Bairnsdale water system. As such, over 90% of basin inflows flow to the Gippsland Lakes.

Licensed surface-water users were unrestricted during the year.

## 18.2 Responsibilities for management of water resources

Table 18-1 shows the responsibilities of various authorities within the Tambo basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 18-1 Responsibilities for water resources management within the Tambo basin, 2010–11

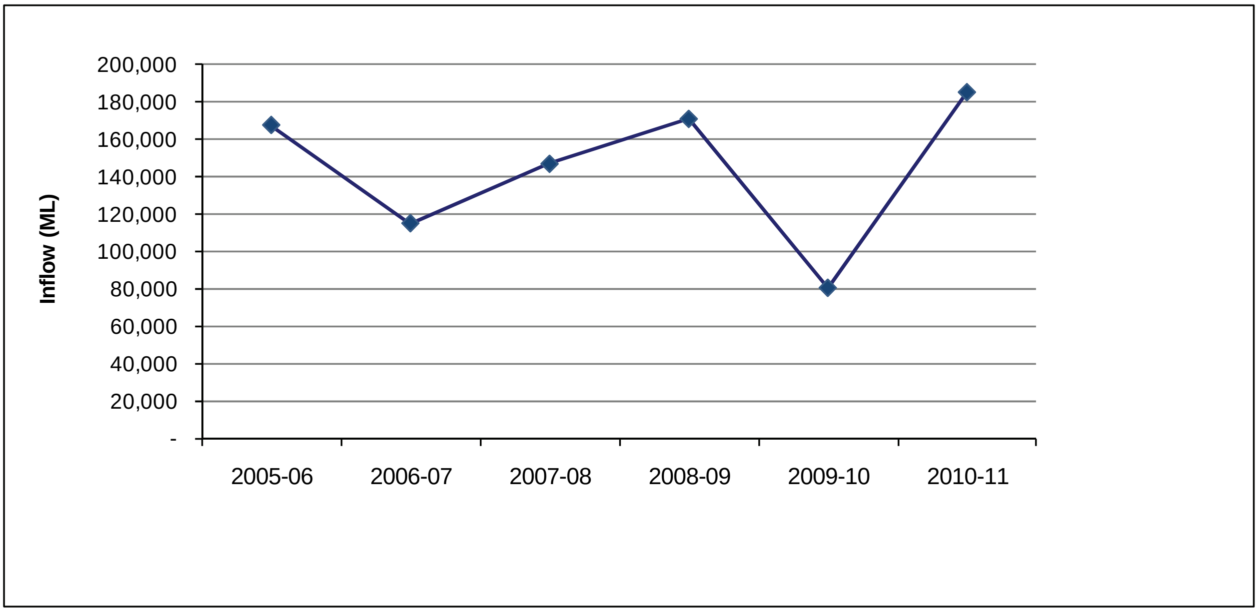
| Authority | Irrigation and rural water supply | Licensing | Urban water supply | Storage management; waterway management; environmental obligations |
|---|---|---|---|---|
| Southern Rural Water | | Manages groundwater and surface water licensed diversions | | |
| East Gippsland Water | | | Supplies 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 |

## 18.3 Rainfall, flows and storages in 2010–11

In 2010–11, rainfall in the Tambo basin ranged between 80% and 125% of the long-term average. Total inflows to the basin were 185,000 ML, or 62% of the long-term average (of 297,800 ML). This compared to 80,500 ML or 27% of the long-term average in 2009–10.The amount of water flowing from the Tambo basin into the Gippsland Lakes was 178,500 ML in 2010–11, which was approximately 96% of total inflows to the basin.

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

### Figure 18-1 Catchment inflows in the Tambo basin



## 18.4 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 18-2. Table 18-2. Consumptive use in the Tambo basin is low, compared to the available resource in the basin.

### Table 18-2 Summary of total water resources and water use in the Tambo basin, 2010–11

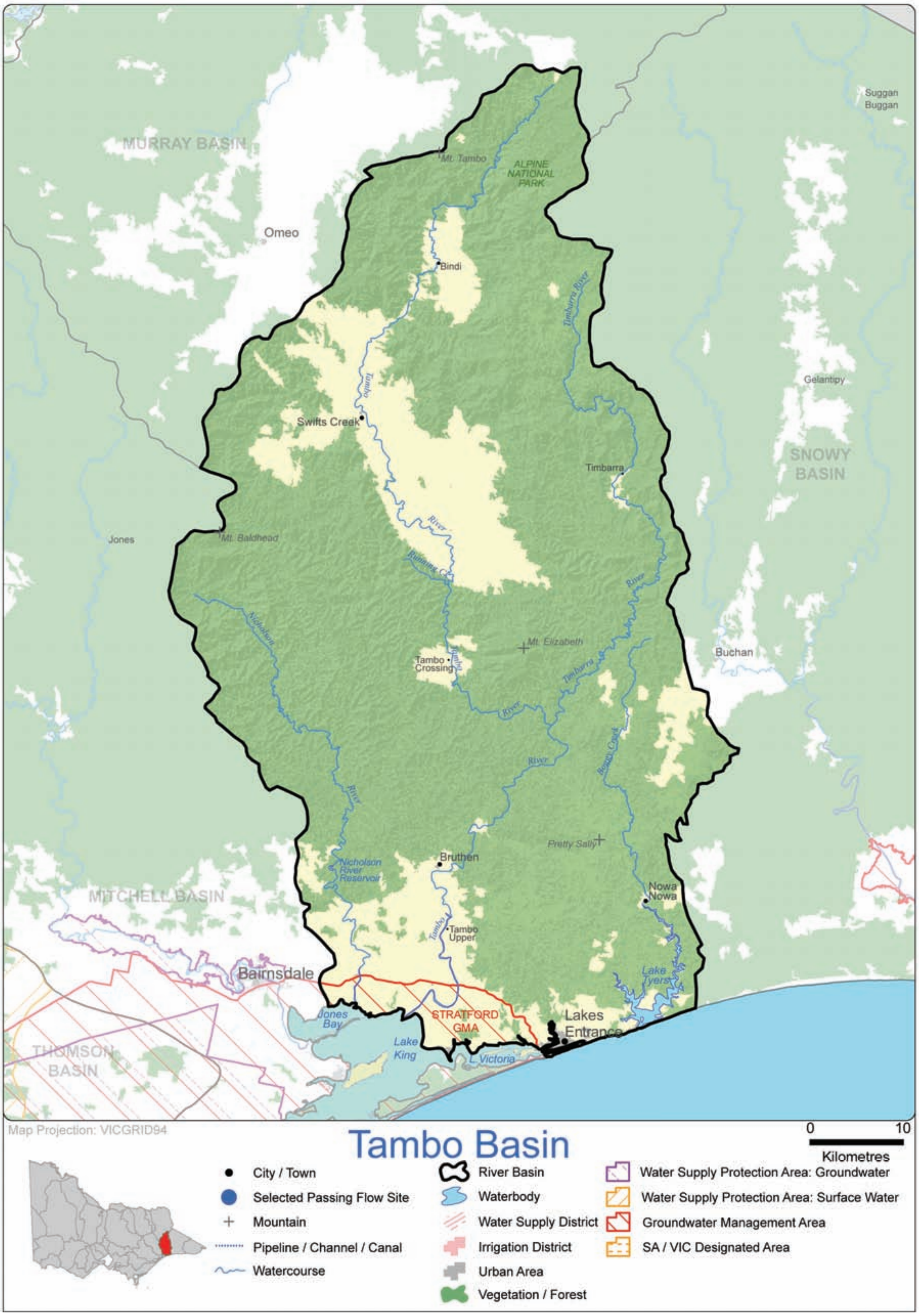
| Water source | Total water resource (ML) | Total use (ML) |
|---|---|---|
| Surface water | 185,000 | 4,400 |
| Groundwater | - | - |
| Recycled water | 540 | 540 |

### 18.4.1 Infrastructure projects to improve water availability

East Gippsland Water undertook to relocate Swifts Creek Tank. This project will increase the clear water volume availability to Swifts Creek. The project commenced in August 2010 and is expected to be complete in December 2011.

## 18.5 Location of water resources

### Figure 18-2 Map of the Tambo basin



# 18.6 Surface water resources

## 18.6.1 Water balance

A surface-water balance for the Tambo basin is shown in Table 18-3.

No reservoir information is recorded in the water balance as there is no on-stream reservoir in the Tambo basin with a capacity greater than 1,000 ML.

### Table 18-3 Balance of surface water in the Tambo basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **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(1) | 185,000 | 80,500 |
| Rainfall on major storages | - | 0 |
| Transfers from other basins | - | 0 |
| Return flow from irrigation | - | 0 |
| Treated wastewater discharged back to river | - | 0 |
| **Sub-total** | **185,000** | **80,500** |
| **Usage** | | |
| Urban diversions | 20 | 30 |
| Licensed diversions from unregulated streams | 500 | 1,100 |
| Small-catchment dams | 3,900 | 3,900 |
| **Sub-total** | **4,400** | **5,000** |
| **Losses** | | |
| Evaporation losses from major storages | - | 0 |
| Evaporation from small-catchment dams(2) | 2,100 | 2,100 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(3) | n/a | 0 |
| **Sub-total** | **2,100** | **2,100** |
| **Water passed at outlet of basin** | | |
| River outflows to the ocean | 178,500 | 73,400 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(3) Assumed to be zero because data is not readily available.

n/a: No information available

## 18.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 18-4 below are estimated by DSE, as outlined in Chapter 5.

### Table 18-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 4,500 | 2,200 | n/a |
| Registered commercial and irrigation | 2,100 | 1,700 | n/a |
| **Total** | **6,600** | **3,900** | **6,000** |

n/a: No information available

## 18.6.3 Water entitlement trade

There were no transfers of water entitlements within the Tambo basin or across basin boundaries in 2010–11.

## 18.6.4 Volume diverted

Table 18-5 shows the volume of water diverted under East Gippsland Water's bulk entitlements. Compliance with individual bulk entitlement volumes was deemed to have occurred if water diverted did not exceed the average annual bulk entitlement volume.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

### Table 18-5 Volume of water diverted under surface water entitlements in the Tambo basin

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance? |
|---|---|---|---|---|---|
| *East Gippsland Water* [1] | | | | | |
| Nowa Nowa[2] | 1 | 118 | 0 | 0 | Yes |
| Swifts Creek | 1 | 224 | 0 | 24 | Yes |
| **Total annual volume of bulk entitlements 2010–11** | | **342** | **0** | **24** | |
| Total annual volume of bulk entitlements *2009–10* | | 3,648 | 0 | 31 | |
| *Licensed diversions from unregulated streams 2010–11* | | *4,203* | | *515* | |
| *Licensed diversions from unregulated streams 2009–10* | | *4,188* | | *1,144* | |

Notes:

(1) East Gippsland Water's Bruthen and Lakes Entrance bulk entitlements were revoked in September 2010. The annual volume of these entitlements (3,306 ML) was transferred to the Bairnsdale bulk entitlement in the Mitchell basin. East Gippsland Water has been sourcing supply for these towns from the Mitchell River for some years due to ongoing water quality and reliability issues.

(2) No water was extracted under the Nowa Nowa bulk entitlement in 2010–11. East Gippsland Water supplied this town under the Bairnsdale bulk entitlement, reported in Table 19-6 in the Mitchell Basin.

## 18.7 Groundwater resources

There are no GMAs or WSPAs located within the Tambo basin.

There is no urban groundwater supply in the Tambo basin.

Groundwater entitlements and use for unincorporated areas are detailed in Appendix A.

## 18.8 Seasonal allocations and restrictions on water use, diversions and extractions

There were no restrictions on water use, diversion or extractions within the Tambo basin in 2010–11.

## 18.9 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 18-6).

### Table 18-6 Volume of recycled water

| Treatment plant | Volume produced (ML) | Volume recycled (ML) | % recycled (excl. within process) | End use type for recycled water (ML): Urban and industrial | Agriculture | Beneficial allocation[1] | Within process[2] | Volume discharged to the environment (ML) | Release to ocean/ other (ML)[3] |
|---|---|---|---|---|---|---|---|---|---|
| Lakes Entrance | 463 | 463 | 100% | 0 | 463 | 0 | 0 | 0 | 0 |
| Metung | 79 | 79 | 100% | 0 | 79 | 0 | 0 | 0 | 0 |
| **Total 2010–11** | **542** | **542** | **100%** | **0** | **542** | **0** | **0** | **0** | **0** |
| Total 2009–10 | 481 | 481 | 100% | 0 | 481 | 0 | 0 | 0 | 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.

## 18.10 Water for the environment

### 18.10.1 Environmental Water Reserve

The Gippsland Lakes are important environmental assets partially dependent on water from the 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, Russell's and Tambo River East swamps, which are nationally important wetlands.

In 2010–11, the Tambo basin EWR 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: that is, water above cap.

### 18.10.2 Passing flow compliance

There are no passing flow requirements in the Tambo basin.

### 18.10.3 Management plans

The Gippsland Region Sustainable Water Strategy states that existing rules will be documented as a local management plan for the Tambo River.

# 19 Mitchell basin

This chapter sets out the accounts for the Mitchell basin. For detailed information about how they were compiled, refer to Chapter 5.

## 19.1 Mitchell basin summary

Inflows in the Mitchell basin were 110% of the long-term average and were more than 150% of 2009–10 inflows. About 98% of these inflows were not diverted, and entered the Gippsland Lakes.

Surface-water users, including those supplied from the Bairnsdale water system, were unrestricted during the year. This is because consumptive use was low, compared to the total surface-water resource.

Licensed groundwater use in the basin reduced in 2010–11, compared to 2009–10.

## 19.2 Responsibilities for management of water resources

Table 19-1 shows the responsibilities of various authorities within the Mitchell basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 19-1 Responsibilities for water resources management within the Mitchell basin, 2010–11

| 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 | | |
| 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 |

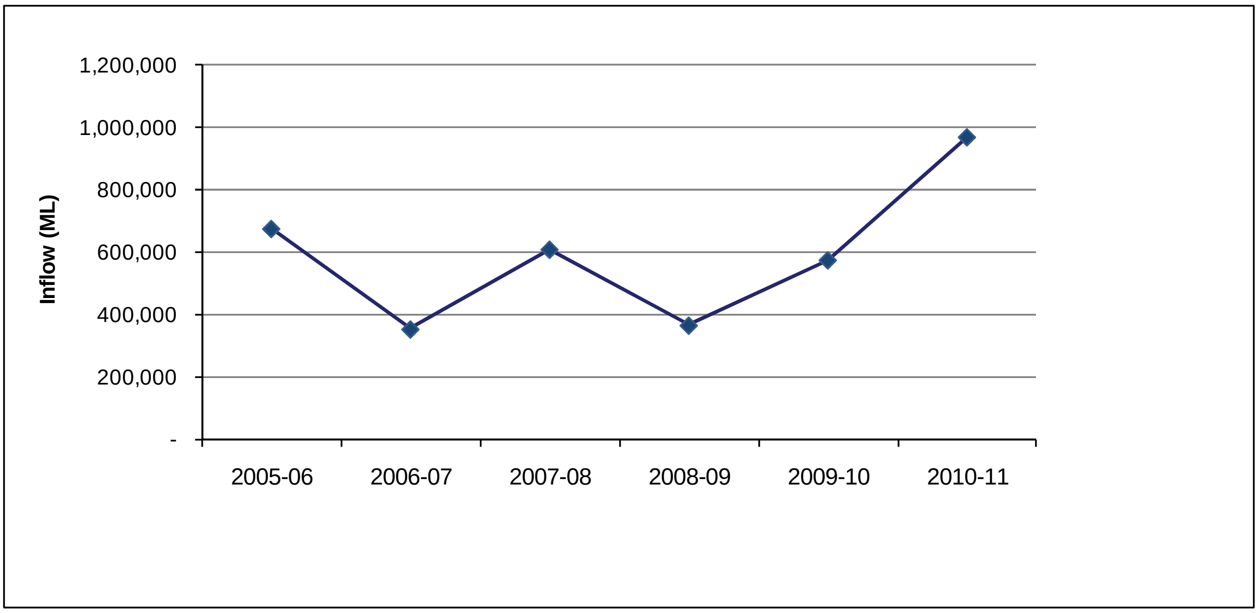
## 19.3 Rainfall, flows and storages in 2010–11

In 2010–11, rainfall in the Mitchell basin ranged between 80% and 125% of the long-term average. Inflows to the basin were 110% of the long-term average (of 884,500 ML), compared to 65% in 2009–10.

The amount of water flowing from the Mitchell basin into the Gippsland Lakes was 954,200 ML in 2010–11, a significant increase from 550,800 ML recorded in 2009–10. The 2010–11 outflows were 98% of the total inflows into the basin.

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

### Figure 19-1 Catchment inflows in the Mitchell basin



## 19.4 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 19-2. 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.

### Table 19-2 Summary of total water resources and water use in the Mitchell basin, 2010–11

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | 969,700 | 14,400 |
| Groundwater(2) | 11,200 | 2,800 |
| Recycled water | 1,430 | 1,410 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 19-7 and the estimated domestic and stock use as presented in Table 19-8.

(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

### 19.4.1 Infrastructure projects to improve water availability

There were no infrastructure projects to improve water availability within the Mitchell River basin in 2010–11.

## 19.5 Location of water resources

### Figure 19-2 Map of the Mitchell basin

## 19.6 Surface water resources

### 19.6.1 Water balance

A surface-water balance for the Mitchell basin is shown in Table 19-3. Diversions make up a relatively small proportion of total inflows, with approximately 1.5% of the total basin inflows diverted for consumptive use.

No storage information is recorded in the water balance as there are no on-stream storages with a capacity greater than 1,000 ML in the Mitchell basin.

#### Table 19-3 Balance of surface water in the Mitchell basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | - | - |
| Volume in storage at end of year | - | - |
| **Change in storage** | **-** | **-** |
| **Inflows** | | |
| Catchment inflow(1) | 969,700 | 575,100 |
| Rainfall on major storages | - | - |
| Transfers from other basins | - | - |
| Return flow from irrigation | - | - |
| Treated wastewater discharged back to river(2) | 40 | 90 |
| **Sub-total** | **969,700** | **575,200** |
| **Usage** | | |
| Urban diversions | 3,960 | 4,800 |
| Licensed diversions from unregulated streams | 5,900 | 13,700 |
| Small-catchment dams | 4,500 | 4,500 |
| **Sub-total** | **14,400** | **23,000** |
| **Losses** | | |
| Evaporation losses from major storages | - | - |
| Evaporation from small-catchment dams(3) | 1,100 | 1,100 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(4) | 0 | 300 |
| **Sub-total** | **1,100** | **1,400** |
| **Water passed at outlet of basin** | | |
| River outflows to the ocean | 954,200 | 550,800 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) For 2010–11, this represents only water returned from alpine resorts.

(3) Evaporation losses are calculated by subtracting estimated usage from water harvested.

(4) Losses are calculated from the Wonnangatta River between Waterford and Angusvale and part upstream of Waterford. This length of river covers approximately 50% of the basin.

### 19.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 19-4 have been estimated by DSE, as outlined in Chapter 5.

#### Table 19-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 4,200 | 2,100 | n/a |
| Registered commercial and irrigation | 2,900 | 2,400 | n/a |
| **Total** | **7,100** | **4,500** | **5,600** |

n/a: No information available

### 19.6.3 Water entitlement trades

Trade of surface water entitlements in the Mitchell basin was limited to transfers of bundled entitlement within the basin. In 2010–11, 10 ML of entitlements were transferred. There was no net movement of water into the Mitchell basin in this year.

Table 19-5summarises the movement of bundled entitlements in the Mitchell basin in 2010–11.

### Table 19-5 Surface water bundled entitlement volume transfers in the Mitchell basin 2010–11

| Trading zone | Permanent transfers (ML) | Temporary transfers (ML) |
|---|---|---|
| Mitchell unregulated | 5 | 5 |
| **Total 2010–11** | **5** | **5** |
| Total 2009–10 | 40 | 90 |

### 19.6.4 Volume diverted

The volume of water diverted under the bulk entitlement established for the Mitchell basin is shown in Table 19-6. Compliance with individual bulk entitlement volumes was deemed to have occurred if water diverted was not more than the maximum volume allowed to be diverted in 2010–11.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

### Table 19-6 Volume of water diverted under surface water entitlements in the Mitchell basin

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance? |
|---|---|---|---|---|---|
| *East Gippsland Water* | | | | | |
| Bairnsdale[1] | 1 | 9,208 | 0 | 3,955 | Yes |
| **Total annual volume of bulk entitlements 2010–11** | | **9,208** | **0** | **3,955** | |
| Total annual volume of bulk entitlements *2009–10* | | 5,902 | 0 | 4,802 | |
| *Licensed diversions from unregulated streams 2010–11* | | *16,910* | | *5,929* | |
| *Licensed diversions from unregulated streams 2009–10* | | *16,895* | | *13,674* | |

Note:

(1) The average annual volume of the Bairnsdale bulk entitlement increased by 3,306 ML in 2010–11. East Gippsland Water's Bruthen and Lakes Entrance bulk entitlements in the Tambo basin were revoked by the Minister for Water in September 2010 and the entitlement volumes were transferred to the Bairnsdale bulk entitlement. East Gippsland Water has been sourcing supply for Bruthen and Lakes Entrance from the Mitchell River for some years due to ongoing water quality and reliability issues.

## 19.7 Groundwater resources

A summary of the licensed entitlements and use from GMUs within the Mitchell basin, excluding domestic and stock use, is presented in Table 19-7.

The Mitchell basin contains the entire Wy Yung WSPA as well as part of the Sale WSPA and Stratford GMA. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A. Groundwater levels in the Wy Yung WSPA are stable, while levels in the Sale WSPA and Stratford GMA are declining.

Groundwater use in 2010–11 decreased compared to 2009–10.

### Table 19-7 Licensed groundwater volumes, Mitchell basin 2010–11

| WSPA/GMA[1] | GMA/ WSPA depth limits[2] (m) | Entitlement limit[3] (ML/year) | Licensed entitlement[4] (ML/year) | Metered use (ML) | Estimated use in unmetered bores (ML)[5] | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Stratford GMA (7%)[6] | Zone 1 >150<br>Zone 2 >350 | 2,026 | 2,026 | 0 | 1,825 | 1,825 | 2,069 |
| Sale WSPA (8%) | 25-200 | 1,669 | 1,661 | 564 | - | 564 | 888 |
| Wy Yung WSPA (100%) | ≤25 | 7,463 | 7,462 | 309 | - | 309 | 798 |
| **Total[7]** | | **11,158** | **11,148** | **873** | **1,825** | **2,698** | **3,754** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.
(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11.
(4) Includes domestic and stock usage in cases where this forms part of a licensed volume.
(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs. Any values reported here are estimates of other activities that used water in this WSPA/GMA.
(6) Non-metered use includes estimated extraction from Latrobe Valley mines.
(7) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 19-8.

### Table 19-8 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores(1)(2) | Estimated domestic and stock use (assuming 1.5 ML per bore(3)) (ML)(4) |
|---|---|---|
| Stratford GMA (7%) | 0 | 0 |
| Sale WSPA (8%) | 30 | 45 |
| Wy Yung WSPA (100%) | 32 | 48 |
| **Total** | **62** | **93** |

Notes:
(1) 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 19-7.
(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(3) Estimated domestic and stock use calculated using a factor of 1.5 ML per bore for Southern Rural Water GMUs. For other authorities, the factor is 2 ML.
(4) Total volumes are based on the sum of management unit data before rounding.

In the Mitchell basin, groundwater is used as an urban water supply from the Lindenow Borefield. The licensed entitlement and metered use for this groundwater supply is provided in Table 19-9.

### Table 19-9 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Lindenow Borefield | 120 | 0 | 0 |
| **Total** | **120** | **0** | **0** |

## 19.8 Seasonal allocations and restrictions on water use, diversions and extractions

There were no restrictions on water use, diversions or extractions within the Mitchell basin in 2010–11.

## 19.9 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 19-10). 100% was recycled at Lindenow and 93% was recycled at Paynesville.

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.

### Table 19-10 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 (ML)[3] |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation[1] | Within process[2] | | |
| Bairnsdale | 1,162 | 1,162 | 100% | 0 | 25 | 1,137 | 0 | 0 | 0 |
| Lindenow | 15 | 15 | 100% | 0 | 0 | 15 | 0 | 0 | 0 |
| Paynesville | 254 | 235 | 93% | 0 | 235 | 0 | 0 | 0 | 19 |
| **Total 2010–11** | **1,431** | **1,412** | **99%** | **0** | **260** | **1,152** | **0** | **0** | **19** |
| Total 2009–10 | 1,343 | 1,343 | 100% | 0 | 263 | 1,080 | 0 | 0 | 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 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.

## 19.10 Water for the environment

### 19.10.1 Environmental Water Reserve

The Gippsland Lakes are important environmental assets partially dependent on water from the 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 (Australian Grayling , Black Bream), water birds (Great Egret) and botanical values (Yellowwood).

In 2010–11 the Mitchell basin EWR 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: that is, water above cap.

### 19.10.2 Passing flow compliance

Some bulk entitlements require passing flows to be met at some points in the basin.

All passing flow requirements were complied with for the Mitchell basin in 2010–11.

Table 19-11 shows passing flow compliance in the Mitchell basin for a selected bulk entitlement compliance point. While there are other compliance points, the point below has been chosen because it is of community interest. The location of this compliance point is presented in Figure 19-2.

### Table 19-11 Selected passing flow compliance in the Mitchell basin

| River | Passing flow | |
|---|---|---|
| Mitchell River | Instrument where passing flows are specified | Bulk Entitlement (Bairnsdale) Conversion Order 2000 |
| | Responsible authority | East Gippsland Water |
| | Compliance point | Mitchell River, downstream of Glenaladale pump station (shown as 1 in Figure 19-2) |
| | Passing flow compliance | • Flows were passed according to the following rules:<br>• no diversion when flow was less than 30 ML per day<br>• 30 ML per day passed when flow was between 30 and 46 ML per day<br>• when flow was between 46 and 246 ML per day, the entire flow, less 16 ML per day, was passed<br>• when flow was between 246 and 265 ML per day the entire flow, less 16 ML per day, was passed<br>• when flow was greater than 265 ML per day the authority passed the entire flow, less 35 ML per day. |

### 19.10.3 Management plans

The Gippsland Region Sustainable Water Strategy states that a local management plan will be developed for the Mitchell River. The existing rules for the Mitchell River will be reviewed or improved.

# 20 Thomson basin

This chapter sets out the accounts for the Thomson basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

## 20.1 Thomson basin summary

The Thomson was one of the few basins in Victoria where 2010–11 inflows were lower than the long-term average. While 2010–11 inflows were only 88% of the long-term average, they were significantly greater than in 2009-10.

The volume of water in major storages in the Thomson basin increased by 253,900 ML in 2010–11. Most of the improvement was attributable to the level in Thomson Reservoir almost doubling over the year, with the storage recording a significant increase from 22% to 41% of capacity by the end of June 2011.

Towns in the Thomson basin were not subject to restrictions in 2010–10. The Melbourne supply system, which partially relies on Thomson Reservoir, eased from Stage 3 restrictions to Stage 2 in October 2010.

With the improvement in water availability, qualifications of rights were no longer required to secure Melbourne's water supplies. The removal of the qualifications restored environmental flows of up to 16,000 ML per year to the Thomson River.

Although irrigation allocations for the Macalister Irrigation District were higher this year (100% high-reliability water shares, 100% low-reliability water shares) than in 2009–10, water use was lower because of higher rainfall during the irrigation season. Groundwater use across the basin also decreased significantly in 2010–11, compared to 2009–10.

Licensed surface-water diverters on Valencia Creek and the Avon River were subject to restrictions for periods during the year.

## 20.2 Responsibilities for management of water resources

Table 20-1 shows the responsibilities of various authorities within the Thomson basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 20-1 Responsibilities for water resources management within the Thomson basin, 2010–11

| 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<br>Releases water to the Thomson River for environmental flows<br>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<br>Obliged to meet passing flow requirements |
| Gippsland Water | | | Supplies towns including Sale, Maffra, Heyfield, Stratford and Boisdale | |
| Minister for Environment | | | | Manages environmental entitlement in the regulated Thomson River |
| West Gippsland Catchment Management Authority | | | | Manages waterways and environmental flows |

## 20.3 Rainfall, flows and storages in 2010–11

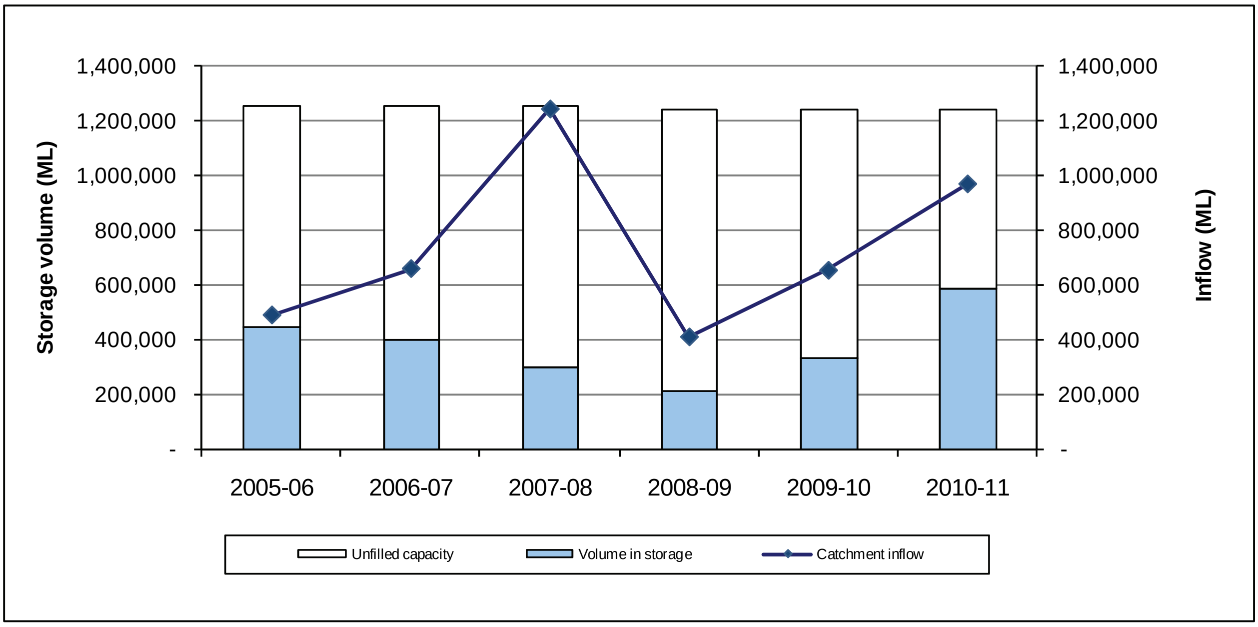
In 2010–11, rainfall in the Thomson basin ranged between 80% and 150% of the long-term average. Inflows to the Thomson basin amounted to 970,500 ML in 2010–11, which is 88% of the long-term average (1,101,760 ML). This is an increase from 2009–10 when inflows were 58% of the long-term average.

The amount of water flowing from the Thomson basin into the Gippsland Lakes in 2010–11 was 521,500 ML. This represents 53% of catchment inflows. Outflows in 2010–11 were higher than the 230,700 ML of outflows in 2009–10, and proportionally more was discharged to the lakes in 2010–11.

The volume of water held in major storages (greater than 1,000 ML capacity) increased from 332,200 ML at the start of July 2010 to 586,100 ML (47% of capacity) by the end of June 2011.

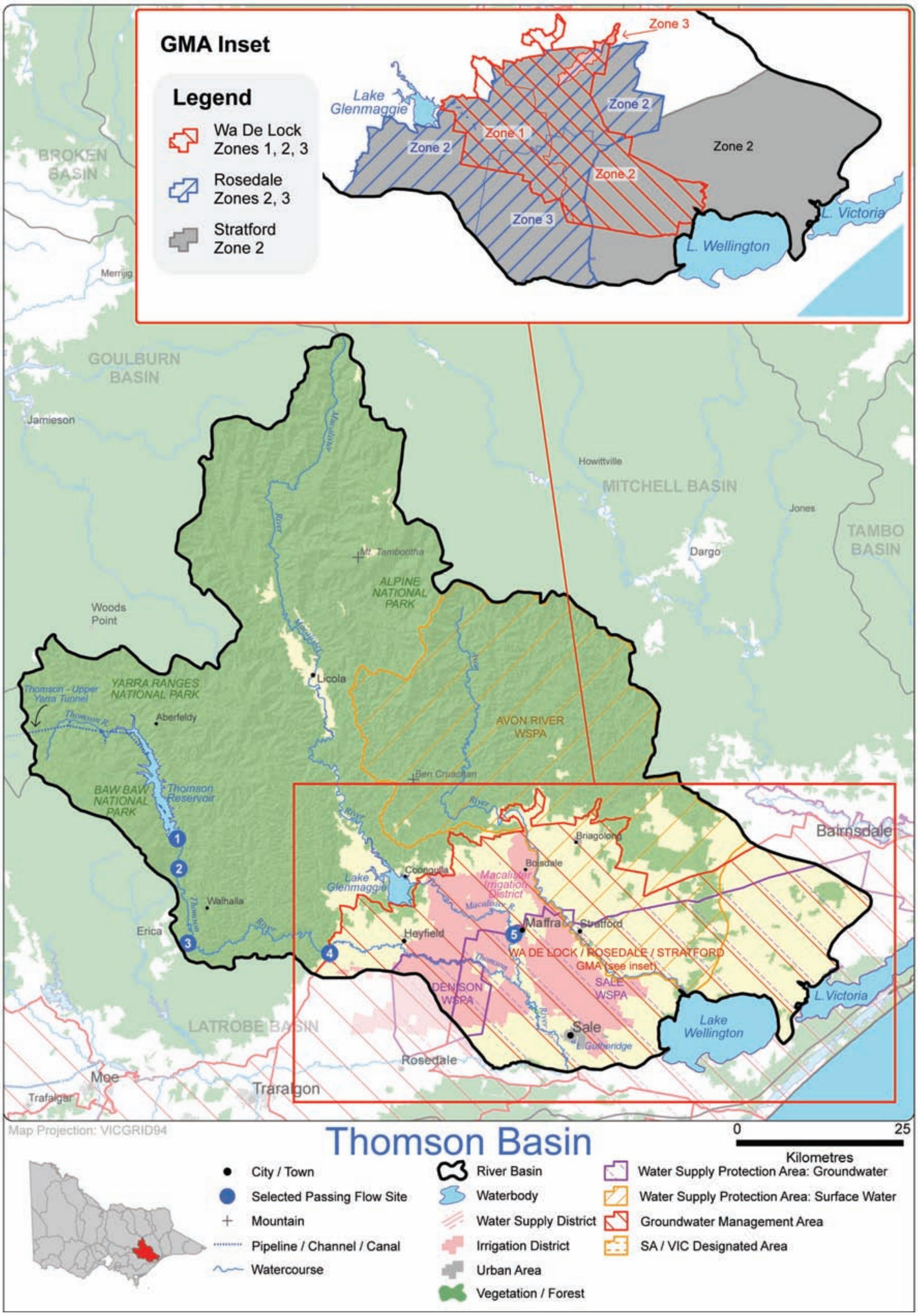
In the Thomson basin, on-stream storages greater than 1,000 ML capacity include Thomson Reservoir and Lake Glenmaggie. Lake Glenmaggie finished the year with a volume of 95,055 ML, which is 54% of its total capacity. Melbourne's biggest water storage, Thomson Reservoir, began the year at 22% of capacity and increased to 41% by the end of June 2011.

### Figure 20-1 Major storages and catchment inflows in the Thomson basin



## 20.4 Location of water resources

### Figure 20-2 Map of the Thomson basin



## 20.5 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 20-2.

An overview of the methodology used to derive the information presented in this chapter is set out in Chapter 5.

### Table 20-2 Summary of total water resources and water use in the Thomson basin, 2010–11

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | 1,010,900 | 177,600 |
| Groundwater(2) | 74,000 | 26,700 |
| Recycled water | 300 | 270 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 20-9 and the estimated domestic and stock use presented inTable 20-10.

(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

### 20.5.1 Infrastructure projects to improve water availability

Southern Rural Water continued works to improve operational efficiency through automation of the Nambrok Denison channels. This involved retrofitting flume gates to 50 regulators. In 2010–11, construction was completed and the system was tuned.

## 20.6 Surface water resources

### 20.6.1 Water balance

A surface-water balance for the Thomson basin is shown in Table 20-3. Irrigation water use in the Macalister Irrigation District comprised the majority of diversions within the basin.

A total volume of 159,500 ML was diverted for irrigation purposes in 2010–11, which is lower than the volume used in 2009–10. Melbourne Water's diversion from the Thomson Reservoir significantly decreased to 1,600 ML in 2010–11 compared to 62,400 ML in 2009–10.

### Table 20-3 Balance of surface water in the Thomson basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | 332,200 | 211,500 |
| Volume in storage at end of year | 586,100 | 332,200 |
| **Change in storage** | **253,900** | **120,700** |
| **Inflows** | | |
| Catchment inflow(1) | 970,500 | 652,800 (5) |
| Rainfall on major storages | 14,400 | 17,600(5) |
| Transfers from other basins | - | 0 |
| Return flow from irrigation | 26,000 | 26,600 |
| Treated wastewater discharged back to river | 30 | 40 |
| **Sub-total** | **1,010,900** | **697,000**(5) |
| **Usage** | | |
| Diversions to towns in Thomson River basin | 1,400 | 1,560 |
| Transfers to Yarra River basin for urban use | 1,600 | 62,400 |
| Irrigation district diversions | 159,500 | 216,800 |
| Licensed diversions from unregulated streams | 8,100 | 10,000 |
| Transfers to other basins(2) | - | 737 |
| Small-catchment dams(3) | 7,000 | 7,000 |
| **Sub-total** | **177,600** | **298,500** |
| **Losses** | | |
| Evaporation losses from major storages | 22,900 | 22,300(5) |
| Evaporation from small-catchment dams | 2,500 | 2,500 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(4) | 32,500 | 22,300 |
| **Sub-total** | **57,900** | **47,100** (5) |
| Water passed at outlet of basin | | |
| River outflows to the Latrobe River | 473,000 | 208,800 |
| River outflows direct to Lake Wellington | 48,500 | 21,900 |

Notes:
(1) Inflows have been back-calculated from outflows plus diversions.
(2) The 2009–10 transfer was from Thomson Reservoir to the Werribee basin for emergency supplies in Bacchus Marsh Irrigation District and Werribee Irrigation District.
(3) Data for water usage from small-catchment dams is estimated by DSE. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.
(4) Losses estimated based on loss functions within the Thomson–Macalister REALM.
(5) Some elements of the 2009–10 water balance have been revised since the publication of the Victorian Water Accounts 2009–2010. These changes result from updated storage ratings and climate data.

### 20.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 20-4 have been estimated by DSE, as outlined in Chapter 5.

#### Table 20-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 5,600 | 2,800 | n/a |
| Registered commercial and irrigation | 5,000 | 4,200 | n/a |
| **Total** | **10,600** | **7,000** | **9,500** |

n/a: No information available

### 20.6.3 Water entitlement trades

Surface water entitlements were traded into, out of and within the Thomson basin in 2010–11 through water share transfers and variations, allocation trade and temporary transfer of bundled entitlement volume. Water share and allocation transactions made up the bulk of this trade, with only 137 ML of Thomson basin bundled entitlement volume being temporarily transferred during the year.

Table 20-5 summarises the trade of water shares into and out of the Thomson basin delivery systems in 2010–11. There was a small net export of both high- and low-reliability water shares with 103 ML of high-reliability, and 49 ML of low-reliability water shares transferred out of the basin in 2010–11.

#### Table 20-5 Transfers and variations of water shares in the Thomson basin 2010–11 (1), (2)

| Delivery system | High-reliability water shares | | | Low-reliability water shares | | |
|---|---|---|---|---|---|---|
| | Source(3) (ML) | Destination(3) (ML) | Net into basin (ML) | Source(3) (ML) | Destination(3) (ML) | Net into basin (ML) |
| Macalister irrigation district | 14,799 | 15104.3 | 305 | 7,000 | 7,155 | 156 |
| Macalister River | 388 | 288 | -100 | 194 | 144 | -50 |
| Thomson River | 623 | 315 | -308 | 320 | 166 | -154 |
| **Total 2010–11** | **15,811** | **15,708** | **-103** | **7,513** | **7,465** | **-49** |
| Total 2009–10 | 16,220 | 16,559 | -340 | 7,869 | 7,919 | -50 |

Notes:
(1) This table summarises all recorded water share transfers and variations in the Thomson basin delivery systems in 2010–11. Trades that were in progress at the end of the year will be finalised in 2011–12.
(2) Transfer applications result in a change of ownership. In some cases, the ownership change occurs with a transfer of land. Transfers of ownership that are part of a water and land sale are also included in this table. Variations do not involve a change of ownership.
(3) The Source column is the use location of the water share before the trade or variation: the Destination column is the use location afterwards. Use locations are reported here as grouped nominated delivery systems. A positive number for Net into basin means that a greater volume of water shares have nominated that use location than have nominated a use location outside the group.

Table 20-6summarises the trade in water allocations into and out of the Thomson basin in 2010–11. All trade in water allocations occurred within the Thomson basin.

### Table 20-6 Allocation trade in the Thomson basin (1), (2)

| Allocation trade type | Volume traded 2010–11 (ML) | Volume traded 2009–10 (ML) |
|---|---|---|
| Trade within Thomson basin | 4,882 | 12,145 |
| Trade from other Victorian basins | 0 | 0 |
| Trade to other Victorian basins | 0 | 0 |
| Interstate trade - inbound | 0 | 0 |
| Interstate trade - outbound | 0 | 0 |
| **Total trade into the Thomson basin** | **4,882** | **12,145** |
| **Net trade into the Thomson basin** | **0** | **0** |

Notes:

(1) This table summarises allocation trades approved into, out of and within the Thomson basin trading zones ( Zone 41 Macalister and Zone 42B Mid-Thomson) compared to trade in other Victorian and interstate basins. Data on allocation trade between New South Wales and South Australian basins is not relevant to this report and therefore not included.

(2) In a pool exchange, some sellers (say 20) sell to some buyers (say 15) at the pool price. Administratively, this is implemented in the water register as 20 trades to a clearing account and then 15 trades from that clearing account. To avoid double counting, only the seller side is counted (that is, it counts as 20 trades).

Table 20-7 summarises the movement of bundled entitlements in the Thomson basin in 2010–11. All transfers occurred between users within the basin, and were mostly temporary in nature.

### Table 20-7 Surface water bundled entitlement volume transfers in the Thomson basin 2010–11

| Trading zone | Permanent transfers (ML) | Temporary transfers (ML) |
|---|---|---|
| Thomson unregulated | 0 | 137 |
| **Total 2010–11** | **0** | **137** |
| Total 2009–10 | 2 | 279 |

## 20.6.4 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 on the Thomson River. The volume of water diverted by these corporations is shown in Table 20-8.

The Thomson River bulk entitlement held by the Melbourne retailers is applied over a multi-year period, where the average usage over a defined rolling period of 15 years must be less than the average bulk entitlement volume.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

### Table 20-8 Volume of water diverted under surface water entitlements in the Thomson basin

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML)(1) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance? (2)(3) |
|---|---|---|---|---|---|
| *Gippsland Water* | | | | | |
| Thomson Macalister towns – Gippsland Water | 1 | 2,335 | 0 | 1,402 | Yes |
| *Melbourne metropolitan retailers* | | | | | |
| Thomson River | 15 | 171,800 | 0 | 1,600 | Yes |
| *Southern Rural Water* | | | | | |
| Thomson/Macalister | 1 | 273,432 | 0 | 159,530 | Yes |
| *Minister for Environment* | | | | | |
| Thomson River – Environment | 1 | 10,000 | 0 | 12,839(4) | Yes |
| Macalister River – Environment | 1 | 10,666 | 0 | 10,666(4) | Yes |
| **Total annual volume of bulk entitlements 2010–11** | | **468,233** | | **186,037** | |
| Total annual volume of bulk entitlements 2009–10 | | 458,935 | 0 | 284,720 | |
| *Licensed diversions from unregulated streams 2010–11* | | *17,190* | | *8,083* | |
| *Licensed diversions from unregulated streams 2009–10* | | *17,201* | | *9,997* | |

Notes:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one-year) period in the bulk entitlement, divided by the number of years in that period.

(2) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

(3) The compliance for the water taken 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 2010–11 was 427,800 ML.

(4) This entitlement complies, due to the carrying-over of 5,634 ML. Further details of the volume of water available are in Chapter 4.

## 20.7 Groundwater resources

A summary of the licensed entitlements and use from GMAs within the Thomson basin, excluding domestic and stock use, is presented in Table 20-9. 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.

The majority of Stratford and Rosedale GMA water use is for mine dewatering. While the groundwater levels in the Denison WSPA and Wa De Lock GMA are stable, levels in the Sale WSPA are declining. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

Groundwater use in the Thomson basin decreased by around 34% in 2010–11, compared to 2009–10.

### Table 20-9 Licensed groundwater volumes, Thomson basin 2010–11

| WSPA/GMA(1) | GMA/WSPA depth limits(2) (m) | Entitlement limit(3) (ML/year) | Licensed entitlement(4) (ML/year) | Metered use (ML) | Estimated use in unmetered bores (ML)(5) | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Rosedale GMA (35%)(6) | Zone 1 50-150, Zone 2 25-350, Zone 3 200-300 | 7,921 | 7,904 | 1,106 | 1,571 | 2,678 | 3,934 |
| Stratford GMA (44%)(6) | Zone 1 >150, Zone 2 >350 | 12,249 | 12,249 | 2 | 11,032 | 11,034 | 12,431 |
| Wa De Lock GMA (100%)(7) | ≤25 | 30,172 | 28,602 | 3,744 | 1,088 | 4,832 | 10,386 |
| Denison WSPA (51%)(7) | ≤25 | 9,094 | 9,093 | 1,543 | 351 | 1,894 | 4,230 |
| Sale WSPA (69%) | 25-200 | 14,737 | 14,661 | 4,977 | - | 4,977 | 7,756 |
| **Total(8)** | | **74,172** | **72,509** | **11,372** | **14,042** | **25,414** | **38,736** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11.

(4) Includes domestic and stock usage in cases where this forms part of a licensed volume.

(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs. Any values reported here are estimates of other activities that used water in this WSPA/GMA.

(6) Non-metered use includes estimated extraction from Latrobe Valley mines.

(7) Non-metered use includes a salinity control extraction.

(8) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 20-10.

### Table 20-10 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores(1)(2) | Estimated domestic and stock use (assuming 1.5 ML per bore(3)) (ML)(4) |
|---|---|---|
| Rosedale GMA (35%) | 63 | 95 |
| Stratford GMA (44%) | 1 | 2 |
| Wa De Lock GMA (100%) | 408 | 612 |
| Denison WSPA (51%) | 115 | 173 |
| Sale WSPA (69%) | 266 | 399 |
| **Total** | **853** | **1,281** |

Notes:

(1) 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 20-9.

(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Estimated domestic and stock use calculated using a factor of 1.5 ML per bore for Southern Rural Water GMUs. For other authorities, the factor is 2 ML.

(4) Total volumes are based on the sum of management unit data before rounding.

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 20-11.

### Table 20-11 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Boisdale | 37 | 0 | 0 |
| Briagolong | 160 | 76 | 81 |
| Sale | 3,500 | 1,859 | 1,920 |
| **Total** | **3,697** | **1,935** | **2,001** |

## 20.8 Qualification of rights

Two qualifications of rights continued into 2010–11 to secure Melbourne's water supplies if dry conditions continued. The qualifications allowed up to 14,000 ML per year of environmental water to be retained in Thomson Reservoir. Further details are provided in Table 20-12 below.

In July 2010, the Minister for Water restored environmental flows of up to 12,000 ML per year to the Thomson River that were being retained in Thomson Reservoir under the September 2009 qualification. The environmental flows were not due to be returned until Melbourne's water restrictions eased to Stage 2, but water projects, conservation and better rainfall allowed the flows to be restored earlier. The September 2009 qualification formally expired in September 2010, when Melbourne's water restrictions were reduced from Stage 3 to Stage 2 following additional improvement in storage levels.

The Minister revoked the remaining qualification of rights in the Thomson basin in October 2010. The revocation of the March 2007 qualification restored the remaining 4,000 ML per year of environmental flows to the Thomson River.

The environmental risks were monitored and managed by West Gippsland Catchment Management Authority under an emergency management plan funded by the three Melbourne retail water businesses. According to WGCMA's impact assessment of the Thomson qualification, no additional environmental impacts were found to have occurred in the Thomson River as a result of the qualifications.

According to the Melbourne retail water business' annual report on the effectiveness of the Melbourne qualifications, about 2,100 ML of water was retained in Thomson Reservoir during the period the qualifications were in effect in 2010–11. Over the four years that environmental flows were qualified in the Thomson and Yarra basins, an additional 148,100 ML of water was harvested. This secured an additional 149 days of supply and avoided the need to introduce Stage 4 restrictions.

### Table 20-12 Qualifications of rights

| Legal instruments | Dates | Qualification type | Qualification description | Triggers for resuming normal sharing rules | Date trigger reached |
|---|---|---|---|---|---|
| Temporary Qualification of Rights in the Melbourne Water Supply System - March 2007 | 1 July 2009 to 30 June 2010 (continuing from 29 March 2007) | Differential access by priority entitlements | Provided up to 4,000 ML/year more water for Melbourne by removing the environmental flow operating tolerances under the Thomson Environment bulk entitlement. | When Melbourne is no longer subject to Stage 2 restrictions or a stage of restrictions more severe than Stage 2. | Revoked 12 October 2010 |
| Temporary Qualification of Rights in the Melbourne Water Supply System - Thomson River September 2009 | 11 September 2009 to 30 June 2010 | Differential access by priority entitlements<br>Reduced passing flow requirements | Allowed Melbourne to use 8,000 of the environment's 10,000 ML of inflows to Thomson Reservoir. The remaining 2,000 ML was available for use by the environment, if needed.<br>Reduced environmental flows in Thomson River to save up to 10,000 ML/year in Thomson Reservoir for Melbourne.<br>Returned the 2,000 ML/year of water set aside in Thomson Reservoir under an earlier qualification to the environment's account in Thomson Reservoir. | When Melbourne is no longer subject to restrictions greater than Stage 2. | Expired 1 September 2010 when Melbourne moved from Stage 3 to Stage 2 restrictions |

## 20.9 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to licensed diversions from unregulated streams and groundwater extractions are presented in Table 20-13. Allocations in the Macalister Irrigation District reached 100% for both high- and low-reliability water shares in 2010–11.

Licenced diversions from the Avon River and Valencia Creek were less heavily restricted than in 2010–11.

### Table 20-13 Seasonal allocations and restrictions on water use in Thomson basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Licensed diversions on unregulated streams | Valencia Creek | Stage 1 restrictions in July, October and December 2010 and in January 2011 |
| | Avon River (Section 1) | Section 1: Stage 4 restrictions in July 2010<br>Section 2: Stage 3 restrictions in July 2010 |
| Irrigation | Macalister Irrigation District | Allocation for high-reliability water shares opened at 55% on 1 July 2010 and reached 100% on 8 February 2010. Allocation for low-reliability water shares reached 100% on 22 February 2011. |

## 20.10 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 2010–11 was slightly less than that produced in 2009–10. A total of 90% of wastewater was recycled in the basin in 2010–11 (Table 20-14).

### Table 20-14 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 (ML)[3] |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation[1] | Within process[2] | | |
| Heyfield | 54 | 54 | 100% | 0 | 54 | 0 | 0 | 0 | 0 |
| Maffra | 160 | 160 | 100% | 0 | 160 | 0 | 0 | 0 | 0 |
| Rawson | 30 | 0 | 0% | 0 | 0 | 0 | 0 | 30 | 0 |
| Stratford | 57 | 57 | 100% | 0 | 57 | 0 | 0 | 0 | 0 |
| **Total 2010–11** | **301** | **271** | **90%** | **0** | **271** | **0** | **0** | **30** | **0** |
| Total 2009–10 | 314 | 277 | 88% | 4 | 273 | 0 | 0 | 38 | -1 |

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.

## 20.11 Water for the environment

### 20.11.1 Environmental Water Reserve

The Gippsland Lakes are important environmental assets partially dependent on water from the 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 the Australian Grayling populations also rely on the Thomson EWR.

In 2010–11 the Thomson basin EWR 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.

### 20.11.2 Entitlements for the environment

The Bulk Entitlement (Thomson River) Order was granted to the Minister for Environment in 2005. The entitlement consists of passing flows and a 10,000 ML share of storage capacity in Thomson Reservoir.

The Macalister River Environmental Entitlement was granted to the Minister for Environment in 2010. The entitlement consists of 7,111 ML of high-reliability and 3,555 ML of low-reliability entitlement.

Environmental releases were made in both the Thomson and Macalister systems in 2010–11, to provide spawning opportunities for native fish. In autumn 2011, a total of 12,840 ML of environmental water was released into the Thomson River and 10,666 ML into the Macalister River.

### 20.11.3 Passing flow compliance

Some bulk entitlements require passing flows to be met at some points in the basin. All passing flow requirements were complied with for the Thomson basin in 2010–11. Table 20-15 shows passing flow compliance in the Thomson basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest. The location of these compliance points is presented in Figure 20-2.

## Table 20-15 Selected passing flow compliance in the Thomson basin

| River | Passing flow | |
|---|---|---|
| Thomson River | Instrument where passing flows are specified | Bulk Entitlement (Thomson River – Environment) Order 2005 |
| | Responsible authority | Minister for Environment(1) |
| | Compliance point | Thomson Reservoir (shown as 1 in Figure 20-2) |
| | Passing flow compliance | • Flows were passed according to the following rules:<br>• from November to February, 75 ML per day<br>• from March to October, 25 ML per day |
| | Compliance point | The Narrows Gauging Station (shown as 2 in Figure 20-2) |
| | Passing flow compliance | From November to February 120 ML per day were passed, while 80 ML per day were passed from March to October |
| | Compliance point | Coopers Creek Gauging Station (shown as 3 in Figure 20-2) |
| | Passing flow compliance | The following rules applied:<br>• in July, 216 ML per day<br>• in August, 238 ML per day<br>• in September, 245 ML per day<br>• in October, 225 ML per day<br>• in November, 205 ML per day<br>• from December to January, 200 ML per day<br>• in February, 180 ML per day<br>• from March to April, 155 ML per day<br>• from May to June, 150 ML per day |
| | Instrument where passing flows are specified | Bulk Entitlement (Thomson Macalister – Southern Rural Water) Conversion Order 2001 |
| | Responsible authority | Southern Rural Water |
| | Compliance point | Thomson River between Cowwarr Weir and Wandocka (shown as 4 in Figure 20-2) |
| | Passing flow compliance | • Lesser of 125 ML per day or natural flow was passed<br>• Where natural flow was less than 50 ML per day, 50 ML per day was passed |
| Macalister River | Instrument where passing flows are specified | Bulk Entitlement (Thomson Macalister – Southern Rural Water) Conversion Order 2001 |
| | Responsible authority | Southern Rural Water |
| | Compliance point | Macalister River below Maffra Weir (shown as 5 in Figure 20-2) |
| | Passing flow compliance | • 60 ML per day was passed, but this was reduced to 30 ML per day when the following conditions occurred:<br>• between June and October, if inflow to Lake Glenmaggie was less than the 80th percentile<br>• in November, if storage volume was less than 133,000 ML<br>• once dropped to 30 ML per day, passing flows had to stay as this until the end of May<br>• passing flows could be increased back up to 60 ML per day:<br>• if between June to October, inflow for the previous month is greater than the 80th percentile<br>• if between August to January, storage volume is greater than 185,000 ML<br>• if inflow to Lake Glenmaggie is less than the calculated passing flows, then passing flow may be reduced to this value |

Note:

(1) While the Minister for Environment holds the environmental bulk entitlement, Melbourne Water manages releases of the passing flows immediately downstream of the Thomson Reservoir and reports on compliance with requirements.

### 20.11.4 Streamflow management plans

The Gippsland Region Sustainable Water Strategy states that a local management plan is required for the Avon River. Existing rules will continue to apply in this area until they are reviewed / revised and incorporated in a new local management plan. It is expected that this will occur by 2014. As a stream flow management plan will not be developed for the Avon River, the Gippsland Region Sustainable Water Strategy states that the Avon WSPA will be undeclared.

# 21 Latrobe basin

This chapter sets out the accounts for the Latrobe basin. For detailed information about how they were compiled, refer to Chapter 5.

## 21.1 Latrobe basin summary

In 2010–11, rainfall in the Latrobe basin ranged between 100% and 150% of the long-term average. Catchment inflows were 1,099,600 ML, more than double the inflows in 2009–10, and 30% greater than the long-term average.

The volume of water in major storages increased over the year. By the end of June, Latrobe basin storages were in a very healthy position for 2011–12, at around 97% of capacity.

Irrigation allocations for the Macalister irrigation District reached 100% for both high-reliability and low-reliability water shares.

Surface-water use across the basin was similar to 2009–10. The total volume of water taken by licensed diverters and licensed groundwater users reduced, compared to 2009–10.

## 21.2 Responsibilities for management of water resources

Table 21-1 shows the responsibilities of various authorities within the Latrobe basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 21-1 Responsibilities for water resources management within the Latrobe basin, 2010–11

| 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<br>Obliged to meet passing flow requirements |
| Gippsland Water | | | Supplies towns including Moe, Morwell and Traralgon<br>Provides industrial supply to Hazelwood and Energy Brix power stations(1), and other major industries | Operates Moondarra Reservoir<br>Obliged to meet passing flow requirements |
| West Gippsland Catchment Management Authority | | | | Manages waterways in the whole of the Latrobe basin |

Note:

(1) Three power stations (Loy Yang A, Loy Yang B and Yallourn) are responsible for their own water supply from the Latrobe system (Blue Rock Lake and Lake Narracan).

## 21.3 Rainfall, flows and storages in 2010–11

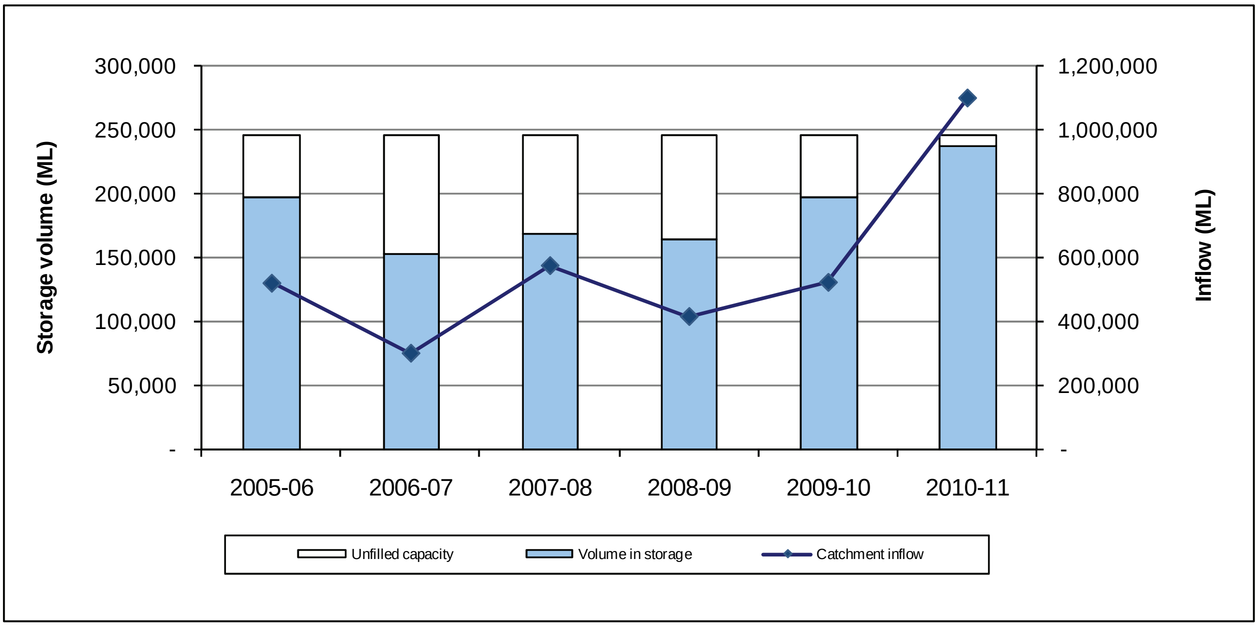
In 2010–11, rainfall in the Latrobe basin ranged between 100% and 150% of the long-term average. Inflows were 130% of the long-term average (of 847,400 ML), which is significantly higher than 61% in 2009–10.

The amount of water flowing from the Latrobe basin into the Gippsland Lakes (excluding the Thomson River) increased to 956,400 ML in 2010–11, from 369,900 ML in 2009–10.

Storage levels for all major storages (greater than 1,000 ML capacity) in the basin increased from 198,100 ML in July 2010 to 237,400 ML (97% of capacity) in June 2011.

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 207,085 ML (99% of capacity).

### Figure 21-1 All major storages and catchment inflows in the Latrobe basin




## 21.4 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 21-2.

### Table 21-2 Summary of total water resources and water use in the Latrobe basin, 2010–11

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | 1,161,700 | 149,800 |
| Groundwater(2) | 42,400 | 18,800 |
| Recycled water | 25,840 | 800 |

Notes:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 21-7 and the estimated domestic and stock use as presented in Table 21-8.

(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

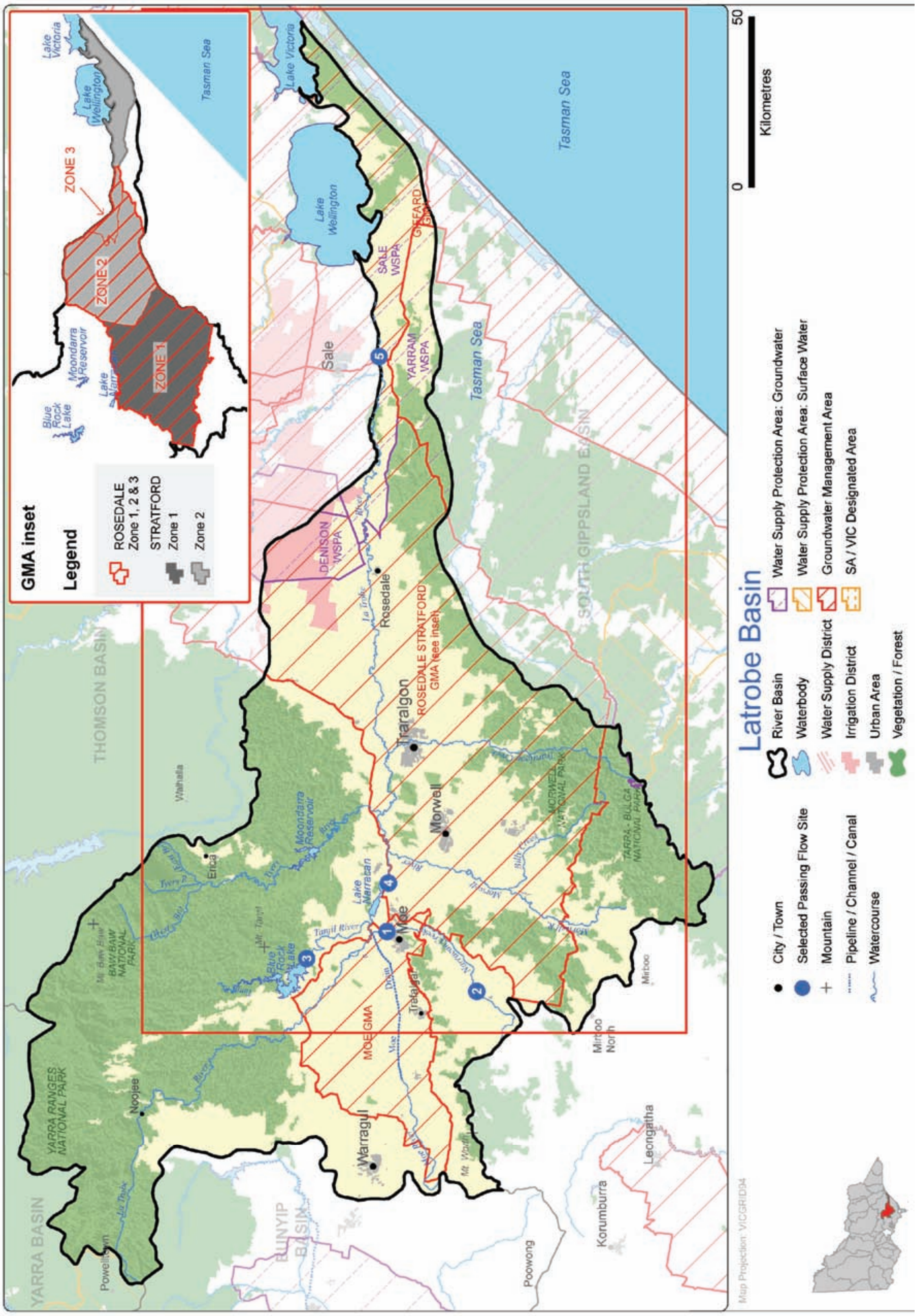
### 21.4.1 Infrastructure projects to improve water availability

Gippsland Water continued work on the Moondarra–Boolarra interconnection pipeline in 2010–11. This project will improve water security for Boolara through the construction of a 9-km pipeline connection to Yinnar. The project commenced in November 2010, with most of the pipeline constructed by the end of 2010–11. Ongoing wet conditions have delayed completion of the project.

Gippsland Water continued work on the Moe–Darnum Pipeline Project in 2010–11. The 7-km pipeline will reduce demand on the Tarago system through provision of water from the Moe system. This project commenced in March 2011, with most of the pipeline constructed by the end of 2010–11. Ongoing wet conditions have also delayed completion of this project.

## 21.5 Location of water resources

### Figure 21-2 Map of the Latrobe basin



# 21.6 Surface water resources

## 21.6.1 Water balance

A surface-water balance for the Latrobe basin is shown in Table 21-3.

The major industrial water users in the basin include some electricity generators and Australian Paper. In 2010–11, these entities accounted for more than half of the surface water diversions in the Latrobe basin. They also returned approximately 52,300 ML to the Latrobe River system.

### Table 21-3 Balance of surface water in the Latrobe basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | 198,100 | 164,400 |
| Volume in storage at end of year | 237,400 | 198,100 |
| **Change in storage** | **39,300** | **33,700** |
| **Inflows** | | |
| Catchment inflow(1) | 1,099,600 | 522,900 (3) |
| Rainfall on major storages | 5,200 | 11,400(3) |
| Transfers from other basins | - | 0 |
| Return flow from power stations and major industry | 52,300 | 42,400 |
| Return flow from irrigation | - | 0 |
| Treated wastewater discharged back to river | 4,630 | 3,260 |
| **Sub-total** | **1,161,700** | **580,000**(3) |
| **Usage** | | |
| Urban and industrial diversions | 121,710 | 122,070 |
| Licensed diversions from regulated streams | 3,390 | 6,670 |
| Licensed diversions from unregulated streams | 4,200 | 7,900 |
| Small-catchment dams | 20,500 | 20,500 |
| **Sub-total** | **149,800** | **157,100** |
| **Losses** | | |
| Evaporation losses from major storages | 10,500 | 13,600 |
| Evaporation from small-catchment dams(2) | 5,700 | 5,700 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation | n/a | 0 |
| **Sub-total** | **16,200** | **19,300** |
| **Water passed at outlet of basin** | | |
| River outflows to the Gippsland Lakes (excluding Thomson River) | 956,400 | 369,900 |
| River outflows to the Gippsland Lakes (including Thomson River) | 1,429,400 | 578,700 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions. Excludes Thomson River outflows.

(2) Evaporation losses are calculated by subtracting estimated usage from water harvested.

(3) Some elements of the 2009–10 water balance have been revised since the publication of the *Victorian Water Accounts 2009–2010.* These changes result from updated storage ratings and climate data.

n/a: No information available

## 21.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 21-4 below have been estimated by DSE, as outlined in Chapter 5.

### Table 21-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 13,000 | 6,500 | n/a |
| Registered commercial and irrigation | 16,700 | 14,000 | n/a |
| **Total** | **29,700** | **20,500** | **26,200** |

n/a: No information available

## 21.6.3 Water entitlement trades

The trade of surface water entitlement volume in the Latrobe basin was limited to transfers of bundled entitlement within the basin. In 2010–11, 344 ML of bundled entitlement volume in the Latrobe basin was transferred on a permanent basis and 606 ML on a temporary basis.

Table 21-5 summarises the trade of bundled entitlements in the Latrobe basin in 2010–11.

### Table 21-5 Surface water bundled entitlement volume transfers in the Latrobe basin 2010–11

| Trading zone | Permanent transfers (ML) | Temporary transfers (ML) |
|---|---|---|
| Latrobe unregulated | 344 | 606 |
| **Total 2010–11** | **344** | **606** |
| Total 2009–10 | 70 | 1,440 |

## 21.6.4 Volume diverted

The volume of water diverted under each bulk entitlement is shown in Table 21-6. Compliance with individual bulk entitlement volumes was deemed to have occurred if water diverted was not more than the maximum volume allowed to be diverted in 2010–11.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

### Table 21-6 Volume of water diverted under surface water entitlements in the Latrobe basin

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML)(1) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance?(2) |
|---|---|---|---|---|---|
| *Gippsland Water* | | | | | |
| Boolarra | 1 | 145 | 11 | 95 | Yes |
| CGRWA – Blue Rock | 3 | 15,150 | 0 | 855 | Yes |
| Erica | 1 | 340 | 0 | 87 | Yes |
| Mirboo North | 1 | 270 | 0 | 190 | Yes |
| Moe – Narracan Creek | 1 | 3,884 | 0 | 2,568 | Yes |
| Moondarra Reservoir | 2 | 62,000 | 0 | 48,358 | Yes |
| Noojee(3) | 1 | 73 | 0 | 0 | Yes |
| Thorpdale | 1 | 80 | 5 | 17 | Yes |
| *Southern Rural Water* | | | | | |
| Yallourn Energy Ltd for Gippsland and Southern Rural Water (4) | 1 | 20,000 | 0 | 15,224 | Yes |
| Latrobe licensed diverters | 2 | 13,400 | | 3,389 | Yes |
| *Great Energy Alliance Corporation Pty Ltd* | | | | | |
| Yallourn Energy Ltd for Loy Yang Power Ltd | 1 | 40,000 | 0 | 21,655 | |
| *TRUenergy* | | | | | |
| Yallourn Energy Ltd | 1 | 36,500 | 0 | 32,664 | Yes |
| *Minister for Environment (on behalf of the Treasurer)* | | | | | |
| Yallourn Energy Ltd for SECV | 1 | 25,000 | 0 | 0 | Yes |
| **Total annual volume of bulk entitlements 2010–11** | | **216,842** | **16** | **125,102** | |
| Total annual volume of bulk entitlements *2009–10* | | 216,842 | 19 | 128,741 | |
| *Licensed diversions from unregulated streams 2010–11* | | *23,915* | | *4,222* | |
| *Licensed diversions from unregulated streams 2009–10* | | *18,562* | | *7,901* | |

Notes:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one-year) period in the bulk entitlement, divided by the number of years in that period.

(2) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

(3) Gippsland Water is not taking water from the Loch River under its Noojee bulk entitlement and instead supplies Noojee from Tarago Reservoir.

(4) Water for Loy Yang B power station.

## 21.7 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. A summary of the licensed entitlements and use from GMUs within the Latrobe basin, excluding domestic and stock use, is presented in Table 21-7. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A. While groundwater levels in the Denison WSPA are stable, levels in the other WSPA and GMAs are declining, with off-shore oil and gas extractions impacting on the Yarram

WSPA water levels. Licensed water used from the Stratford and Rosedale GMAs are generally related to mine dewatering.

The reported groundwater use in the Latrobe basin in 2010–11 was significantly less than that reported in 2009–10.

## Table 21-7 Licensed groundwater volumes, Latrobe basin 2010–11

| WSPA/GMA(1) | GMA/WSPA depth limits(2) (m) | Entitlement limit(3) (ML/year) | Licensed entitlement(4) (ML/year) | Metered use (ML) | Estimated use in unmetered bores (ML)(5) | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Moe GMA (100%) | >25 | 8,200 | 3,937 | 191 | - | 191 | 1,095 |
| Rosedale GMA (58%)(6) | Zone 1 50-150<br>Zone 2 25-350<br>Zone 3 200-300 | 13,040 | 13,013 | 1,821 | 2,587 | 4,408 | 6,416 |
| Stratford GMA (41%)(6) | Zone 1 >150<br>Zone 2 >350 | 11,321 | 11,321 | 2 | 10,197 | 10,198 | 11,377 |
| Denison WSPA (49%)(7) | ≤25 | 8,649 | 8,648 | 1,467 | 334 | 1,801 | 3,757 |
| Sale WSPA (17%) | 25-200 | 3,611 | 3,593 | 1,220 | - | 1,220 | 1,838 |
| Yarram WSPA (5%) | Zone 1 >200<br>Zone 2 All depths | 1,285 | 1,285 | 349 | - | 349 | 633 |
| **Total(8)** | | **46,106** | **41,796** | **5,050** | **13,117** | **18,167** | **25,116** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11.

(4) Includes domestic and stock usage in cases where this forms part of a licensed volume.

(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs. Any values reported here are estimates of other activities that used water in this WSPA/GMA.

(6) Non-metered use includes estimated extraction from Latrobe Valley mines.

(7) Non-metered use includes a salinity control extraction.

(8) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 21-8.

## Table 21-8 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores(1)(2) | Estimated domestic and stock use (assuming 1.5 ML per bore(3)) (ML)(4) |
|---|---|---|
| Moe GMA (100%) | 134 | 201 |
| Rosedale GMA (58%) | 104 | 156 |
| Stratford GMA (41%) | 1 | 2 |
| Denison WSPA (49%) | 110 | 165 |
| Sale WSPA (17%) | 65 | 98 |
| Yarram WSPA (5%) | 16 | 25 |
| **Total** | **430** | **646** |

Notes:

(1) 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 21-7.

(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Estimated domestic and stock use calculated using a factor of 1.5 ML per bore for Southern Rural Water GMUs. For other authorities, the factor is 2 ML.

(4) Total volumes are based on the sum of management unit data before rounding.

In the Latrobe basin, groundwater is available as an urban water supply for the township of Trafalgar. The licensed entitlement for this groundwater supply is provided in Table 21-9: however, this entitlement is not currently metered or used.

### Table 21-9 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Trafalgar | 100 | 0 | 0 |
| **Total** | **100** | **0** | **0** |

## 21.8 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations for the Macalister Irrigation District are presented in Table 21-10. Allocations reached 100% for both high-reliability and low-reliability water shares in 2010–11.

Licenced groundwater use and licenced diversions from unregulated streams were unrestricted in 2010–11.

### Table 21-10 Seasonal allocations and restrictions on water use in Latrobe basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Irrigation | Macalister Irrigation District | Allocation for high-reliability water shares opened at 55% on 1 July 2010 and reached 100% on 8 February 2010. Allocation for low-reliability water shares reached 100% on 22 February 2011. |

## 21.9 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 2010–11 was similar to that for 2009–10, and represents around 3% of the wastewater produced.

### Table 21-11 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 (ML)(3) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation(1) | Within process(2) | | |
| Mirboo North | 106 | 80 | 76% | 31 | 49 | 0 | 0 | 26 | 0 |
| Moe | 2,723 | 0 | 0% | 0 | 0 | 0 | 0 | 2,723 | 0 |
| Morwell | 713 | 713 | 100% | 0 | 0 | 713 | 0 | 0 | 0 |
| Dutson Downs (regional outfall sewer) | 10,850 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 10,850 |
| Saline wastewater outfall pipeline | 9,561 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 9,561 |
| Warragul | 1,874 | 0 | 0% | 0 | 0 | 0 | 0 | 1,874 | 0 |
| Willow Grove | 13 | 4 | 28% | 0 | 4 | 0 | 0 | 10 | 0 |
| **Total 2010–11** | **25,841** | **797** | **3%** | **31** | **53** | **713** | **0** | **4,632** | **20,411** |
| Total 2009–10 | 21,711 | 717 | 3% | 8 | 32 | 677 | 0 | 3,262 | 17,732 |

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.

## 21.10 Water for the environment

### 21.10.1 Environmental Water Reserve

The Gippsland Lakes, and the Australian Grayling population, are important environmental assets partially dependent on water from the 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* (EPBC Act) and the FFG Act.

In 2010–11 the Latrobe basin EWR 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: that is, water above cap.

### 21.10.2 Environmental entitlements

The Latrobe River Environmental Entitlement was created in 2010 and is held by the Minister for Environment. The entitlement allows for access to water from the Latrobe River under specified conditions for the lower Latrobe wetlands, including Sale Common, Hearts Morass and Dowd Morass.

No diversions were made under the entitlement in 2010–11.

### 21.10.3 Passing flow compliance

Some bulk entitlements require passing flows to be met at some points in the basin.

All passing flow requirements were complied with for the Latrobe basin in 2010–11.

Table 21-12 shows passing flow compliance in the Latrobe basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest. The location of these compliance points is presented in Figure 21-2.

### Table 21-12 Selected passing flow compliance in the Latrobe basin

| River | Passing flow | |
|---|---|---|
| Narracan Creek | Instrument where passing flows are specified | Bulk Entitlement (Moe – Narracan Creek) Conversion Order 1998 |
| | Responsible authority | Gippsland Water |
| | Compliance point | Narracan Creek, Moe diversion weir (shown as 1 in Figure 21-2) |
| | Passing flow compliance | • The lesser of 11 ML per day or natural flow was passed<br>• The authority passed 11 ML per day when flow was between 11 and 27 ML per day<br>• The authority passed the entire flow, minus 16 ML per day, when flow was greater than 27 ML per day |
| Easterbrook Creek | Instrument where passing flows are specified | Bulk Entitlement (Thorpdale) Conversion Order 1997 |
| | Responsible authority | Gippsland Water |
| | Compliance point | Thorpdale pumping station (shown as 2 in Figure 21-2) |
| | Passing flow compliance | • The lesser of 1 ML per day or natural flow was passed<br>• The authority passed 1 ML per day when flow was between 1 and 2.73 ML per day<br>• The authority passed the entire flow, minus 1.73 ML per day, when flow was greater than 2.73 ML per day |
| Latrobe River and Tanjil River | Instrument where passing flows are specified | Bulk Entitlement (Latrobe – Southern Rural) Conversion Order 1996 |
| | Responsible authority | Southern Rural Water |
| | Compliance point | Blue Rock Lake (to maintain flow at Tanjil South) (shown as 3 in Figure 21-2) |
| | Passing flow compliance | • 90 ML per day was passed from January to April<br>• 100 ML per day was passed from May to July<br>• 150 ML per day was passed from August to November<br>• 100 ML per day was passed during December |
| | Compliance point | Yallourn Weir (shown as 4 in Figure 21-2) |
| | Passing flow compliance | • The lesser of a minimum average weekly of 350 ML per day, with a daily minimum of 300 ML per day, or modified natural flow, was passed |
| | Compliance point | Swing Bridge gauging station (Sale) (shown as 5 in Figure 21-2) |
| | Passing flow compliance | • The lesser of a minimum average weekly of 750 ML per day, with a daily minimum of 700 ML per day, or modified natural flow, was passed |

### 21.10.4 Streamflow management plans

The Gippsland Region Sustainable Water Strategy states that existing rules will be documented as local management plans for the following unregulated river systems within the Latrobe basin:

- Moe River
- Morwell River
- Narracan Creek
- Upper Latrobe River

Note that no statutory streamflow management plan is required.

# 22 South Gippsland basin

This chapter sets out the accounts for the South Gippsland basin. For detailed information about how they were compiled, refer to Chapter 5.

## 22.1 South Gippsland basin summary

Inflows in the South Gippsland basin in 2010–11 were 72% higher than the long-term average. Levels in the basin's major storages continued to recover from the extremely low levels experienced in 2006–07. By the end of the year, the total volume held in store had increased from 6,600 ML to 8,300 ML, or 100% of capacity.

Increased water availability enabled urban water corporations to provide unrestricted supplies to their customers. The volume of diversions for urban water use was similar to 2009–10.

In contrast, licensed groundwater use and licenced diversions from unregulated streams reduced significantly in 2010–11, compared to 2009–10.

## 22.2 Responsibilities for management of water resources

Table 22-1 shows the responsibilities of various authorities within the South Gippsland basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 22-1 Responsibilities for water resources management within the South Gippsland basin, 2010–11

| 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 | | |
| 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 |

## 22.3 Rainfall, flow and storages in 2010–11

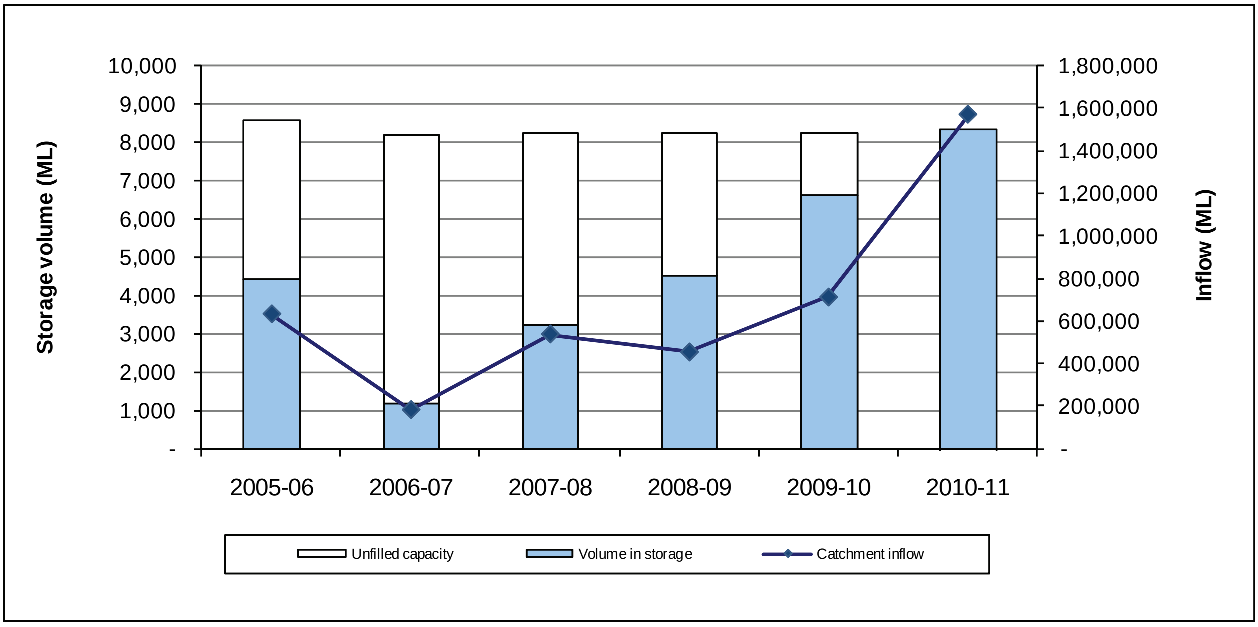
In 2010–11, rainfall across the South Gippsland basin ranged between 100% and 150% of the long-term average. Inflows were 1,568,000 ML, or 72% higher than the long-term average (of 911,500 ML). This was more than double the volume of inflows in 2009–10.

The amount of water flowing from the South Gippsland basin into Westernport Bay and Bass Strait was 1,529,000 ML in 2010–11. This represents 98% of the total inflows into the basin.

Storage levels for all major on-stream storages (greater than 1,000 ML capacity) in the basin increased from 6,600 ML in July 2010 to 8,300 ML (100% of capacity) by June 2011.

Only volumes for major on-stream storages have been included in the water balance. In the South Gippsland basin, this includes Lance Creek, Western, Candowie and Hyland reservoirs.

**Figure 22-1 All major storages and catchment inflows in the South Gippsland basin**




## 22.4 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 22-2. Consumptive use in the South Gippsland basin was low, compared to the available resource in the basin.

**Table 22-2 Summary of total water resources and water use in the South Gippsland basin, 2010–11**

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | 1,575,000 | 35,800 |
| Groundwater(2) | 38,800 | 12,100 |
| Recycled water | 5,430 | 190 |

Notes:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 22-7 and the estimated domestic and stock use as presented in Table 22-8.

(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

### 22.4.1 Infrastructure projects to improve water availability

A number of infrastructure projects were undertaken in the South Gippsland basin in 2010–11, to improve water availability.

A desalination plant in the South Gippsland basin is currently being constructed to augment Melbourne's water supply by 150 GL/year. The desalination plant is being built to service Melbourne, Geelong and towns in the Westernport and South Gippsland region. The plant will supply the water via an 85-km pipeline to Melbourne. The project commenced in October 2006 and is expected to be completed in 2012.

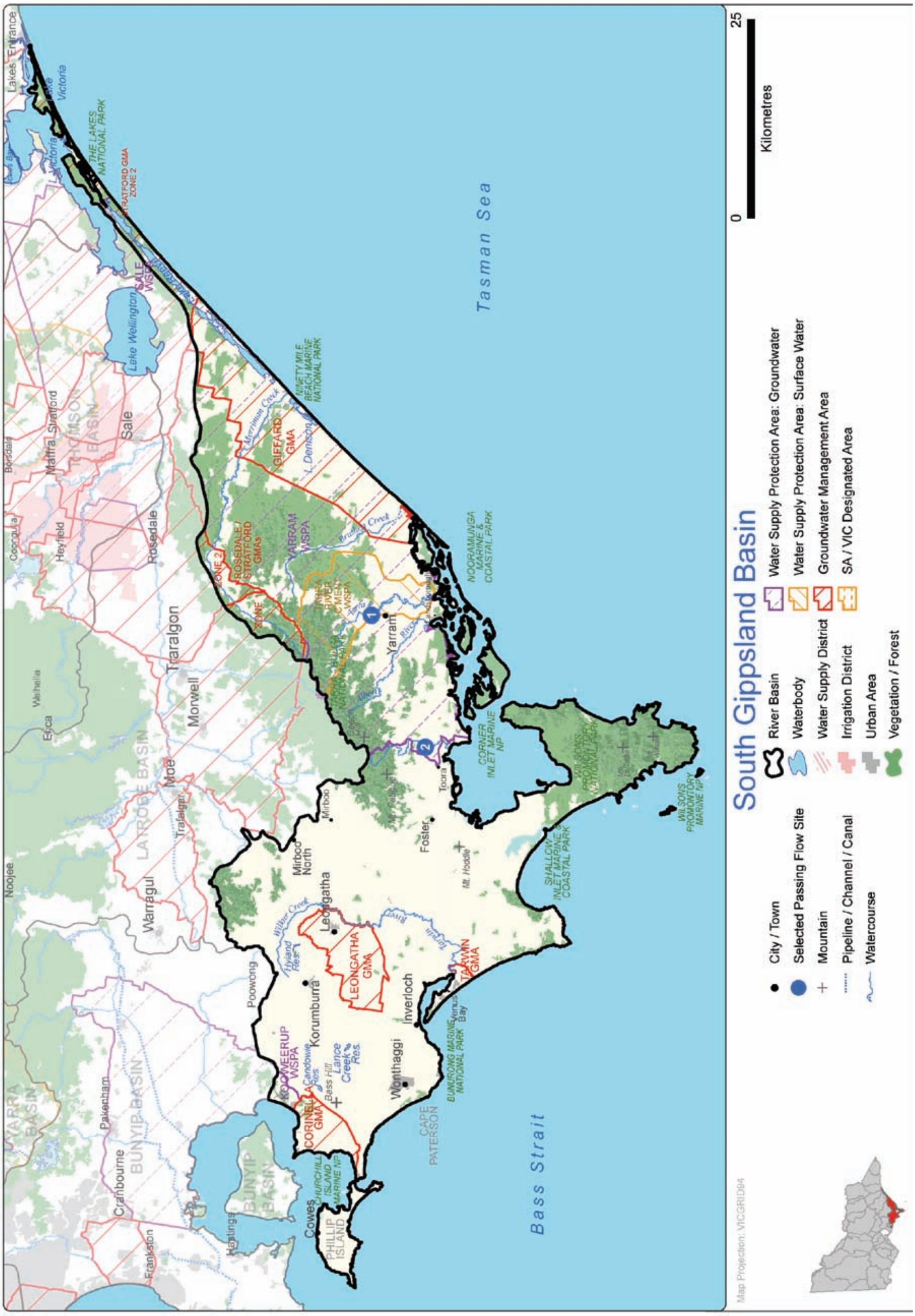
Westernport Water is proposing to raise the wall of Candowie Reservoir by up to 3 metres, to increase the capacity of the storage by up to 2,300 ML and improve security of supply. Westernport Water continued development of the business case and detailed design in 2010–11. The project is expected to be complete in June 2013.

South Gippsland Water constructed a sedimentation water quality mixing tank for Dumbalk Raw Water Storage to capture the backwash water for recycling. The project commenced in June 2010 and was completed in June 2011.

South Gippsland Water also began the Toora Clearwater Storage Construction Project to provide 3 ML of off-stream storage for the Toora Water Treatment Plant. The project commenced in June 2010 and is expected to be completed after June 2011.

## 22.5 Location of water resources

### Figure 22-2 Map of the South Gippsland basin



# 22.6 Surface water resources

## 22.6.1 Water balance

A surface-water balance for the South Gippsland basin is shown Table 22-3.

Diversions make up a relatively small proportion of total inflows, with around 2% of basin inflows diverted for consumptive use in 2010–11. Most inflows leave the basin and flow into Bass Strait or Westernport Bay.

### Table 22-3 Balance of surface water in the South Gippsland basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | 6,600 | 4,500 |
| Volume in storage at end of year | 8,300 | 6,600 |
| **Change in storage** | **1,700** | **2,100** |
| **Inflows** | | |
| Catchment inflow(1) | 1,568,000 | 711,400 |
| Rainfall on major storages | 1,800 | 3,400 |
| Transfers from other basins | - | - |
| Return flow from irrigation | - | - |
| Treated wastewater discharged back to river | 5,150 | 2,400 |
| **Sub-total** | **1,575,000** | **717,200** |
| **Usage** | | |
| Urban diversions | 7,680 | 8,000 |
| Licensed diversions from unregulated streams | 3,800 | 5,200 |
| Small-catchment dams | 24,300 | 24,300 |
| **Sub-total** | **35,800** | **37,500** |
| **Losses** | | |
| Net evaporation losses from major storages | 3,300 | 1,100 |
| Evaporation from small-catchment dams(2) | 5,100 | 5,100 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(3) | n/a | n/a |
| **Sub-total** | **8,400** | **6,200** |
| **Water passed at outlet of basin** | | |
| River outflows to Bass Strait and Westernport | 1,529,000 | 671,400 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Evaporation losses are calculated by subtracting estimated usage from water harvested.

(3) Assumed to be zero because data is not readily available.

n/a: No information available

## 22.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 22-4 below have been estimated by DSE, as outlined in Chapter 5.

### Table 22-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 23,000 | 11,500 | n/a |
| Registered commercial and irrigation | 15,200 | 12,800 | n/a |
| **Total** | **38,200** | **24,300** | **29,400** |

n/a: No information available

## 22.6.3 Water entitlement trades

The trade of surface water entitlements in the South Gippsland basin was limited to transfers of bundled entitlement volume within the basin. In 2010–11, no permanent or temporary transfers were traded within the basin. This is a significant decrease from 2009–10. There was no net trade of water into or out of the basin in 2010–11.

Table 22-5 summarises the trade of bundled entitlements in the South Gippsland basin in 2010–11.

### Table 22-5 Surface water bundled entitlement volume transfers in the South Gippsland basin 2010–11

| Trading zone | Permanent transfers (ML) | Temporary transfers (ML) |
|---|---|---|
| South Gippsland unregulated | 0 | 0 |
| **Total 2010–11** | **0** | **0** |
| Total 2009–10 | 124 | 119 |

## 22.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 22-6. Compliance with individual bulk entitlement volumes was deemed to have occurred if water diverted was not more than the maximum volume allowed to be diverted in 2010–11.

### Table 22-6 Volume of water diverted under surface water entitlements in the South Gippsland basin

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance? |
|---|---|---|---|---|---|
| *Gippsland Water* | | | | | |
| Seaspray | 1 | 61 | 0 | 31 | Yes |
| *South Gippsland Water* | | | | | |
| Devon North Alberton – Yarram and Port Albert | 1 | 853 | 0 | 473 | Yes |
| Dumbalk | 1 | 100 | 0 | 21 | Yes |
| Fish Creek | 1 | 251 | 0 | 90 | Yes |
| Foster | 1 | 326 | 0 | 165 | Yes |
| Korumburra | 1 | 1,000 | 0 | 741 | Yes |
| Leongatha | 1 | 2,476 | 0 | 1,650 | Yes |
| Loch, Poowong and Nyora | 1 | 420 | 0 | 164 | Yes |
| Meeniyan | 1 | 200 | 0 | 50 | Yes |
| Toora Port Franklin – Welshpool and Port Welshpool | 1 | 1,617 | 0 | 526 | Yes |
| Wonthaggi – Inverloch | 1 | 3,800 | 0 | 1,611 | Yes |
| *Westernport Water* | | | | | |
| Westernport | 1 | 2,911 | 0 | 2,116 | Yes |
| Westernport – Bass River | 1 | 3,000 | | 37 | Yes |
| **Total annual volume of bulk entitlements 2010–11** | | **17,015** | **0** | **7,675** | |
| Total annual volume of bulk entitlements *2009–10* | | 20,487 | 0 | 8,000 | |
| *Licensed diversions from unregulated streams 2010–11* | | *12,921* | | *3,784* | |
| *Licensed diversions from unregulated streams 2009–10* | | *12,306* | | *5,223* | |

## 22.7 Groundwater resources

A summary of the licensed entitlements and use from GMUs within the South Gippsland basin, excluding domestic and stock use, is presented in Table 22-7.

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 entitlements and use for unincorporated areas are summarised in Appendix A.

Groundwater use in 2010–11 decreased by 38%, compared to 2009–10.

## Table 22-7 Licensed groundwater volumes, South Gippsland basin 2010–11

| WSPA/GMA[1] | GMA/ WSPA depth limits[2] (m) | Entitlement limit[3] (ML/year) | Licensed entitlement[4] (ML/year) | Metered use (ML) | Estimated use in unmetered bores (ML)[5] | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Corinella GMA (100%) | All depths | 2,550 | 662 | 68 | - | 68 | 129 |
| Giffard GMA (100%) | 50-200 | 5,670 | 5,670 | 865 | - | 865 | 1,717 |
| Leongatha GMA (100%) | All depths | 6,500 | 1,833 | 31 | - | 31 | 158 |
| Rosedale GMA (6%)[6] | Zone 1 50–150<br>Zone 2 25–350<br>Zone 3 200–300 | 1,353 | 1,350 | 189 | 268 | 457 | 660 |
| Stratford GMA (7%)[6] | Zone 1 >150<br>Zone 2 >350 | 2,049 | 2,049 | 0 | 1,846 | 1,846 | 2,019 |
| Tarwin GMA (100%) | ≤25 | 1,300 | 38 | 9 | - | 9 | 6 |
| Sale WSPA (6%) | 25-200 | 1,195 | 1,189 | 404 | - | 404 | 613 |
| Yarram WSPA (95%) | Zone 1 >200<br>Zone 2 All depths | 24,032 | 24,032 | 6,533 | - | 6,533 | 11,146 |
| **Total[7]** | | **44,649** | **36,823** | **8,099** | **2,114** | **10,213** | **16,448** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11.

(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.

(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs. Any values reported here are estimates of other activities that used water in this WSPA/GMA.

(6) Non-metered use includes estimated extraction from Latrobe Valley mines.

(7) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 22-8.

## Table 22-8 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores[1][2] | Estimated domestic and stock use (assuming 1.5 ML per bore [4]) (ML) |
|---|---|---|
| Corinella GMA (100%) | 88 | 132 |
| Giffard GMA (100%) | 70 | 105 |
| Leongatha GMA (100%)[3] | 92 | 138 |
| Rosedale GMA (6%) | 11 | 16 |
| Stratford GMA (7%) | 0 | 0 |
| Tarwin GMA (100%) | 700 | 1,050 |
| Sale WSPA (6%) | 22 | 32 |
| Yarram WSPA (95%) | 308 | 461 |
| **Total[5]** | **1,291** | **1,935** |

Notes:

(1) 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 the previous table.

(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Licence increase approved April 2010.

(4) Estimated domestic and stock use calculated using a factor of 1.5 ML per bore for Southern Rural Water GMUs. For other authorities, the factor is 2 ML.

(5) Estimated use for domestic and stock is based on the proportion of bores for each management unit data located in the basin before rounding.

The licensed entitlements and metered use for urban groundwater supplies is provided in Table 22-9.

### Table 22-9 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Leongatha[(1)] | 715 | 0 | 16 |
| Yarram | 94 | 23 | 7 |
| Corinella / Grantville | 490 | 0 | 0 |
| **Total** | **1,299** | **23** | **23** |

Note:

(1) Increase to license from 400 ML to 715 ML was approved April 2010.

## 22.8 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to licensed diversions from unregulated streams are presented in Table 22-10

### Table 22-10 Seasonal allocations and restrictions on water use in South Gippsland basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Licensed diversions from unregulated streams | Bruthen Creek and tributaries | Irrigation ban from July to September 2010 |
| | Greigs Creek | Irrigation ban in July and August 2010 and in January 2011 |

## 22.9 Recycled water

South Gippsland Water is responsible for eight wastewater treatment plants within the basin, with the Yarram (Tarraville) 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, compared to 6% in 2009–10 (Table 22-11).

### Table 22-11 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 (ML)[(3)] |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation[(1)] | Within process[(2)] | | |
| Coronet Bay | 202 | 119 | 59% | 0 | 119 | 0 | 0 | 0 | 83 |
| Cowes | 1,232 | 44 | 3% | 28 | 9 | 0 | 8 | 1,187 | 0 |
| Foster | 159 | 0 | 0% | 0 | 0 | 0 | 0 | 159 | 0 |
| Korumburra | 811 | 0 | 0% | 0 | 0 | 0 | 0 | 811 | 0 |
| Leongatha domestic | 630 | 0 | 0% | 0 | 0 | 0 | 0 | 630 | 0 |
| Leongatha trade waste | 1,026 | 0 | 0% | 0 | 0 | 0 | 0 | 1,026 | 0 |
| Toora | 76 | 0 | 0% | 0 | 0 | 0 | 0 | 76 | 0 |
| Welshpool | 43 | 0 | 0% | 0 | 0 | 0 | 0 | 43 | 0 |
| Wonthaggi/Cape Paterson/Inverloch | 1,222 | 0 | 0% | 0 | 0 | 0 | 0 | 1,222 | 0 |
| Yarram (Tarraville) | 26 | 26 | 100% | 0 | 26 | 0 | 0 | 0 | 0 |
| **Total 2010–11** | **5,426** | **189** | **3%** | **28** | **153** | **0** | **8** | **5,153** | **83** |
| Total 2009–10 | 4,748 | 307 | 6% | 84 | 219 | 0 | 4 | 2,400 | 2,041 |

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 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.

## 22.10 Water for the environment

### 22.10.1 Environmental Water Reserve

There are important environmental assets dependent on water from the EWR in the South Gippsland basin. 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 EPBC Act and the Victorian FFG Act*,* also relies on water from the South Gippsland EWR.

In 2010–11, 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: that is, water above cap.

### 22.10.2 Passing flow compliance

Some bulk entitlements require passing flows to be met at some points in the basin.

All passing flow requirements were complied with for the South Gippsland basin in 2010–11.

Table 22-12 shows passing flow compliance in the South Gippsland basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest. The location of these compliance points is presented in Figure 22-2.

#### Table 22-12 Selected passing flow compliance in the South Gippsland basin

| River | Passing flow | |
|---|---|---|
| Tarra River | Instrument where passing flows are specified | Bulk Entitlement (Devon North, Alberton, Yarram and Port Albert) Conversion Order 1997 |
| | Responsible authority | South Gippsland Water |
| | Compliance point | Tarra River diversion weir (shown as 1 in Figure 22-2) |
| | Passing flow compliance | • The authority passed the entire flow when flows were between 0 and 3 ML per day<br>• The authority passed 3 ML per day when flow was between 3 and 6 ML per day<br>• The authority passed half the flow when flow was between 6 and 12 ML per day<br>• The authority passed 6 ML per day when flow was greater than 12 ML per day |
| Agnes River | Instrument where passing flows are specified | Bulk Entitlement (Toora, Port Franklin, Welshpool and Port Welshpool) Conversion Order 1997 |
| | Responsible authority | South Gippsland Water |
| | Compliance point | Agnes River storage diversion point (shown as 2 in Figure 22-2) |
| | Passing flow compliance | The lesser of 1 ML per day or natural flow was passed |

### 22.10.3 Streamflow management plans

The Gippsland Region Sustainable Water Strategy states that existing rules will be documented as local management plans for the following unregulated river systems in the South Gippsland Basin: Agnes River, Albert River, Bruthen Creek, Franklin River, Merrimans Creek, Tarra River and Tarwin River. As a stream flow management plan will not be developed for the Tarra River, the Gippsland Region Sustainable Water Strategy states that the Tarra River Catchment WSPA will be undeclared.

# 23 Bunyip basin

This chapter sets out the accounts for the Bunyip basin. For detailed information about how they were compiled, refer to Chapter 5.

## 23.1 Bunyip basin summary

Inflows to the Bunyip basin in 2010–11, at 1,185,400 ML, were 219% of long-term average and were double the volume of inflows in 2009–10.

Towns in the basin supplied by Gippsland Water were not subject to restrictions in 2010–11. Melbourne remained on Stage 3a restrictions until October, when restrictions were eased to Stage 2. Diversions for urban water use increased in 2010–11 compared to 2009–10, likely as a result of reduced restriction levels.

In contrast, licensed groundwater use and licensed diversions from unregulated streams reduced significantly in 2010–11, compared to 2009–10. This could be attributed to above-average rainfall suppressing demand for water.

## 23.2 Responsibilities for management of water resources

Table 23-1 shows the responsibilities of various authorities within the Bunyip basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 23-1 Responsibilities for water resources management within the Bunyip basin, 2010–11

| Authority | Irrigation and rural water supply | 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<br>Provides bulk water supply to South East Water | Operates Tarago Reservoir<br>Obliged to meet passing flows<br>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 |

Note:

(1) Metropolitan Melbourne is mostly supplied from the Yarra and Thomson basins.

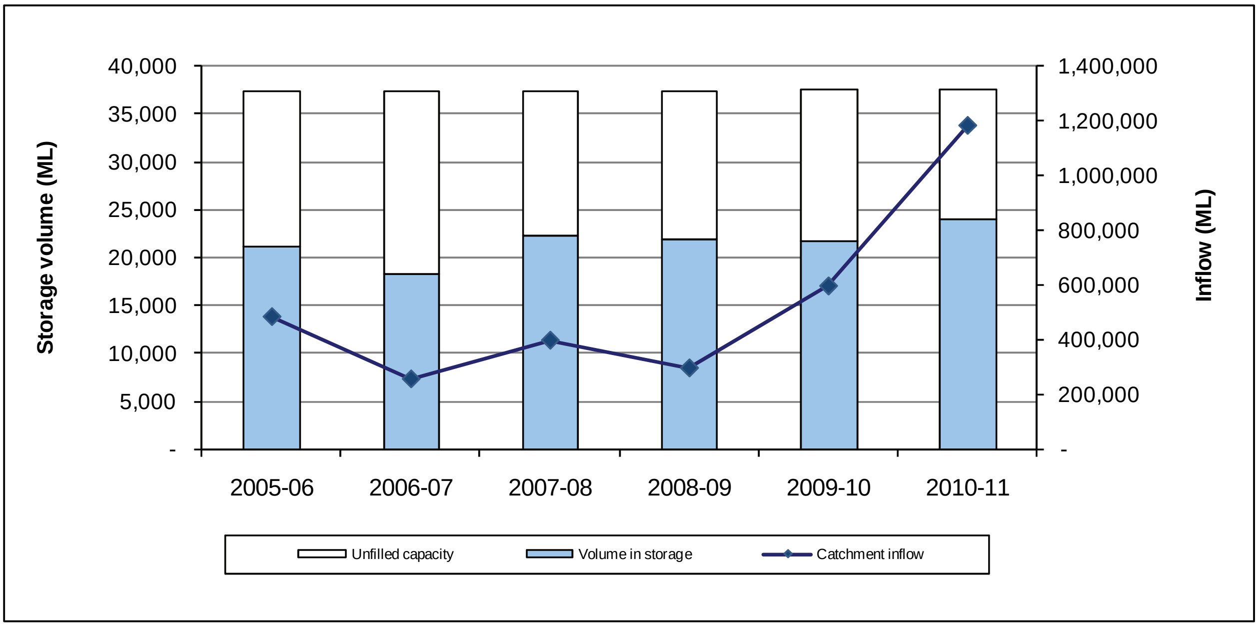
## 23.3 Rainfall, flows and storages in 2010–11

In 2010–11, rainfall in the Bunyip basin ranged between 125% and 200% of the long-term average. Catchment inflows were 1,185,400, which was more than double the long-term average of 541,000 ML. This was significantly higher than 2009–10 inflows of 597,100 ML and was the highest inflow for the past six years.

The amount of water flowing from the Bunyip basin into Port Phillip Bay, Westernport Bay and Bass Strait was 1,158,200 ML in 2010–11, compared to 567,700 in 2009–10. This represents 98% of the catchment inflows into the basin for 2010–11.

The Tarago Reservoir is the only major on-stream storage (greater than 1,000 ML) in the Bunyip basin. The Tarago Reservoir ended the year at 24,000 ML, or 96% of its effective capacity of 25,000 ML. Tarago Reservoir has a capacity of 37,500 ML; however in 2010–11, as in previous years, it operated at a temporary capacity of 25,000 ML for dam safety reasons.

### Figure 23-1 All major storages and catchment inflows in the Bunyip basin (1)




Note:

(1) The reservoir has a capacity of 37,500 ML; however it is operated at 25,000 ML capacity for dam safety reasons.

## 23.4 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 23-2. These figures exclude water delivered directly to customers from Melbourne Water's supply system in the Yarra and Thomson basins.

### Table 23-2 Summary of total water resources and water use in the Bunyip basin, 2010–11

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | 1,202,300 | 38,500 |
| Groundwater(2) | 25,500 | 8,800 |
| Recycled water | 174,620 | 18,440 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 23-7 and the estimated domestic and stock use as presented in .

Table 23-8.

(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

### 23.4.1 Infrastructure projects to improve water availability

A desalination plant is currently being constructed in the South Gippsland basin that will augment Melbourne's water supply by 150 GL/year. When completed, desalinated water will be supplied to Melbourne's Cardinia Reservoir, located in the Bunyip basin, which will then supply Melbourne, Geelong and towns in the Westernport and South Gippsland region which are located off the transfer pipeline. The plant will add to Melbourne's water supply via an 85-km pipeline to Melbourne. The project commenced in October 2006 and is expected to be completed by 2012.

Melbourne Water completed construction of the Cardinia pump station in 2011. This will transfer desalinated water to Silvan Reservoir from Cardinia Reservoir.

Gippsland Water completed work on the Rokeby raw water pump station in 2010–11. This project involved constructing a pump station at Rokeby to transfer water from Melbourne Water's Westernport pipeline to Gippsland Water's Pederson pipeline. This project will enable water foregone at Pederson Weir for environmental flows under the Tarago Bulk Entitlement to be recovered and supplied to Warragul. The project commenced in January 2010 and was completed in October 2010.

## 23.5 Location of water resources

### Figure 23-2 Map of the Bunyip basin

# 23.6 Surface water resources

## 23.6.1 Water balance

A surface-water balance for the Bunyip basin is shown in Table 23-3.

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 23-3 Balance of surface water in the Bunyip basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | 21,800 | 22,000 |
| Volume in storage at end of year | 24,000 | 21,800 |
| **Change in storage** | **2,200** | **-200** |
| **Inflows** | | |
| Catchment inflow(1) | 1,185,400 | 597,100 |
| Rainfall on major storages | 3,100 | 2,300 |
| Transfers from other basins | - | - |
| Return flow from irrigation | - | - |
| Treated wastewater discharged back to river | 13,810 | 9,200 |
| **Sub-total** | **1,202,300** | **608,600** |
| **Usage** | | |
| Urban diversions | 19,270 | 16,670 |
| Licensed diversions from regulated streams | - | 150 |
| Licensed diversions from unregulated streams | 3,700 | 5,300 |
| Small-catchment dams | 15,500 | 15,500 |
| **Sub-total** | **38,500** | **37,600** |
| **Losses** | | |
| Evaporation losses from major storages | 1,200 | 1,600 |
| Losses from small-catchment dams(2) | 600 | 600 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(3) | 1,600 | 1,300 |
| **Sub-total** | **3,400** | **3,500** |
| **Water passed at outlet of basin** | | |
| River outflows to the ocean and Port Phillip Bay and Westernport | 1,158,200 | 567,700 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Data for water usage from small-catchment dams is estimated by DSE. Evaporation losses are calculated by subtracting estimated usage from total water harvested.

(3) Losses were estimated using loss functions in the Tarago River REALM.

## 23.6.2 Small-catchment dams

Small-catchment dams are responsible for diverting a large volume of surface water in the basin. Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values provided in Table 23-4 are estimated by DSE, as outlined in Chapter 5.

### Table 23-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 8,000 | 4,000 | n/a |
| Registered commercial and irrigation | 13,700 | 11,500 | n/a |
| **Total** | **21,700** | **15,500** | **16,100** |

n/a: No information available

## 23.6.3 Water entitlement trades

There are no declared water systems in the Bunyip basin. As such, surface water trade in the Bunyip basin was limited to transfers of bundled entitlements. In 2010–11, 4 ML of licences was transferred within the basin on a permanent basis, and 12 ML on a temporary basis. No bulk entitlements were transferred.

Table 23-5 summarises the movement of bundled entitlements in the Bunyip basin in 2010–11.

### Table 23-5 Surface water bundled entitlement volume transfers in the Bunyip basin 2010–11

| Trading zone | Permanent transfers (ML) | Temporary transfers (ML) |
|---|---|---|
| Bunyip unregulated | 4 | 12 |
| **Total 2010–11** | 4 | 12 |
| Total 2009–10 | 58 | 159 |

### 23.6.4 Volume diverted

The volume of water diverted in 2010–11 is shown in Table 23-6.

Licensed diversions from unregulated streams are a large component of surface water use in the basin. Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

### Table 23-6 Volume of water diverted under surface water entitlements in the Bunyip basin

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML) (1) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance? (2) |
|---|---|---|---|---|---|
| *Gippsland Water* | | | | | |
| Tarago River | 5 | 4,825 | 0 | 3,168 | Yes |
| *Melbourne metropolitan retailers* | | | | | |
| Tarago and Bunyip Rivers | 5 | 30,510 | 0 | 16,100 | Yes |
| Southern Rural Water | | | | | |
| Tarago River – Southern Rural Water | 5 | 1,260 | 0 | 0 | Yes |
| *Minister for Environment* | | | | | |
| Tarago and Bunyip Rivers | 1 | 3000 | 0 | 0 | Yes |
| **Total annual volume of bulk entitlements 2010–11** | | **39,595** | **0** | **19,268** | |
| Total annual volume of bulk entitlements 2009–10 | | 34,035 | 0 | 16,815 | |
| *Licensed diversions from unregulated streams 2010–11* | | *19,450* | | *3,675* | |
| *Licensed diversions from unregulated streams 2009–10* | | *19,319* | | *5,295* | |

Notes:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one-year) period in the bulk entitlement, divided by the number of years in that period.

(2) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

## 23.7 Groundwater resources

A summary of the licensed entitlements and use from GMUs within the Bunyip basin, excluding domestic and stock use, is presented Table 23-7.

The Bunyip basin contains the whole Frankston GMA, Nepean GMA and Koo Wee Rup WSPA, as well as part of the Moorabbin GMA. Groundwater levels in the Koo Wee Rup WSPA are declining, while levels in the Nepean and Frankston GMAs are stable. Insufficient observation bores are available to determine trends for the Moorabbin GMA. A groundwater management plan has been endorsed by the Minister for the Koo Wee Rup WSPA in light of declining water levels. Groundwater entitlements and use for unincorporated areas are detailed in Appendix A. Reported groundwater use in the Bunyip basin decreased significantly in 2010–11, compared to 2009–10, largely as a result of reduced extractions from the Koo Wee Rup WSPA and Nepean GMA.

### Table 23-7 Licensed groundwater volumes, Bunyip basin 2010–11

| WSPA/GMA(1) | GMA/ WSPA depth limits(2) (m) | Entitlement limit(3) (ML/year) | Licensed entitlement(4) (ML/year) | Metered use (ML) | Estimated use in unmetered bores (ML)(5) | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Frankston GMA (100%) | 50-200 | 3,200 | 1,069 | 72 | - | 72 | 126 |
| Moorabbin GMA (63%) | All depths | 1,692 | 1,638 | 341 | - | 341 | 739 |
| Nepean GMA | All depths | 6,013 | 6,115 | 1,798 | - | 1,798 | 3,521 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (100%)[6] | | | | | | | |
| Koo-Wee-Rup WSPA (100%) | All depths | 12,915 | 12,018 | 1,939 | - | 1,939 | 3,378 |
| **Total [6]** | | **23,820** | **20,840** | **4,150** | **-** | **4,150** | **7,764** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.
(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11.
(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.
(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.
(6) Licence entitlement greater than entitlement limit due to correction of a licence volume in the Water Register. PCV to be amended.
(7) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 23-8. The number of domestic and stock bores in the Bunyip basin reduced in 2010–11, compared to 2009–10.

### Table 23-8 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores[(1)(2)] | Estimated domestic and stock use (assuming 1.5 ML per bore[(3)]) (ML)[(4)] |
|---|---|---|
| Frankston GMA (100%) | 138 | 207 |
| Moorabbin GMA (63%) | 232 | 348 |
| Nepean GMA (100%) | 2,155 | 2,155 |
| Koo Wee Rup WSPA (100%) | 1,299 | 1,949 |
| **Total** | **3,824** | **4,659** |

Notes:

(1) 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 the previous table.
(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(3) Estimated domestic and stock use calculated using a factor of 1.5 ML per bore all for Southern Rural Water GMUs listed other than Nepean GMA which uses a factor of 1 ML per bore because most Nepean properties have access to potable water and bores are mainly used for domestic purposes such as watering gardens. All other authorities use a factor of 2 ML per bore.
(4) Estimated domestic and stock use is based on the proportion of bores for each management unit data located in the basin before rounding.

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 23-9.

### Table 23-9 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Lang Lang | 119 | 4 | 22 |

## 23.8 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers are shown in Table 23-10. There were no restrictions on groundwater use or licensed diversions from unregulated streams in the Bunyip basin in 2010–11.

### Table 23-10 Seasonal allocations and restrictions on water use in Bunyip basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Urban | South East Water customers | Stage 3 restrictions from 1 July 2010 to 31 August 2010, Stage 2 from 1 September 2010 to 30 June 2011 |

## 23.9 Recycled water

Gippsland Water, South East Water and Melbourne Water operate wastewater treatment plants within the Bunyip basin. Overall, 2% of wastewater was recycled for off-site purposes.

The largest treatment plant is the Eastern Treatment Plant operated by Melbourne Water, which recycled 1% of its total wastewater volume of 159,160 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 23-11 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 (ML)(3) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | To retailers | Urban and industrial | Agriculture | Beneficial allocation(1) | Within process(2) | | |
| Blind Bight | 247 | 248 | 75% | 0 | 185 | 0 | 0 | 63 | 0 | 0 |
| Boneo | 3,611 | 367 | 9% | 0 | 326 | 0 | 0 | 41 | 3,243 | 0 |
| Drouin | 990 | 45 | 5% | 0 | 0 | 45 | 0 | 0 | 945 | 0 |
| Eastern Treatment Plant | 159,160 | 16,741 | 1% | 2,144 | 0 | 0 | 0 | 14,597 | 0 | 142,419 |
| Koo Wee Rup | 202 | 28 | 14% | 0 | 28 | 0 | 0 | 0 | 198 | -24 |
| Lang Lang | 63 | 41 | 65% | 0 | 41 | 0 | 0 | 0 | 18 | 4 |
| Longwarry | 224 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 184 | 40 |
| Mt Martha | 5,607 | 746 | 0% | 0 | 2 | 0 | 0 | 744 | 4,861 | 0 |
| Neerim South | 46 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 46 | 0 |
| Pakenham | 2,529 | 160 | 5% | 0 | 114 | 7 | 0 | 39 | 2,402 | 0 |
| Somers | 1,946 | 63 | 2% | 0 | 41 | 4 | 0 | 18 | 1,915 | 0 |
| **Total 2010–11** | **174,624** | **18,439** | **2%** | **2,144** | **737** | **56** | **0** | **15,502** | **13,812** | **142,438** |
| Total 2009–10 | 135,800 | 23,538 | 6% | 6,317 | 937 | 1,178 | 0 | 15,106 | 9,197 | 102,763 |

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.

## 23.10 Water for the environment

### 23.10.1 Environmental Water Reserve

Westernport Bay is an important environmental asset dependent on water from the 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 2010–11 the Bunyip basin EWR comprised:

- the Tarago and Bunyip Rivers Environmental Entitlement 2009
- all other water in the basin not allocated for consumptive use: that is water above the cap
- water set aside for the environment through the operation of passing flow conditions on licensed diversions.

### 23.10.2 Environmental entitlements

The Tarago and Bunyip Rivers Environmental Entitlement was granted to the Minister for Environment in 2009. The entitlement allows for the extraction of 3,000 ML per year and came into effect in April 2010. The entitlement consists of passing flows and a 10.3% share of inflows into the storage.

No environmental releases were made from the Tarago and Bunyip Rivers Environmental Entitlement in 2010–11.

### 23.10.3 Passing flow compliance

All passing flow requirements were complied with for the Bunyip basin in 2010–11.

# 24 Yarra basin

This chapter sets out the accounts for the Yarra basin. For detailed information about how they were compiled, refer to Chapter 5.

## 24.1 Yarra basin summary

In 2010–11, rainfall in the Yarra basin ranged between 125% and 200% of the long-term average. Catchment inflows were 1,461,100 ML, equivalent to138% of the long-term average of 1,054,000 ML. This is the first time in four years that inflows to the Yarra basin were more than 50% of the long-term average.

The volume of water in major storages in the Yarra basin increased from 351,500 ML (50% of capacity) to 546,300 ML (77% of capacity) by the end of the year.

Melbourne's restrictions were reduced from Stage 3 to Stage 2 at the beginning of September 2010. The improvement in water availability also enabled the restoration of 30,000 ML per year of environmental flows that had been reserved in storage under a qualification of rights in the Yarra system to secure Melbourne's water supplies.

Licensed diversions from unregulated streams were lower compared to 2009–10, despite fewer streams being subject to bans and restrictions on diversions than in 2009–10.

Groundwater use in the Yarra basin was also decreased, compared to 2009–10.

## 24.2 Responsibilities for management of water resources

Table 24-1 shows the responsibilities of various authorities within the Yarra basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 24-1 Responsibilities for water resources management within the Yarra basin, 2010–11

| Authority | Irrigation and rural water supply | 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<br>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 | | |

Notes:
(1) Melbourne is also supplied from the Thomson and Bunyip basins.

## 24.3 Rainfall, flows and storages in 2010–11

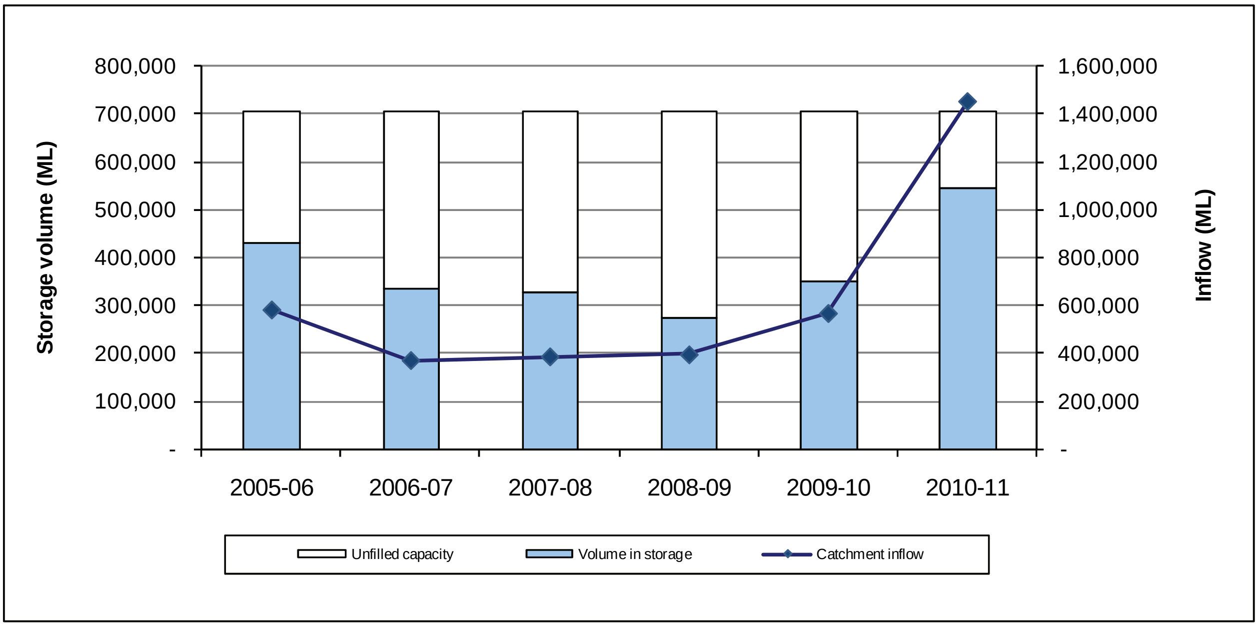
In 2010–11, rainfall in the Yarra basin ranged between 125% and 200% of the long-term average. At 1,461,100 ML, catchment inflows were 138% of the long-term average. This is the first time in four years that inflows to the Yarra basin were more than 50% of the long-term average.

The amount of water flowing from the Yarra basin into Port Phillip Bay was 943,700 ML in 2010–11. This represents 65% of the catchment inflows to the basin, compared to 38% in 2009–10.

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 (greater than 1,000 ML) in the basin increased from 351,500 ML in July 2010 to 546,300 ML (77% of capacity) by the end of June 2011.

**Figure 24-1 All major storages and catchment inflows in the Yarra basin**




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 increased from 138,800 ML in July 2010 to 191,100 ML in June 2011.

## 24.4 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 24-2.

**Table 24-2 Summary of total water resources and water use in the Yarra basin, 2010–11**

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | 1,499,300 | 492,100 |
| Groundwater(2) | 4,800 | 900 |
| Recycled water | 11,430 | 2,430 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 24-6 and the estimated domestic and stock use presented in Table 24-7.

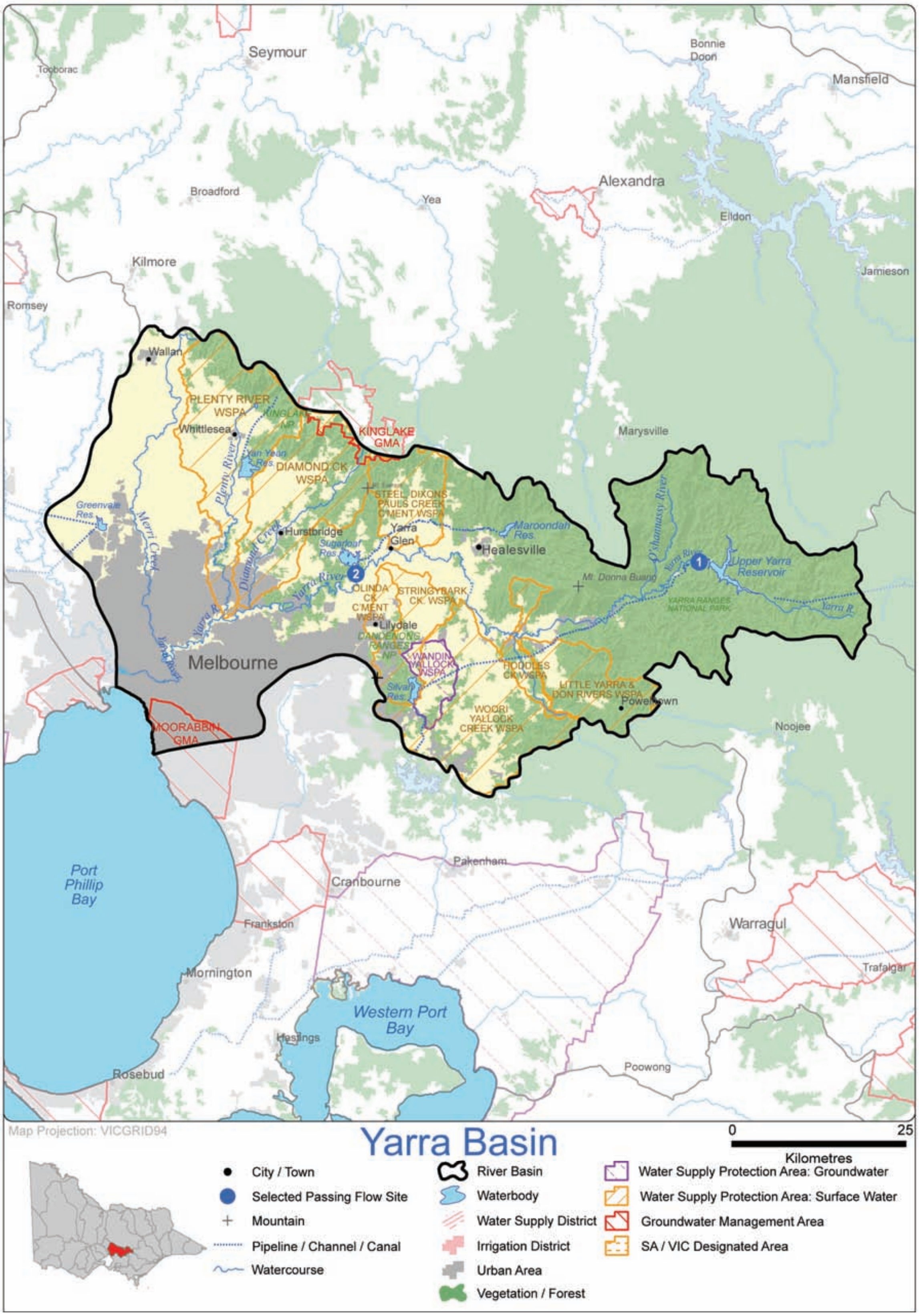
(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

### 24.4.1 Infrastructure projects to improve water availability

The dam wall height of the Toorourrong Reservoir was increased by Melbourne Water. This was done to mitigate future flooding impacts in Whittlesea.

## 24.5 Location of water resources

### Figure 24-2 Map of the Yarra basin



## 24.6 Surface water resources

### 24.6.1 Water balance

A surface-water balance for the Yarra basin is presented in Table 24-3.

Melbourne Water transferred 12,900 ML from the Thomson and Goulburn basins to the Yarra basin for Melbourne's supplies in 2010–11. This volume is less than the volume transferred in 2009–10.

#### Table 24-3 Balance of surface water in the Yarra basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | 138,800 | 96,000 |
| Volume in storage at end of year | 191,100 | 138,800 |
| **Change in storage** | **52,300** | **42,800** |
| **Inflows** | | |
| Catchment inflow(1) | 1,453,600 | 568,000 |
| Rainfall on major storages | 16,500 | 11,600 |
| Transfers from Thomson | 1,600 | 62,400 |
| Transfers from Goulburn (Silver and Wallaby creeks) | 11,300 | 5,300 |
| Transfers from Goulburn via North-South pipeline(2) | 7,476 | 16,740 |
| Return flow from irrigation | - | - |
| Treated wastewater discharged back to river | 8,840 | 6,920 |
| **Sub-total** | **1,499,300** | **671,000** |
| **Usage** | | |
| Urban diversions(3) | 464,130 | 368,070 |
| Licensed diversions from unregulated streams | 12,100 | 14,300 |
| Small-catchment dams(4) | 15,900 | 15,900 |
| Transfers to the Werribee system | - | - |
| **Sub-total** | **492,100** | **398,300** |
| **Losses** | | |
| Net evaporation losses from major storages | 10,000 | 10,800 |
| Evaporation from small-catchment dams(4) | 1,200 | 1,200 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(5) | n/a | n/a |
| **Sub-total** | **11,200** | **12,000** |
| **Water passed at outlet of basin** | | |
| River outflows to Port Phillip Bay | 943,700 | 217,900 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Transfers were made until 28 October 2010 under a supply agreement

(3) Diversions from the Melbourne supply system represent the total amount diverted for consumptive purposes and do not equate to the sum of the three individual Melbourne bulk entitlements, due to a different calculation method.

(4) Data for water usage from small-catchment dams is estimated by DSE. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(5) Losses estimated to be zero since no loss function is available for the Yarra basin.

n/a: No information available

### 24.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 24-4 have been estimated by DSE, as outlined in Chapter 5.

#### Table 24-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 10,500 | 5,300 | n/a |
| Registered commercial and irrigation | 12,600 | 10,600 | n/a |
| **Total** | **23,100** | **15,900** | **17,100** |

n/a: No information available

### 24.6.3 Water entitlement trades

There were no transfers of water entitlements within the Yarra basin or across basin boundaries in 2010–11.

### 24.6.4 Volume diverted

The Melbourne metropolitan retailers (City West Water, South East Water, Western Water and Yarra Valley Water) hold bulk entitlements on the Yarra River. The volume of water diverted by these corporations is shown in Table 24-5.

The Yarra River bulk entitlement held by the Melbourne retailers is applied over a multi-year period, where the average usage over a defined rolling period (15 years) must be less than the average bulk entitlement volume.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Melbourne Water.

#### Table 24-5 Volume of water diverted under surface water entitlements in the Yarra basin

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML)(1) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance?(2) |
|---|---|---|---|---|---|
| *Melbourne metropolitan retailers* | | | | | |
| Yarra River | 15 | 400,000 | 0 | 456,400 | Yes(3) |
| *Western Water* | | | | | |
| Melbourne headworks system | 1 | 18,250 | 0 | 7,730 | Yes |
| *Minister for Environment* | | | | | |
| Yarra Environmental Entitlement | 1 | 17,000 | 0 | 0 | Yes |
| **Total annual volume taken in 2010–11** | | **435,250** | **0** | **464,130** | |
| Total annual volume taken in 2009–10 | | 428,250 | | 300,374 | |
| *Licensed diversions from unregulated streams* 2010–11 | | *50,874* | | *12,101* | |
| *Licensed diversions from unregulated streams* 2009–10 | | *45,753* | | *14,285* | |

Notes:

(1) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

(2) The compliance for the water taken 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 2010–11 was 427,800 ML.

(3) While the 2010–11 diversion was 456,400 ML, the 15 year rolling average diverted volume remained less than 400,000 ML per year.

## 24.7 Groundwater resources

A summary of the licensed entitlements and use from GMUs within the Yarra basin, excluding domestic and stock use, is presented in Table 24-6.

The Yarra basin contains the whole Wandin Yallock WSPA as well as part of the Kinglake GMA and Moorabbin GMA. Groundwater levels in the Wandin Yallock WSPA had an increasing trend in 2010–11. Insufficient observation bores are available to determine trends in the Kinglake and Moorabbin GMAs. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

Reported groundwater use in the Yarra basin decreased significantly in 2010–11 compared to 2009–10, due to reduced extractions in the Moorabbin GMA and Wandin Yallock WSPA.

#### Table 24-6 Licensed groundwater volumes, Yarra basin 2010–11

| WSPA/GMA(1) | GMA/WSPA depth limits(2) (m) | Entitlement limit (ML/year)(3) | Licensed entitlement (4) (ML/year) | Metered use (ML) | Estimated use in unmetered bores (ML)(5) | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Kinglake GMA (22%) | All depths | 446 | 412 | 31 | - | 31 | 38 |
| Moorabbin GMA (37%) | All depths | 1,008 | 976 | 203 | - | 203 | 464 |
| Wandin Yallock WSPA (100%)(6) | All depths | 2,924 | 2,933 | 198 | - | 198 | 377 |
| **Total(6)** | | **4,378** | **4,320** | **432** | **-** | **432** | **878** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11. The PCV for Wandin Yallock is currently under review. The licensed entitlement is greater than PCV.
(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.
(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.
(6) The PCV was exceeded in 2010–11 and is currently being amended for Wandin Yallock WSPA.
(7) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 24-7. Groundwater is not used to augment urban supplies in the Yarra basin.

### Table 24-7 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores(1)(2) | Estimated domestic and stock use (assuming 2 ML per bore(3)) (ML)(4) |
|---|---|---|
| Kinglake GMA (22%) | 59 | 118 |
| Moorabbin GMA (37%) | 138 | 207 |
| Wandin Yallock WSPA (100%) | 82 | 123 |
| **Total** | **279** | **448** |

Notes:
(1) 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 24-6.
(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(3) Estimated domestic and stock use is calculated using a factor of 2 ML per bore for Kinglake GMA, while Moorabbin GMA and Wandin Yallock WSPA use a factor of 1.5 ML per bore.
(4) Total volumes are based on the sum of management unit data before rounding.

## 24.8 Qualification of rights

A qualification of rights in the Yarra basin continued into 2010–11 to secure Melbourne’s water supplies if dry conditions continued. The qualification provided Melbourne with up to 30,000 ML of extra water per year by delaying the introduction of the Yarra Environmental Entitlement and by reducing passing flows at some sites along the river and its tributaries.

The Minister for Water restored environmental flows of up to 10,000 ML per year to the Yarra River in July 2010, and revoked the qualification of rights in October 2010. The full environmental flow regime under the Yarra Environmental Entitlement was not due to be introduced until Melbourne’s water restrictions eased to Stage 1, but water projects, conservation and better rainfall allowed flows to be restored earlier.

The environmental risks were managed by Melbourne Water in line with a water quality monitoring program and the Yarra River Environmental Emergency Contingency Plan. No additional environmental impacts were found to have occurred in the Yarra River as a result of the qualifications.

According to the Melbourne retail water business’ annual report on the effectiveness of the Melbourne qualifications, the Yarra qualification retained 4,000 ML in storage for Melbourne in 2010–11. An additional 148,100 ML of water was harvested over the four years that environmental flows were qualified in the Thomson and Yarra basins, which secured an additional 149 days of supply and avoided the need to introduce Stage 4 restrictions.

### Table 24-8 Qualifications of rights

| Legal instruments | Dates | Qualification type | Qualification description | Triggers for resuming normal sharing rules | Date trigger reached |
|---|---|---|---|---|---|
| Temporary Qualification of Rights in the Melbourne Water Supply System - Yarra 2010 | 10 March 2010 to 30 June 2010 | Differential access by priority entitlements<br>Reduced passing flow requirements | Delayed the introduction of the new environmental flow regime for the Yarra River to retain water in storages for supply to Melbourne and further reduced environmental flows by up to 10,000 ML/year. | When Melbourne is no longer subject to Stage 2 restrictions or a stage of restrictions more severe than Stage 2. | Revoked 12 October 2010 |

## 24.9 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions from unregulated streams are presented in Table 24-9. Melbourne's restrictions were reduced from Stage 3 to Stage 2 at the beginning of spring. Fewer streams were subject to bans and restrictions for licensed diversions in 2010–11 than 2009-10.

### Table 24-9 Seasonal allocations and restrictions on water use in Yarra basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Urban | Yarra Valley Water, South East Water and City West Water customers | Stage 3 restrictions from 1 July 2010 to 31 August 2010, Stage 2 from 1 September 2010 to 30 June 2011 |
| Licensed diversions from unregulated streams | Wandin Yallock Creek | Irrigation ban in July 2010 |
| | Hoddles Creek | Irrigation ban in July and September 2010 |
| | Yarra River | Irrigation ban in July 2010, September 2010, and from December 2010 to June 2011 |
| | Arundel Creek, Moonee Ponds Creek | Irrigation ban in December 2010 |
| | Steels/Dixons Creek | Irrigation ban from December 2010 to June 2011 |
| | Diamond Creek | Irrigation ban in January and February 2011 |
| | Olinda Creek, Stringybark Creek | Irrigation ban in January 2011 |
| | Yarra River, Little Yarra River | Restricted in January 2011 |

## 24.10 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 24-10.

Wastewater was reused at four of the plants in 2010–11. Compared with 2009–10, the volume of wastewater entering the treatment plants increased while the volume of water that was recycled decreased in 2010–11. Overall, 5% of wastewater was reused in the basin, which is a decrease from the 7% recycled in 2009–10.

### Table 24-10 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 (ML)(3) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation(1) | Within process(2) | | |
| Aurora | 532 | 312 | 28% | 150 | 0 | 0 | 162 | 0 | 220 |
| Brushy Creek | 4,717 | 815 | 0% | 13 | 0 | 0 | 802 | 8,842 | -4,939 |
| Craigieburn | 1,196 | 146 | 0% | 2 | 0 | 0 | 143 | 0 | 1,051 |
| Healesville | 463 | 130 | 0% | 0 | 0 | 0 | 130 | 0 | 333 |
| Lilydale | 2,616 | 440 | 2% | 50 | 0 | 0 | 389 | 0 | 2,176 |
| Monbulk | 21 | 0 | 0% | 0 | 0 | 0 | | 0 | 21 |
| Upper Yarra | 1,026 | 202 | 0% | 0 | 0 | 0 | 202 | 0 | 824 |
| Wallan | 605 | 264 | 44% | 63 | 201 | 0 | | 0 | 341 |
| Whittlesea | 259 | 118 | 36% | 93 | 0 | 0 | 25 | 0 | 141 |
| **Total 2010–11** | **11,435** | **2,425** | **5%** | **371** | **201** | **0** | **1,854** | **8,842** | **168** |
| Total 2009–10 | 9,557 | 2,639 | 7% | 467 | 249 | 0 | 1,923 | 6,918 | 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 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.

## 24.11 Water for the environment

### 24.11.1 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 EWR. The Yarra River between Warburton and Warrandyte has been identified as a Victorian heritage river and also depends on the EWR.

In 2010–11 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 including operation of licensed diversions with passing flow conditions
- all other water in the basin not allocated for consumptive use: that is water above the cap.

### 24.11.2 Environmental entitlements

The Yarra River Environmental Entitlement was granted to the Minister for Environment in 2006. The entitlement consists of passing flows, 55 ML of unregulated flows, and 17,000 ML of regulated entitlement. Due to the ongoing water shortage in Melbourne, 2010–11 was the first time that this entitlement could be accessed. Water that was previously qualified from the entitlement was fully returned to the environment with the revoking of the qualification of rights in October 2010.

No environmental releases were made from the Yarra River Environmental Entitlement in 2010–11.

### 24.11.3 Passing flow compliance

Bulk entitlements require passing flows to be met at some points in the basin.

All passing flow requirements were complied with for the Yarra basin in 2010–11.

Table 24-11 shows some passing flow requirements in the Yarra basin for selected compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest. The location of these compliance points is presented in Figure 24-2.

#### Table 24-11 Selected passing flow compliance in the Yarra basin at selected sites

| River | Passing flow | |
|---|---|---|
| Yarra River | Instrument where passing flows are specified | Yarra River Environmental Entitlement 2006 |
| | Responsible authority | Melbourne Water |
| | Compliance point | Upper Yarra Reservoir to Yarra River: Upper Yarra Reservoir (shown as 1 in Figure 24-2) |
| | Passing flow compliance | Flows of 10 ML per day were passed downstream of Upper Yarra Reservoir |
| | Compliance point | Yering Gorge Pump Station (shown as 2 in Figure 24-2) |
| | Passing flow compliance | Passing flow requirements were qualified until 12 October 2010, with Melbourne Water meeting the qualified requirements<br>• Flows of 150 ML per day were passed downstream of Yering Gorge Pump Station<br>Normal passing flow rules resumed after the qualification was revoked, Melbourne Water met these requirements<br>• Flows of 350 ML/day are required to be passed downstream of Yerring Gorge Pump Station between June and November<br>• Flows of 200 ML/day are required to be passed downstream of Yerring Gorge Pump Station between December and May |

### 24.11.4 Streamflow management plans

The following streamflow management plans (SFMPs) are approved and were in operation in 2010–11:

- Diamond Creek SFMP
- Hoddles Creek SFMP
- Olinda Creek SFMP
- Plenty River SFMP
- Stringybark Creek SFMP
- Pauls, Steels and Dixons creeks SFMP.

Development of the Woori Yallock Creek WSPA SFMP and the Little Yarra and Don Rivers WSPA SFMP continued in 2010–11. Currently these SFMPs are in draft form awaiting final approval.

# 25 Maribyrnong basin

This chapter sets out the accounts for the Maribyrnong basin. For detailed information about how they were compiled, refer to Chapter 5.

## 25.1 Maribyrnong basin summary

The Maribyrnong basin experienced rainfall between 125% and 200% of the long-term average in 2010–11. Catchment inflows were 249,400 ML, more than double the long-term average of 113,000 ML and 10 times greater than the volume of inflows in 2009–10.

Rosslynne Reservoir showed significant recovery, increasing from 1,200 ML (5% of capacity) at the beginning of the year to 16,700 ML (66% of capacity) by the end of June 2011.

All Western Water and City West Water towns in the basin began the year on Stage 3 restrictions, and were eased to Stage 2 restrictions in spring.

Southern Rural Water's licensed diverters on the regulated Maribyrnong River had access to their full licence volume after successive years of 0% allocation.

Long-running bans on licensed diversions from unregulated rivers and creeks were removed in August and September.

## 25.2 Responsibilities for management of water resources

Table 25-1 shows the responsibilities of various authorities within the Maribyrnong basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 25-1 Responsibilities for water resources management within the Maribyrnong basin, 2010–11

| Authority | Irrigation and rural water supply | 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<br>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<br>Obliged to meet passing flow requirements |

Note:
(1) Melbourne is mostly supplied from the Yarra and Thomson basins.

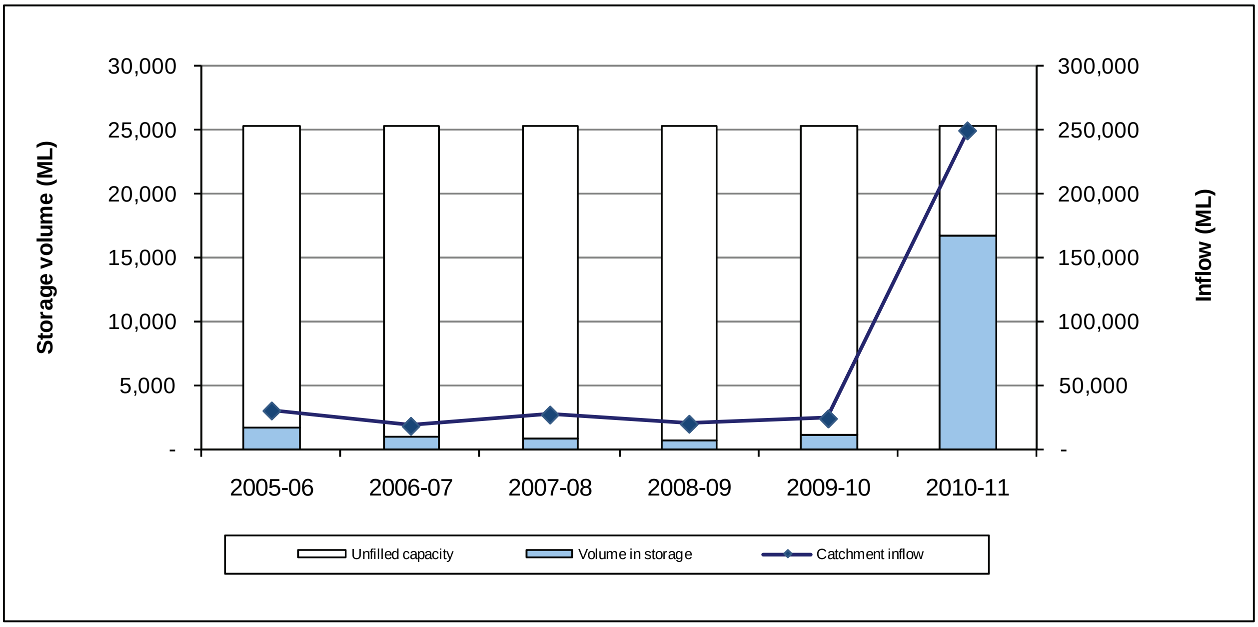
## 25.3 Rainfall, flows and storages in 2010–11

Most of the Maribyrnong basin experienced rainfall between 125% and 200% of the long-term average in 2010–11. Catchment inflows were 249,400 ML, more than double the long-term average of 113,000 ML and 10 times greater than the volume of inflows in 2009–10 inflows.

The amount of water flowing into Port Phillip Bay in 2010–11 was 222,200 ML, compared to 9,100 ML in 2009–10. This represents 90% of the catchment inflows into the basin.

Rosslynne Reservoir, with a capacity of 25,368 ML, is the only storage larger than 1,000 ML located within the basin. The storage volume increased from 1,200 ML (5% of capacity) at the start of July 2010 to 16,700 ML (66% of capacity) by the end of June 2011.

**Figure 25-1 All major storages and catchment inflows in the Maribyrnong basin**




## 25.4 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 25-2.

An overview of the methodology used to derive the information presented in this chapter is set out in Chapter 5.

**Table 25-2 Summary of total water resources and water use in the Maribyrnong basin, 2010–11**

| Water source | Total water resource (ML) | Total use (ML) |
|---|---|---|
| Surface water | 253,300 | 9,400 |
| Groundwater(1)(2) | 1,600 | 170 |
| Recycled water | 3,530 | 1,200 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 25-6 and the estimated domestic and stock use presented in Table 25-7.

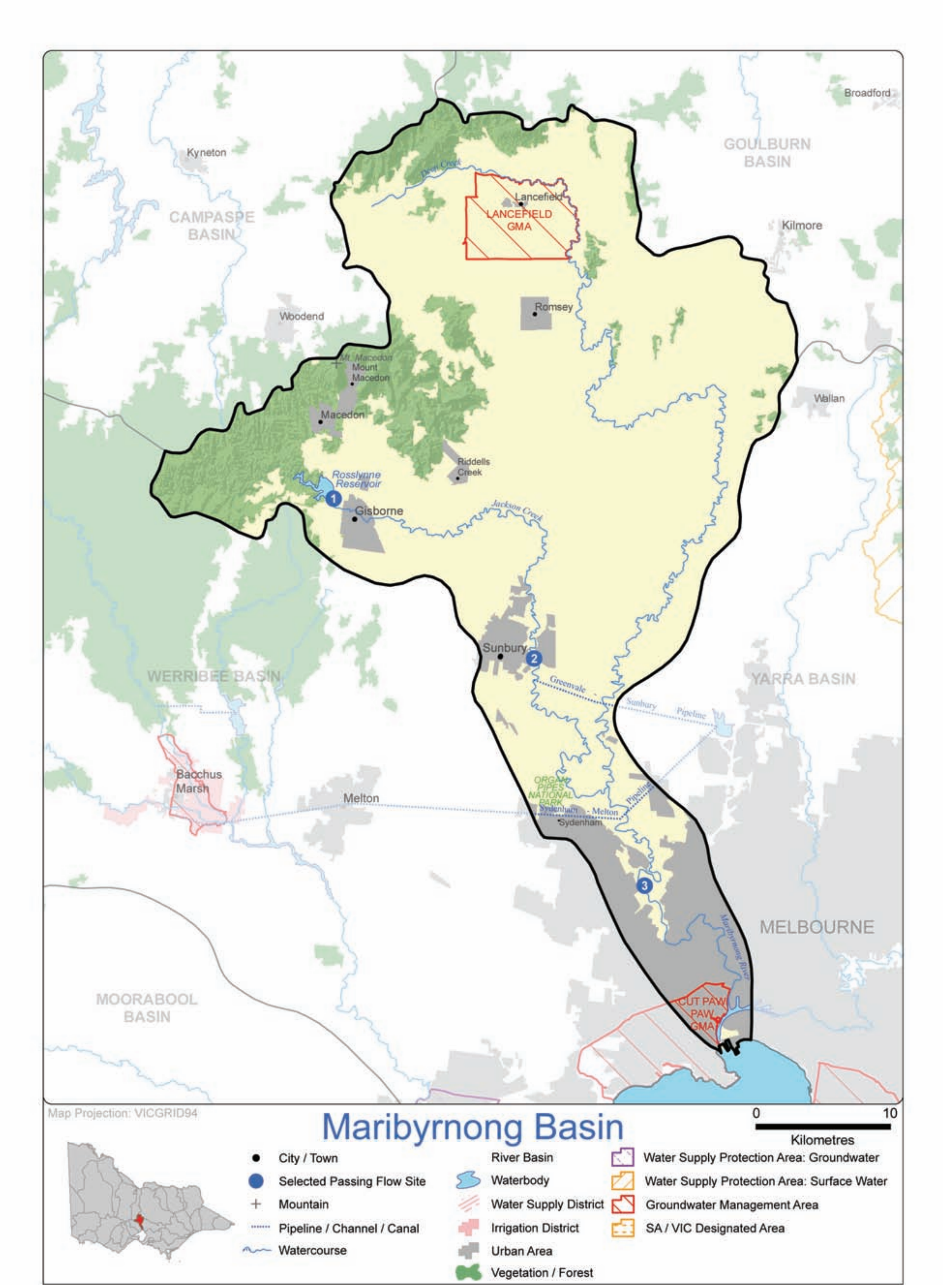
(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

### 25.4.1 Infrastructure projects to improve water availability

To increase supply capacity, Western Water installed a new 10 ML clear water storage tank at Rosslynne Water Treatment Plant. The project commenced in February 2010 and was completed in June 2011.

## 25.5 Location of water resources

### Figure 25-2 Map of the Maribyrnong basin



## 25.6 Surface water resources

### 25.6.1 Water balance

A surface-water balance for the Maribyrnong basin is shown in Table 25-3.

Urban areas within the Maribyrnong basin do not rely heavily on the water resources of the basin. Towns within the Melbourne metropolitan area are supplied from the Melbourne headworks system located in the Yarra, Thomson and Bunyip basins. This is the first of several years that the basin's local sources of water (for example Rosslynne Reservoir) have received high inflows. For several towns within the Maribyrnong basin, Western Water typically sources water under its Melbourne headworks system bulk entitlement. This volume is reported in the Yarra basin chapter. Small-catchment dams were estimated to be the largest diversion of water in the Maribyrnong basin in 2010–11.

#### Table 25-3 Balance of surface water in the Maribyrnong basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | 1,200 | 800 |
| Volume in storage at end of year | 16,700 | 1,200 |
| **Change in storage** | **15,500** | **400** |
| **Inflows** | | |
| Catchment inflow(1) | 249,400 | 24,200(4) |
| Rainfall on major storages | 1,200 | 300(4) |
| Transfers from other basins | - | - |
| Return flow from irrigation | - | - |
| Treated wastewater discharged back to river | 2,680 | 1,020 |
| **Sub-total** | **253,300** | **25,400**(4) |
| **Usage** | | |
| Urban diversions | 1,050 | 1,100 |
| Licensed diversions from regulated streams | 100 | 300 |
| Licensed diversions from unregulated streams | 400 | 400 |
| Small-catchment dams(2) | 7,800 | 7,800 |
| **Sub-total** | **9,400** | **9,600** |
| **Losses** | | |
| Evaporation losses from major storages | 400 | 400(4) |
| Evaporation from small-catchment dams(2) | 4,800 | 4,800 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(3) | 1,000 | 1,200 |
| **Sub-total** | **6,200** | **6,400**(4) |
| **Water passed at outlet of basin** | | |
| River outflows to Port Phillip Bay | 222,200 | 9,100 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Data for water usage from small-catchment dams is provided by DSE. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(3) Losses were estimated using loss functions from the Maribyrnong REALM.

(4) Some elements of the 2009–10 water balance have been revised since the publication of the Victorian Water Accounts 2009–2010. These changes result from updated storage ratings and climate data.

### 25.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 25-4 are based on the estimates from DSE for an average year as per Chapter 5.

#### Table 25-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 5,800 | 2,900 | n/a |
| Registered commercial and irrigation | 5,800 | 4,900 | n/a |
| **Total** | **11,600** | **7,800** | **12,600** |

n/a: No information available

### 25.6.3 Water entitlement trades

For the fourth consecutive year, there were no trades of water entitlements within the basin or across basin boundaries.

### 25.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 25-5. Compliance with individual bulk entitlement volumes was deemed to have occurred if water diverted was not more than the maximum volume allowed to be diverted in 2010–11.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

#### Table 25-5 Volume of water diverted under surface water entitlements in the Maribyrnong basin

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML)(1) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance? (2) |
|---|---|---|---|---|---|
| *Western Water* | | | | | |
| Gisborne – Barringo Creek | 5 | 320 | 0 | 0 | Yes |
| Lancefield | 1 | 315 | 0 | 177 | Yes |
| Macedon and Mt Macedon(3) | 5 | 645 | 0 | 452 | Yes |
| Riddells Creek | 1 | 300 | 0 | 44 | Yes |
| Romsey | 1 | 460 | 0 | 307 | Yes |
| Maribyrnong (Rosslynne Reservoir) | 5 | 6,100 | 0 | 73 | Yes |
| *Melbourne Water* | | | | | |
| Maribyrnong | 5 | 1,396 | 0 | 114 | Yes |
| *Southern Rural Water* | | | | | |
| Maribyrnong | 5 | 382 | 0 | 0 | Yes |
| **Total annual volume of bulk entitlements 2010–11** | | **9,918** | **0** | **1,167** | |
| Total annual volume of bulk entitlements 2009–10 | | 9,918 | 0 | 1,363 | |
| *Licensed diversions from unregulated streams 2010–11* | | *2,011* | *0* | *402* | |
| *Licensed diversions from unregulated streams 2009–10* | | *1,795* | *0* | *427* | |

Notes:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one-year) period in the bulk entitlement, divided by the number of years in that period.

(2) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

(3) Average bulk entitlement volume over 5 year period is 645 ML per year, but up to 873 ML can be diverted in any one year.

## 25.7 Groundwater resources

The Maribyrnong basin contains the whole Lancefield GMA and part of the Cut Paw Paw GMA. Licensed groundwater entitlements and use for these GMAs in the Maribyrnong basin, excluding domestic and stock use, are presented in Table 25-6. Groundwater levels in the Lancefield GMA are stable. There are insufficient observation bores available to determine a trend for the Cut Paw Paw GMA. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

Reported groundwater use in the Maribyrnong basin decreased significantly in 2010–11, compared to 2009–10. This is largely as a result of decreased extractions from the Lancefield GMA in 2010–11.

#### Table 25-6 Licensed groundwater volumes, Maribyrnong basin 2010–11

| WSPA/GMA(1) | GMA/WSPA depth limits(2) (m) | Entitlement limit (ML/year))(3) | Licensed entitlement(4) (ML/year) | Metered use (ML) | Estimated use in unmetered bores (ML)(5) | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Cut Paw Paw GMA (21%) | >50 | 777 | 110 | 6 | - | 6 | 6 |
| Lancefield GMA (100%) | All depths | 1,485 | 1,390 | 51 | - | 51 | 293 |
| **Total(6)** | | **2,262** | **1,499** | **58** | **-** | **58** | **299** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.
(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11.
(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.
(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.
(6) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 25-7.

### Table 25-7 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores(1)(2) | Estimated domestic and stock use (assuming 1.5 ML per bore (3)) (ML)(4) |
|---|---|---|
| Cut Paw Paw GMA (21%) | 0 | 0 |
| Lancefield GMA (100%) | 76 | 114 |
| **Total** | **76** | **114** |

Notes:

(1) 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 25-6.
(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(3) Estimated domestic and stock use calculated using a factor of 1.5 ML per bore for Southern Rural Water GMUs. For other authorities, the factor is 2 ML.
(4) Total volumes are based on the sum of management unit data before rounding.

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 25-8.

### Table 25-8 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Lancefield | 294 | 12 | 111 |
| Romsey | 600 | 0 | 0 |
| **Total** | **894** | **12** | **111** |

## 25.8 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers, licensed diversions from unregulated streams, irrigation and regulated diversions are presented in Table 25-9. Western Water's towns were subject to the same restrictions as Melbourne, as supply to these towns is supplemented from the Melbourne system. All Western Water and City West Water towns in the basin began the year on Stage 3 restrictions, and were eased to Stage 2 restrictions in spring.

Irrigation bans for licensed diversions from unregulated streams continued from 2009–10 for several streams, but were removed in August and September.

### Table 25-9 Seasonal allocations and restrictions on water use in Maribyrnong basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Urban | Rosslynne supply system towns including Sunbury, Romsey, Macedon, Mt Macedon, Riddells Creek, Gisborne and Lancefield | Stage 3 restrictions from 1 July 2010 to 14 October 2010, Stage 2 restrictions from 15 October 2010 to 30 June 2011 |
| | City West Water customers | Stage 3 restrictions from 1 July 2010 to 31 August 2010, Stage 2 from 1 September 2010 to 30 June 2011 |
| Licensed diversions from unregulated streams | Bolinda Creek, Riddells Creek | Irrigation ban from July to August 2010 |
| | Barringo Creek, Witch Creek | Irrigation ban from July to September 2010 |
| | Maribyrnong River | Winterfill ban in July 2010 and from November 2010 to June 2011 |
| Regulated diversions | Jacksons Creek | Allocation against licence volume increased from 0% to 25% in |

| | | |
|---|---|---|
| (Southern Rural Water) | | November 2011, and reached 100% in April 2011 |
| Regulated diversions (Melbourne Water) | Maribyrnong River | Allocation against licence volume remained at 0% all year: however, access to unregulated flows was allowed from January to June 2011. |

## 25.9 Recycled water

All wastewater treatment plants within the basin are operated by Western Water. Overall, 18% of the wastewater was reused in 2010–11, a decrease of 27% on the proportion reused in 2009–10. There was an increase in the volume of water produced but a decrease in the volume of water recycled in 2010–11, compared to 2009–10.

### Table 25-10 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 (ML)(3) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation(1) | Within process(2) | | |
| Gisborne | 551 | 362 | 6% | 34 | 0 | 0 | 328 | 352 | -163 |
| Riddells Creek | 263 | 19 | 7% | 3 | 15 | 0 | 1 | 256 | -12 |
| Romsey | 525 | 217 | 41% | 25 | 192 | 0 | 0 | 308 | 0 |
| Sunbury | 2,192 | 598 | 16% | 166 | 185 | 0 | 247 | 1,760 | -166 |
| **Total 2010–11** | **3,531** | **1,196** | **18%** | **229** | **392** | **0** | **575** | **2,676** | **-341** |
| Total 2009–10 | 2,803 | 1,897 | 45% | 470 | 805 | 0 | 622 | 1,021 | -115 |

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 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.

## 25.10 Water for the environment

### 25.10.1 Environmental Water Reserve

Important environmental assets such as the Australian Grayling and native grassland depend on the Maribyrnong EWR.

In 2010–11 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: that is, water above cap.

### 25.10.2 Passing flow compliance

Some bulk entitlements require passing flows to be met at some points in the basin.

All passing flow requirements were complied with for the Maribyrnong basin in 2010–11.

Table 25-11 shows the passing flow requirements in the Maribyrnong basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest.

### Table 25-11 Selected passing flow requirements in the Maribyrnong basin

| River | Passing flow | |
|---|---|---|
| Maribyrnong River, Jacksons Creek | Instrument where passing flows are specified | Bulk Entitlement (Maribyrnong – Southern Rural Water) Conversion Order 2000, amended 2004 |
| | Responsible authority | Southern Rural Water |
| | Compliance point | Gisborne gauging station (shown as 1 in Gisborne gauging station (shown as 1 in Figure 25-2) |
| | Passing flow compliance | The lesser of 3 ML per day or natural flow was passed |
| | Compliance point | Sunbury gauging station (shown as 2 in Sunbury gauging station (shown as 2 in Figure 25-2) |
| | Passing flow compliance | The lesser of 10 ML per day or natural flow was passed |
| | Compliance point | Keilor gauging station (shown as 3 in Keilor gauging station (shown as 3 in Figure 25-2) |
| | Passing flow compliance | The lesser of 5 ML per day or natural flow was passed |

### 25.10.3 Streamflow management plans

No further work was undertaken in preparation for the development of an SFMP for the upper Maribyrnong River. Instead, the need for a SFMP in the Maribyrnong River will be reviewed as part of the Central Region Sustainable Water Strategy Review.

# 26 Werribee basin

This chapter sets out the accounts for the Werribee basin. For detailed information about how they were compiled, refer to Chapter 5.

## 26.1 Werribee basin summary

The Werribee basin experienced rainfall between 125% and 200% of the long-term average in 2010–11. Catchment inflows were 267,000 ML, more than double the long-term average of 102,000 ML and 12 times greater than the volume of inflows in 2009–10.

Major storages showed significant recovery, increasing from 7,500 ML (11% of capacity) at the beginning of the year to 64,400 ML (92% of capacity) by the end of June 2011.

Western Water relied less heavily on Melbourne's supplies to supply its towns, including Melton and Bacchus Marsh. These towns were subject to Stage 3 restrictions until October 2010, when restrictions were reduced to Stage 2 in line with Melbourne. Stage 3 restrictions were eased to lower levels in spring and removed in summer for Central Highlands Water towns supplied from the Ballarat system. Towns supplied from Central Highlands Water's Blackwood system remained on Stage 3 restrictions all year.

Allocations in the Werribee System reached 100% for high-reliability water shares, and 55% for low-reliability water shares, in 2010–11, after successive years of very low allocations.

Bans on licensed diversions from Kororoit Creek and the Lerderderg River that had been in place since 2006 were removed in October 2010.

Entitlements in the Deutgam WSPA were qualified during the year, restricting groundwater access around Werribee.

## 26.2 Responsibilities for management of water resources

Table 26-1 shows the responsibilities of various authorities within the Werribee basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 26-1 Responsibilities for water resources management within the Werribee basin, 2010–11

| 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<br>Obliged to meet passing flow requirements |
| Western Water | | | Supplies towns in the north of the basin including Melton and Bacchus Marsh | Operates Djerriwarrh Reservoir<br>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<br>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 |

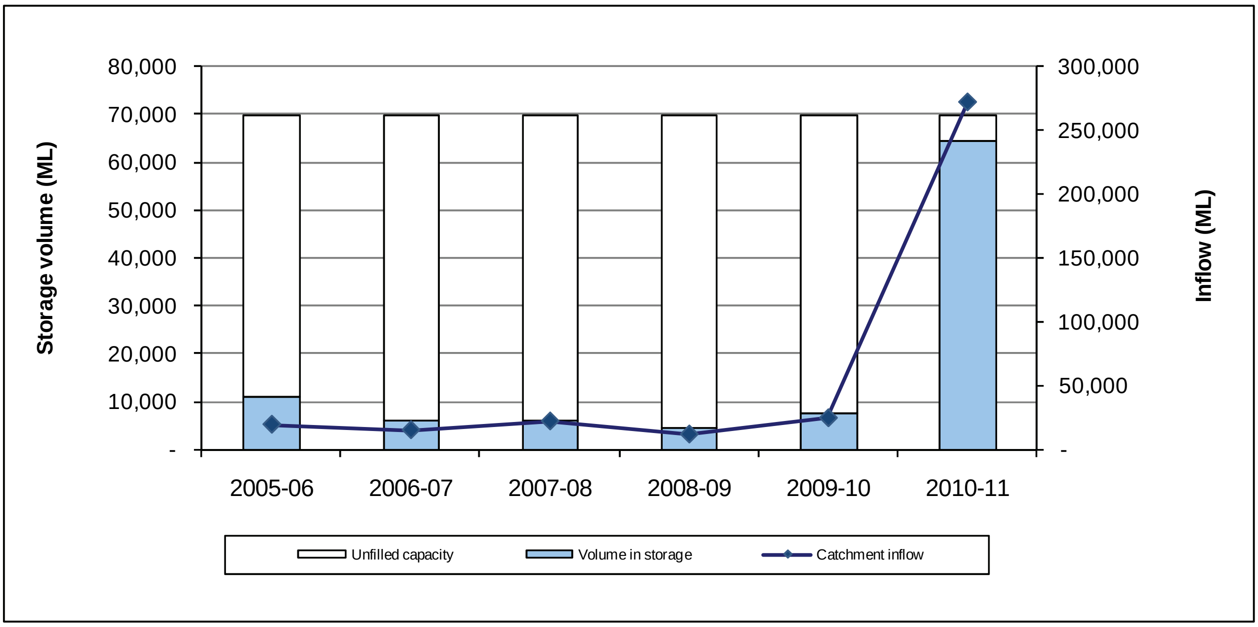
## 26.3 Rainfall, flows and storages in 2009–10

In 2010–11, rainfall in the Werribee basin ranged between 125% and 200% of the long-term average. Catchment inflows were 267,000 ML, or 262% of the long-term average of 102,000 ML. This was significantly higher than 2009–10 inflows of 22,300 ML.

In 2010–11, 178,000 ML of water flowed from the Werribee basin into Port Phillip Bay. This represents 67% of the catchment inflows into the basin. About 600 ML flowed into Port Phillip Bay in 2009–10.

Storage levels for all major storages (greater than 1,000 ML capacity) in the basin increased from 7,500 ML in July 2010 to 64,400 ML (92% of capacity) by June 2011. 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 26-1 All major storages and catchment inflows in the Werribee basin**




## 26.4 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 26-2.

**Table 26-2 Summary of total water resources and water use, Werribee basin, 2010–11**

| Water source | Total water resource (ML) | Total use (ML) |
|---|---|---|
| Surface water | 276,400 | 22,600 |
| Groundwater**(1)** (2) | 6,000 | 490 |
| Recycled water | 190,270 | 33,020 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 26-8 and the estimated domestic and stock use presented in Table 26-9.

(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

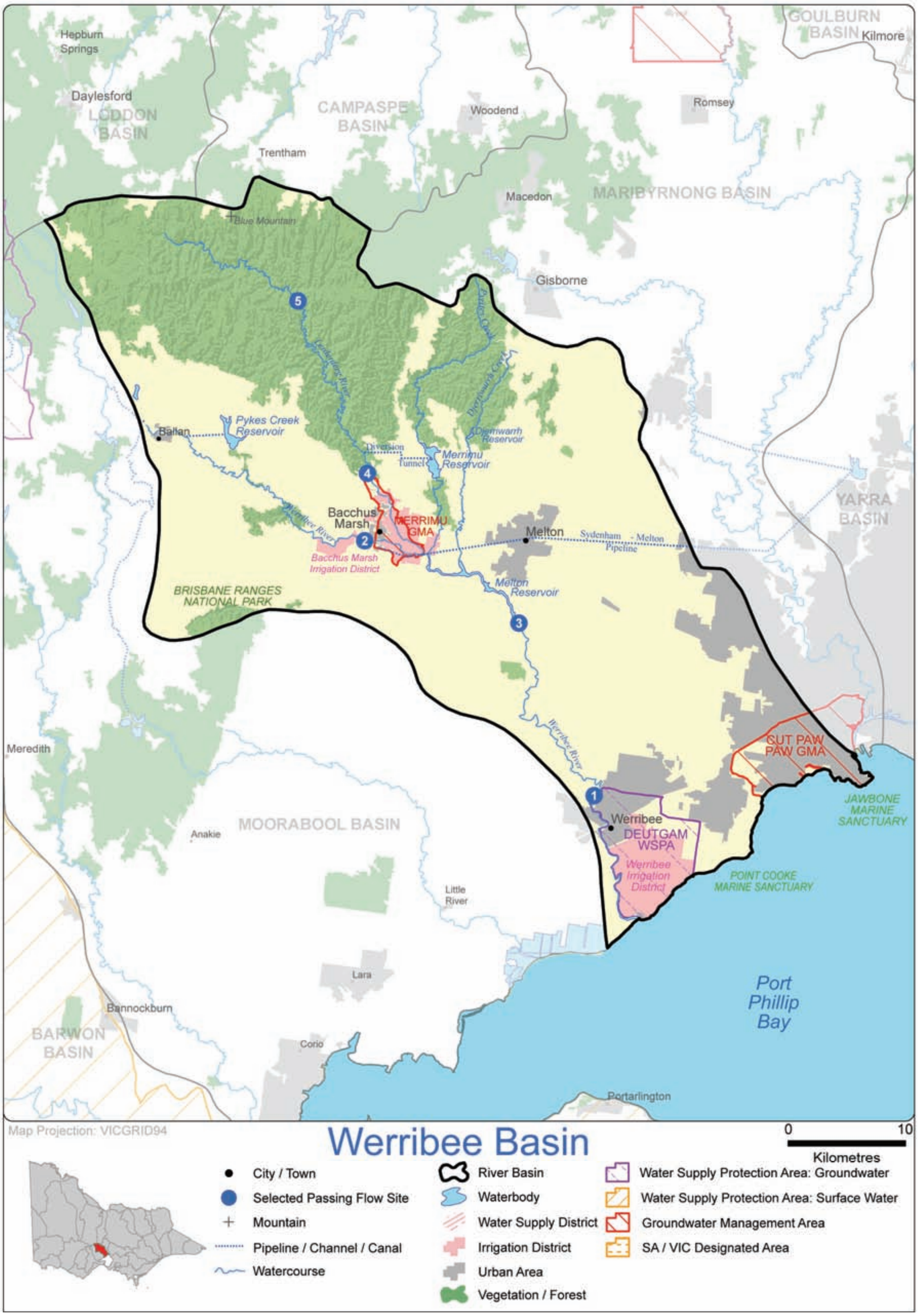
### 26.4.1 Infrastructure projects to improve water availability

To increase supply capacity, Western Water installed a new 10 ML clear water storage tank at the Merrimu Water Treatment Plant. The project commenced in February 2010 and was completed in June 2011.

Barwon Water began work on the Melbourne to Geelong pipeline which will create a new water resource for Geelong by connecting it to Melbourne’s supply at Werribee. A new pump station and pipeline to Geelong are required. The project commenced in September 2010 and is expected to be complete in early 2012. Works undertaken in 2010–11 include constructing a 31-km pipeline, connecting pipe works at Werribee, and starting work on the pump station.

## 26.5 Location of water resources

### Figure 26-2 Map of the Werribee basin



## 26.6 Surface water resources

### 26.6.1 Water balance

A surface-water balance for the Werribee basin is shown in Table 26-3. 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, storages that are greater than 1,000 ML include the Melton, Merrimu and Pykes Creek reservoirs.

#### Table 26-3 Balance of surface water in the Werribee basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | 7,500 | 4,400 |
| Volume in storage at end of year | 64,400 | 7,500 |
| **Change in storage** | **56,900** | **3,100** |
| **Inflows** | | |
| Catchment inflow(1) | 267,000 | 24,300(5) |
| Rainfall on major storages | 2,800 | 700(5) |
| Transfers from other basins(2) | 0 | 737 |
| Return flow from irrigation | - | - |
| Treated wastewater discharged back to river | 6,570 | 0 |
| **Sub-total** | **276,400** | **25,700**(5) |
| **Usage** | | |
| Urban diversions | 1,860 | 320 |
| Irrigation district diversions and licensed diversions from regulated systems | 11,100 | 1,200 |
| Licensed diversions from unregulated streams | 300 | 300 |
| Small-catchment dams(3) | 9,300 | 9,300 |
| **Sub-total** | **22,600** | **11,100** |
| **Losses** | | |
| Evaporation losses from major storages | 1,700 | 1,700(5) |
| Evaporation from small-catchment dams(3) | 5,400 | 5,400 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(4) | 11,800 | 3,800 |
| **Sub-total** | **18,900** | **10,900**(5) |
| **Water passed at outlet of basin** | | |
| River outflows to Port Phillip Bay | 178,000 | 600 |

Notes:

(1) Inflows have been calculated from outflows plus diversions.

(2) In 2009–10, Southern Rural Water transferred water from its Thomson Macalister bulk entitlement to the Werribee and Bacchus Marsh Irrigation districts under a qualification of rights.

(3) Data for water usage from small-catchment dams is provided by DSE. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(4) Losses were estimated using loss functions from the Werribee REALM.

(5) Some elements of the 2009–10 water balance have been revised since the publication of the Victorian Water Accounts 2009–2010. These changes result from updated storage ratings and climate data.

### 26.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 26-4 below have been estimated by DSE for an average year as outlined in Chapter 5.

#### Table 26-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 5,900 | 2,900 | n/a |
| Registered commercial and irrigation | 7,600 | 6,400 | n/a |
| **Total** | **13,500** | **9,300** | **14,700** |

n/a: No information available

### 26.6.3 Water entitlement trades

Surface water was traded within the Werribee basin in 2010–11 through water share transfers and variations and allocation trade. There was no temporary or permanent trade of bundled entitlements within the basin in this year. There was no net trade of water into the Werribee basin in 2010–11.

Table 26-5 summarises the trade of water shares into and out of the Werribee basin delivery systems in 2010–11.

### Table 26-5 Transfers and variations of water shares in the Werribee basin 2010–11 (1), (2)

| Delivery system | High-reliability water shares | | | Low-reliability water shares | | |
|---|---|---|---|---|---|---|
| | Source(3) (ML) | Destination (3) (ML) | Net into basin (ML) | Source(3) (ML) | Destination(3) (ML) | Net into basin (ML) |
| Bacchus Marsh irrigation district | 200 | 200 | 0 | 93 | 93 | 0 |
| Werribee irrigation district | 468 | 468 | 0 | 218 | 218 | 0 |
| Werribee River | 4 | 4 | 0 | 0 | 0 | 0 |
| **Total 2010–11** | **673** | **673** | **0** | **310** | **310** | **0** |
| Total 2009–10 | 742 | 742 | 0 | 356 | 356 | 0 |

Notes:

(1) This table summarises all recorded water share transfers and variations in the Werribee basin delivery systems in 2010–11. Trades that were in progress at the end of the year will be finalised in 2011–12.

(2) Transfer applications result in a change of ownership. In some cases, the ownership change occurs with a transfer of land. Transfers of ownership that are part of a water and land sale are also included in this table. Variations do not involve a change of ownership.

(3) The Source column is the use location of the water share before the trade or variation: the Destination column is the use location afterwards. Use locations are reported here as grouped nominated delivery systems. A positive number for Net into basin means that a greater volume of water shares have nominated that use location than have nominated a use location outside the group.

Table 26-6 summarises the trade of allocation in Victoria's share of the Werribee basin in 2010–11. The only trade in allocation that occurred in this year was within the Werribee basin.

### Table 26-6 Allocation trade in the Werribee basin (1), (2)

| Allocation trade type | Volume traded 2010–11 (ML) | Volume traded 2009–10 (ML) |
|---|---|---|
| Trade within Werribee basin | 633 | 68 |
| Trade from other Victorian basins | 0 | 0 |
| Trade to other Victorian basins | 0 | 0 |
| Interstate trade – inbound | 0 | 0 |
| Interstate trade – outbound | 0 | 0 |
| **Total trade in the Werribee basin** | **633** | **68** |
| **Net trade into the Werribee basin** | **0** | **0** |

Notes:

(1) This table summarises allocation trades approved into, out of and within the Victorian Werribee basin trading zones ( Zone 31AD Bacchus Marsh District, Zone 31 BR Lower Werribee Diverters, Zone 31 BD Werribee District and Zone 31AR Upper Werribee Diverters) compared to trade in other Victorian and interstate basins. Data on allocation trade between New South Wales and South Australian basins is not relevant to this report and therefore not included.

(2) In a pool exchange, some sellers (say 20) sell to some buyers (say 15) at the pool price. Administratively, this is implemented in the water register as 20 trades to a clearing account and then 15 trades from that clearing account. To avoid double counting, only the seller side is counted (that is, it counts as 20 trades).

## 26.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 26-7. Compliance with individual bulk entitlement volumes was deemed to have occurred if water diverted was not more than the maximum volume allowed to be diverted in 2010–11.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

### Table 26-7 Volume of water diverted under surface water entitlements in the Werribee basin

| Bulk entitlement | Bulk entitlement period (years) | Average bulk entitlement over period (ML per year)(1) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance? |
|---|---|---|---|---|---|
| *Central Highlands Water* | | | | | |
| Ballan | 1 | 451 | 0 | 0 | Yes |
| Blackwood and Barry's Reef | 1 | 140 | 0 | 31 | Yes |
| *Western Water* | | | | | |
| Myrniong | 1 | 58 | 0 | 21 | Yes |
| Werribee system – Western Water | 5 | 9,986 | 0 | 1,804 | Yes |
| *Southern Rural Water* | | | | | |
| Werribee system – Irrigation | 5 | 27,040 | 0 | 11,103 | Yes |
| *Minister for Environment* | | | | | |
| Werribee River | 1 | -(2) | 0 | 0 | Yes |
| **Total annual volume of bulk entitlements 2010–11** | | **37,675** | **0** | **12,958** | |
| Total annual volume of bulk entitlements 2009–10 | | 37,675 | 0 | 1,482 | |
| *Licensed diversions from unregulated streams 2010–11* | | *1,109* | *0* | *296* | |
| *Licensed diversions from unregulated streams 2009–10* | | *1,244* | *0* | *282* | |

Notes:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one-year) period in the bulk entitlement, divided by the number of years in that period.

(2) The Werribee River Environmental Entitlement consists of a 10% share of inflows into storage, with the actual volume available in any year varying depending upon inflow conditions.

\- Not applicable

## 26.7 Groundwater resources

A summary of the licensed entitlements and use from GMUs within the Werribee basin, excluding domestic and stock use, is presented in Table 26-8.

The Werribee basin contains the whole Deutgam WSPA and Merrimu GMA as well as part of the Cut Paw Paw GMA. Groundwater levels in the Deutgam WSPA were increasing and levels for Merrimu GMA were declining. Insufficient observation bores were available to determine water levels trends for the Cut Paw Paw GMA. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

Licensed groundwater use across the Werribee basin increased by approximately 77% in 2010–11, compared to 2009–10. The Deutgam WSPA was subject to a total use ban for the beginning of 2010–11, which was reduced to 75% by the end of the reporting period. The ability to extract groundwater in the Deutgam WSPA at the end of 2010–11 accounts for the large increase in groundwater use.

### Table 26-8 Licensed groundwater volumes, Werribee basin 2010–11

| WSPA/GMA(1) | GMA/WSPA depth limits(2) (m) | Entitlement limit(3) (ML/year) | Licensed entitlement(4) (ML/year) | Metered use (ML) | Estimated use in unmetered bores (ML)(5) | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Cut Paw Paw GMA (79%) | >50 | 2,873 | 405 | 24 | - | 24 | 19 |
| Merrimu GMA (100%) | ≤30 | 451 | 440 | 177 | - | 177 | 217 |
| Deutgam WSPA (100%) | ≤30 | 3,823 | 5,097 | 244 | - | 244 | 15 |
| **Total(6)** | | **7,147** | **5,943** | **445** | **-** | **445** | **251** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11. The Deutgam WSPA was subject to a total use ban from 1July 2010, moving to 75% by the end of the season.

(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.

(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.

(6) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 26-9.

### Table 26-9 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores(1)(2) | Estimated domestic and stock use (assuming 1.5 ML per bore (3)) (ML)(4) |
|---|---|---|
| Cut Paw Paw GMA (79%) | 0 | 0 |
| Merrimu GMA (100%) | 14 | 21 |
| Deutgam WSPA (100%)(5) | 180 | 18 |
| **Total** | **194** | **39** |

Notes:

(1) 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 26-8.

(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Estimated domestic and stock use was calculated using a factor of 1.5 ML per bore for Southern Rural Water GMUs, except for Deutgam WSPA which used a factor of 0.1 ML per bore (as domestic and stock use was banned in the first half of the year in this area). For other authorities, the factor is 2 ML/bore.

(4) Total volumes are based on the sum of management unit data before rounding.

(5) Rights on extractions from Deutgam WSPA qualified in 2010–11, including for domestic and stock use.

In the Werribee basin, groundwater is used as an urban water supply for the township of Blackwood. The licensed entitlements and metered use for this groundwater supply are provided in Table 26-10.

### Table 26-10 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Blackwood | 50 | 0 | 5 |

## 26.8 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers, licensed diversions from unregulated streams, and groundwater extractions are presented in Table 26-11.

With significant improvement in Lake Merrimu storage levels, Western Water did not rely as heavily on Melbourne system supplies for Melton and Bacchus Marsh in 2010–11. These towns were subject to the same level of restrictions as Melbourne, and eased from Stage 3 to Stage 2 in October 2010.

Restrictions were eased to lower levels in spring and removed in summer for Central Highlands Water towns supplied from the Ballarat system. Central Highlands Water towns supplied from the Blackwood system remained on Stage 3 restrictions all year.

Allocations in the Werribee System reached 100% for high-reliability water shares and 55% for low-reliability water shares in 2010–11. This is a significant improvement from the previous four years when allocations for high-reliability entitlements ranged between 5 and 15%.

A ban on licensed diversions from Kororoit Creek and the Lerderderg River that had been in place since 2006 was removed in October 2010.

### Table 26-11 Seasonal allocations and restrictions on water use in Werribee basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Urban | Ballan (Ballarat supply system) | Stage 3 restrictions for 1 July 2010 to 31 July 2010, Stage 1 restrictions from 1 August 2010 to 31 December 2010 |
| | Barry's Reef and Blackwood | Stage 3 restrictions from 1 July 2010 to 30 June 2011 |
| | Myrniong, Bacchus Marsh and Melton | Stage 3 restrictions from 1 July 2010 to 14 October 2010, Stage 2 restrictions from 15 October 2010 to 30 June 2011 |
| | City West Water customers | Stage 3 restrictions from 1 July 2010 to 31 August 2010, Stage 2 from 1 September 2010 to 30 June 2011 |
| Licensed diversions from unregulated streams | Lerderderg River | Irrigation ban from July to September 2010 |
| | Kororoit Creek | Irrigation ban from July to September 2010 |
| Irrigation and regulated diversions | Werribee system (Werribee irrigation district and Bacchus Marsh irrigation district) | Allocation for high-reliability water shares opened at 6% on 1 July 2010 and reached 100% on 30 November 2010. Allocation for low-reliability water shares reached 55% on 19 April 2011. |
| Groundwater | Deutgam WSPA | Extractions were fully restricted from 1 July 2010 and moved to 75% allocation during the latter part of 2010–11. |

## 26.9 Recycled water

Five wastewater treatment plants operate within the Werribee basin. The volume of wastewater produced in 2010–11 was 190,269 ML, an increase of 33,299 ML compared to 2009–10. Thirty-seven per cent of wastewater was reused in 2010–11 which has decreased slightly from 2009–10. An additional 427 ML of water was treated in 2010–11, compared to 2009–10.

The majority of water recycling in the basin occurs at Melbourne Water's Western Treatment Plant, which reused 17% of wastewater. This included 9,261 ML for on-site irrigation and environmental management and 18,723 ML for habitat management at Ramsar-listed wetlands, which represented a slight increase from 2009–10.

### Table 26-12 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 (ML)(3) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | To retailers | Urban and industrial | Agriculture | Beneficial allocation(1) | Within process(2) | | |
| Altona | 5,496 | 175 | 1% | 0 | 77 | 0 | 0 | 98 | 5,420 | -99 |
| Ballan | 110 | 28 | 26% | 0 | 0 | 28 | 0 | 0 | 81 | 0 |
| Melton | 3,343 | 2,417 | 67% | 0 | 330 | 1,919 | 0 | 168 | 926 | 0 |
| Parwan (Bacchus Marsh) | 576 | 432 | 75% | 0 | 0 | 432 | 0 | 0 | 144 | 0 |
| Western Treatment Plant | 180,745 | 29,972 | 17% | 1,921 | 67 | 9,261 | 18,723 | 0 | 0 | 150,773 |
| **Total 2010–11** | **190,269** | **33,023** | **17%** | **1,921** | **474** | **11,640** | **18,723** | **266** | **6,572** | **150,674** |
| Total 2009–10 | 156,970 | 58,812 | 37% | 12,785 | 281 | 28,291 | 17,199 | 257 | 0 | 98,157 |

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.

## 26.10 Water for the environment

### 26.10.1 Environmental Water Reserve

Important environmental assets, such as the Australian Grayling, Tupong and Red Gums, depend on the Werribee basin EWR.

In 2010–11, 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.

### 26.10.2 Environmental entitlements

The Werribee River Environmental Entitlement was granted to the Minister for Environment in 2011. The entitlement consists of a 10% share of inflows into storage, with the actual volume available in any year depending on inflow conditions.

No environmental releases were made from the Werribee River Environmental Entitlement in 2010–11.

### 26.10.3 Passing flow compliance

Bulk entitlements require passing flows to be met at some points in the basin.

All passing flow requirements were complied with for the Werribee basin in 2010–11.

Table 26-13 shows the passing flow compliance in the Werribee basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest.

### Table 26-13 Selected passing flow compliance in the Werribee basin

| River | Passing flow | |
|---|---|---|
| Werribee River and tributaries | Instrument where passing flows are specified | Bulk Entitlement (Werribee System – Irrigation) Conversion Order 1997 (amended 2005) |
| | Responsible authority | Southern Rural Water |
| | Compliance point | Upper Werribee Diversion Weir (shown as 1 in Figure 26-2) |
| | Passing flow compliance | The lesser of 5 ML per day or the natural inflow were passed downstream of the Upper Werribee diversion weir |
| | Compliance point | Bacchus Marsh Diversion Weir (gauging station) (shown as 2 in Figure 26-2) |
| | Passing flow compliance | The following passing flow rules were applied:<br>• the lesser of 12 ML per day continuous flow (averaged over any seven-day period) or the natural inflow, or<br>• the sum of the lesser of at least 5 ML per day continuous flow or the natural inflow AND other intermittent flows from deliberate releases or spills.<br>Passing flow requirements were met in 2009–10. |
| | Compliance point | Melton Reservoir (shown as 3 in Melton Reservoir (shown as 3 in Figure 26-2)) |
| | Passing flow compliance | Passing flows were based on the following rules for May–August:<br>• the lesser of 15 ML per day continuous flow or the natural inflow if the reservoir is above target for that month, or<br>• the lesser of 15 ML per day (averaged over any 7 day period) or the natural inflow averaged over the same period if the level is at or below the following target for that month:<br>  • targets in May, June and July are 6500 ML, target in August is 9,000 ML<br>  • if the natural flow here is less than 15 ML per day, the passing flow is to be shared between all authorities having a share of Lake Merrimu capacity and their volume of storage will be adjusted accordingly.<br>Passing flow requirements were met in 2009–10. |
| | Compliance point | Below the Lerderderg Diversion Weir (shown as 4 in Figure 26-2) |
| | Passing flow compliance | The storage operator had to release passing flow according to the following passing flow rules:<br>• a low flow equal to the lesser of 30 ML per day and the natural inflow<br>• a fresh flow from June to December inclusive of:<br>  • 150 ML per day up to 5 times a year, and<br>  • 1500 ML per day for 24 hours in 3 out of 4 years if the instantaneous flow at this location exceeds 1500 ML per day.<br>Passing flow requirements were met in 2009–10. |
| | Compliance point | Below Werribee Diversion Weir (shown as 5 in Figure 26-2) |
| | Passing flow compliance | Passing flows were determined according to the following operational tolerances:<br>• 10 ML per day if the declared seasonal allocation for the Werribee irrigation district exceeds 130% of water right<br>• 1 ML per day averaged over any 30 day period, if the declared seasonal allocation for the Werribee irrigation district is equal to or less than 130% of water right.<br>Passing flow requirements were met in 2009–10. |

# 27 Moorabool basin

This chapter sets out the accounts for the Moorabool basin. For detailed information about how they were compiled, refer to Chapter 5.

## 27.1 Moorabool basin summary

Rainfall in the Moorabool basin was generally 25 to 50% above the long-term average. Catchment inflows were 262,800 ML, close to triple the long-term average of 97,000 ML, and over six times greater than inflows in 2009–10.

Storage levels for all major storages in the basin showed significant recovery in 2010–11, increasing from 8,400 ML (27% of capacity) at the beginning of the year to 78,000 ML (90% of capacity) by the end of June 2011. Geelong's storages in the Barwon basin also improved, finishing the year at 69% of capacity.

Barwon Water eased Stage 3 restrictions for the Geelong system to lower levels in spring, and removed restrictions at the end of February. Towns supplied from the Geelong system had been subject to restrictions since July 2006.

Transfers from the Campaspe basin via the Goldfields Superpipe enabled Central Highlands Water to ease Stage 3 restrictions for Ballarat and surrounding towns to Stage 1 early in the year. Central Highlands Water removed restrictions at the end of December following above-average spring rainfall and improved storage levels. Ballarat and surrounds had been subject to restrictions for over five years.

Licensed diversions from the Moorabool River were less severely restricted than in 2009–10. Licensed groundwater use was unrestricted, but decreased by around 70% compared to 2009–10.

## 27.2 Responsibilities for management of water resources

Table 27-1 shows the responsibilities of various authorities within the Moorabool basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 27-1 Responsibilities for water resources management within the Moorabool basin, 2010–11

| Authority | Irrigation and rural water supply | 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<br>Manages Stony Creek Reservoir on Stony Creek<br>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<br>Obliged to meet passing flow requirements |
| Corangamite Catchment Management Authority | | | | Responsible for waterway management in Moorabool 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.

## 27.3 Rainfall, flows and storages in 2010–11

In 2010–11, rainfall in the Moorabool basin was generally between 125% and 150% of the long-term average. This was higher than rainfall in 2009–09, which was between 80 to 125% of the long-term average.

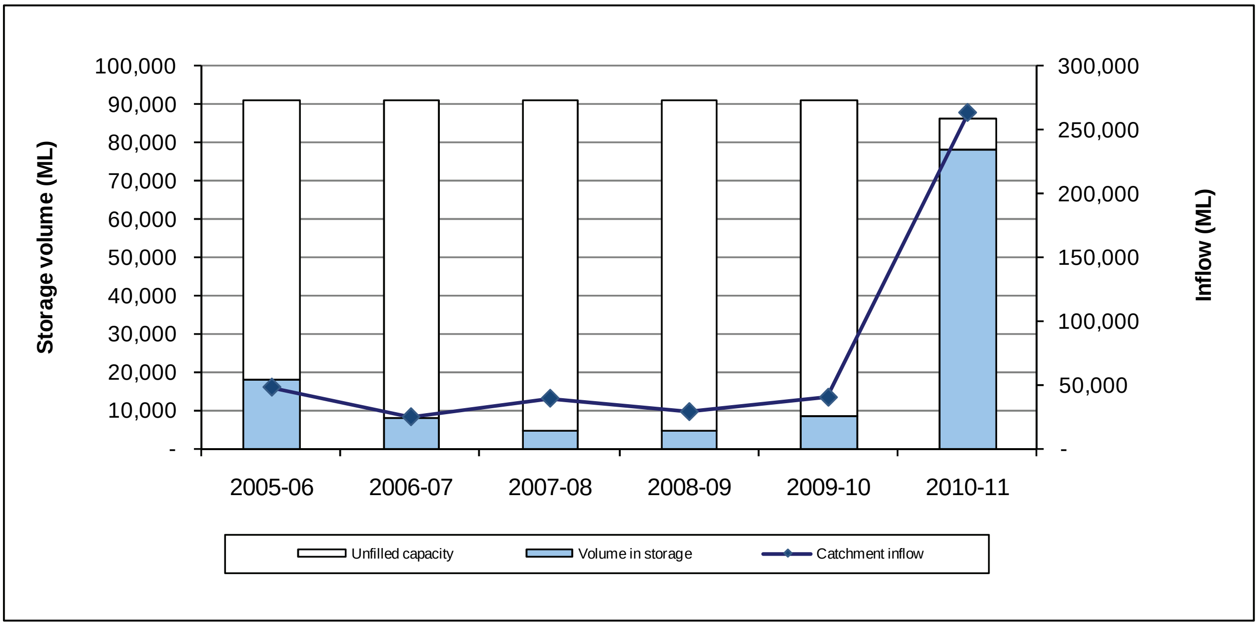
Catchment inflows were 262,800 ML, close to triple the long-term average of 97,000 ML, and over six times greater than inflows in 2009–10.

The amount of water flowing from the Moorabool basin into Port Phillip Bay and the Barwon River was 152,000 ML in 2010–11, or 58% of the catchment inflows into the basin. This is in contrast to outflows in 2009–10, which were very low, at only 1,700 ML.

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 increased from 8,400 ML (27% of capacity) at the beginning of the year, to 78,000 ML (90% of capacity) by the end of June 2011.

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 increased from 7,500 ML in 2009–10 to 70,200 ML in 2010–11.

**Figure 27-1 All major storages and catchment inflows in the Moorabool basin**




## 27.4 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 27-2.

**Table 27-2 Summary of total water resources and water use in the Moorabool basin, 2010–11**

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | 268,500 | 30,400 |
| Groundwater(2) | 3,800 | 740 |
| Recycled water | - | - |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented inTable 27-7 and estimated domestic and stock use presented in Table 27-8.

(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

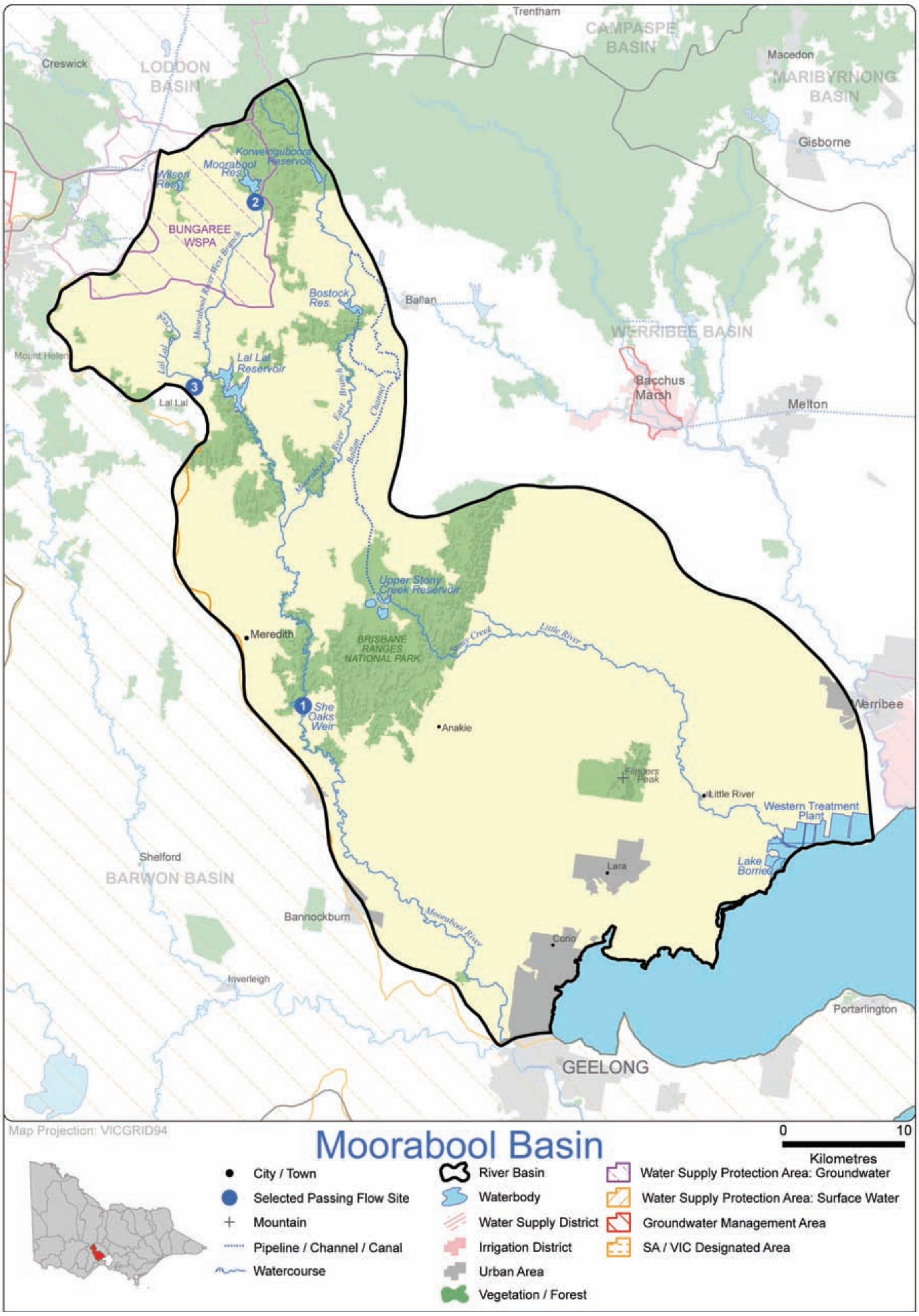
\- Not applicable

### 27.4.1 Infrastructure projects to improve water availability

There were no infrastructure projects to improve water availability within the Moorabool basin in 2010–11.

## 27.5 Location of water resources

### Figure 27-2 Map of the Moorabool basin



## 27.6 Surface water resources

### 27.6.1 Water balance

A surface-water balance for the Moorabool basin is shown in Table 27-3.

The majority of water used for consumptive purposes in the basin was sourced from small-catchment dams.

### Table 27-3 Balance of surface water in the Moorabool basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | 7,500 | 3,400 |
| Volume in storage at end of year | 70,200 | 7,500 |
| **Change in storage** | **62,700** | **4,100** |
| **Inflows** | | |
| Catchment inflow(1) | 262,800 | 40,000(5) |
| Rainfall on major storages | 5,700 | 2,400(5) |
| Transfers from other basins | - | - |
| Return flow from irrigation | - | - |
| Treated wastewater discharged back to river | - | - |
| **Sub-total** | **268,500** | **42,400**(5) |
| **Usage** | | |
| Urban diversions(2) | 3,650 | 450 |
| Transfers to Barwon basin (White Swan Reservoir)(2) | 3,840 | 1,040 |
| Licensed diversions from unregulated streams | 700 | 900 |
| Small-catchment dams(3) | 22,200 | 22,200 |
| **Sub-total** | **30,400** | **24,600** |
| **Losses** | | |
| Evaporation losses from major storages | 5,900 | 3,700 (5) |
| Evaporation from small-catchment dams(3) | 7,300 | 7,300 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(4) | 10,100 | 1,000 |
| **Sub-total** | **23,300** | **12,000** (5) |
| **Water passed at outlet of basin** | | |
| River outflows to Port Phillip Bay (Little River) and other small coastal streams | 111,200 | 1,500 |
| River outflows to the Barwon River (Moorabool River) | 40,900 | 200 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) The urban diversions figure of 3,650 ML represents water diverted from the Moorabool basin to directly supply urban customers in the Barwon basin and in the Ballarat area (which is in both the Moorabool and Barwon basins). The 3,840 ML transfer to the Barwon basin represents water transferred to White Swan Reservoir before being supplied to urban customers in the Ballarat area.

(3) Data for water usage from small-catchment dams is provided by DSE. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(4) Losses were estimated using loss functions from the Lower Barwon REALM and Moorabool REALM. The losses accounted for in the water balance do not include losses occurring between the point of water diversion from the Moorabool basin and the point of use.

(5) Some elements of the 2009–10 water balance have been revised since the publication of the *Victorian Water Accounts 2009–2010.* These changes result from updated storage ratings and climate data.

### 27.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 27-4 below are estimated by DSE, as outlined in Chapter 5.

### Table 27-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 6,100 | 3,000 | n/a |
| Registered commercial and irrigation | 22,800 | 19,200 | n/a |
| **Total** | **28,900** | **22,200** | **29,500** |

n/a: No information available

### 27.6.3 Water entitlement trades

There are no declared systems in the Moorabool basin. Surface water trade was limited to a temporary licence transfer of 40 ML within the basin. No trade took place on a permanent basis. There was no net trade of water into the Moorabool basin during the year.

Table 27-5 summarises the trade of bundled entitlements in the Moorabool basin in 2010–11.

**Table 27-5 Surface water bundled entitlement volume transfers in the Moorabool basin 2010–11**

| Trading zone | Permanent transfers (ML) | Temporary transfers (ML) |
|---|---|---|
| Moorabool unregulated | 0 | 40 |
| **Total 2010–11** | **0** | **40** |
| Total 2009–10 | 0 | 1 |

### 27.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 27-6.

Compliance with individual bulk entitlement volumes was deemed to have occurred if water diverted was not more than the maximum volume allowed to be diverted in 2010–11.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

**Table 27-6 Volume of water diverted under surface water entitlements in the Moorabool basin**

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML)(1) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance?(2) |
|---|---|---|---|---|---|
| *Barwon Water* | | | | | |
| Lal Lal – Barwon(3) | 3 | 5,925 | 0 | 80 | Yes |
| Meredith | 1 | 600 | 0 | 71 | Yes |
| Upper East Moorabool System | 1 | 9,000 | 0 | 1,062 | Yes |
| She Oaks | 3 | 2,000 | 0 | 149 | Yes |
| *Central Highlands Water* | | | | | |
| Lal Lal(3) | 3 | 12,575 | 0 | 2,284 | Yes |
| Upper West Moorabool System | 1 | 10,500 | 0 | 3,841 | Yes |
| *Minister for Environment* | | | | | |
| Moorabool River(3) | 1 | 2,500 | 0 | 691 | Yes |
| **Total annual volume of bulk entitlements 2010–11** | | **43,100** | | **8,178** | |
| Total annual volume of bulk entitlements 2009–10 | | 43,100 | 300 | 1,497 | |
| *Licensed diversions from unregulated streams 2010–11* | | *3,744* | | *721* | |
| *Licensed diversions from unregulated streams 2009–10* | | *3,752* | | *869* | |

Notes:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one-year) period in the bulk entitlement, divided by the number of years in that period.

(2) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

(3) Barwon Water and Central Highlands Water's Lal Lal bulk entitlements were reduced by an average annual volume of 2,500 ML as part of the establishment of the Moorabool River Environmental Entitlement. The environmental entitlement was granted by the Minister for Water in October 2010. The entitlement consists of an 11.9% share of inflows into storage from which a maximum of 7,500 ML can be taken over any consecutive 3-year period; the actual volume available in any year depends upon inflow conditions.

## 27.7 Groundwater resources

A summary of the licensed entitlements and use for the Bungaree WSPA in the Moorabool basin, excluding domestic and stock use, is presented in Table 27-7. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A. The Loddon Highlands WSPA replaced Spring Hill WSPA in 2010–11 (and is no longer reported in the Moorabool basin).

In 2011–11, usage within the Bungaree WSPA decreased by around 70%, compared to 2009–10.

### Table 27-7 Licensed groundwater volumes, Moorabool basin 2010–11

| WSPA/GMA[1] | GMA/ WSPA depth limits[2] (m) | Entitlement limit[3] (ML/year) | Licensed entitlement[4] (ML/year) | Metered use (ML) | Estimated use in unmetered bores (ML)[5] | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Bungaree WSPA (67%)[6] | All depths | 3,555 | 3,555 | 489 | - | 489 | 1,745 |
| **Total[7]** | | **3,555** | **3,555** | **489** | **-** | **489** | **1,745** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11.

(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.

(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.

(6) The licensed entitlement volume for Bungaree WSPA includes a 70 ML mineral water levy, gazetted 20 June 2009.

(7) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 27-8.

### Table 27-8 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores[1][2] | Estimated domestic and stock use (assuming 1.5 ML per bore[3]) (ML)[4] |
|---|---|---|
| Bungaree WSPA (67%) | 168 | 253 |
| **Total** | **168** | **253** |

Notes:

(1) 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 27-7.

(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Estimated domestic and stock use calculated using a factor of 1.5 ML per bore for Southern Rural Water GMUs. For other authorities, the factor is 2 ML.

(4) Total volumes are based on the sum of management unit data before rounding.

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 27-9.

### Table 27-9 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Ballarat | 120 | 0 | 0 |

## 27.8 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions from unregulated streams are presented in Table 27-10. Ballarat and Geelong are both partly supplied from the Moorabool basin. Both towns began the year on Stage 3 restrictions. Restrictions for both towns were removed in summer, after easing to lower levels during spring.

Licensed diversions from the Moorabool River were less severely restricted than in 2009–10.

### Table 27-10 Seasonal allocations and restrictions on water use in Moorabool basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Urban | Greater Geelong and surrounding towns | Stage 3 restrictions from 1 July 2010 to 30 August 2010, Stage 2 restrictions 1 September 2010 to 2 October 2010 and Stage 1 restrictions from 3 October 2010 to 28 February 2011 |
| | Ballarat and surrounding towns | Stage 3 restrictions for 1 July 2010 to 31 July 2010, Stage 1 restrictions from 1 August 2010 to 31 December 2010 |
| Licensed diversions from unregulated streams | Moorabool River | Irrigation ban from July to August 2010, Roster in October 2010 and Stage 5 restriction in December 2010. |

## 27.9 Recycled water

There are no wastewater treatment plants within the Moorabool basin.

## 27.10 Water for the environment

### 27.10.1 Environmental Water Reserve

Important environmental assets such as River Blackfish and Australian Grayling and other fish between Lal Lal Reservoir and She Oakes depend on the Moorabool basin EWR, as well as the Hovells Creek Estuary, which is part of Port Phillip Bay and Bellarine Peninsula Ramsar site.

In 2010–11 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: that is, water above cap.

### 27.10.2 Environmental entitlement

The Moorabool River Environmental Entitlement was granted to the Minister for Environment in 2010. The entitlement consists of passing flows and an 11.9% share of inflows into storage.

In 2010–11, 691 ML of water was released down the Moorabool River in winter 2011 to maintain water quality and instream habitat for native fish and macro-invertebrates.

### 27.10.3 Passing flow compliance

All passing flow requirements were complied with for the Moorabool basin in 2010–11.

Table 27-11 shows the passing flow compliance in the Moorabool basin for selected bulk entitlement compliance points. While there are other compliance points in the basin, the points below have been chosen as they were judged to be of community interest.

### Table 27-11 Selected passing flow compliance in the Moorabool basin

| River | Passing flow | |
|---|---|---|
| Moorabool River | Instrument where passing flows are specified | Bulk Entitlement (She Oaks) Conversion Order 1995 |
| | Responsible authority | Barwon Water |
| | Compliance point | She Oaks diversion weir (shown as 1 in Figure 27-2)) |
| | Passing flow compliance | Requirement of the lesser of 40 ML per day or natural flow was provided |
| West Moorabool River | Instrument where passing flows are specified | Bulk Entitlement (Upper West Moorabool System) Conversion Order 1995 |
| | Responsible authority | Central Highlands Water |
| | Compliance point | Moorabool reservoir (shown as 2 in Figure 27-2)) |
| | Passing flow compliance | Requirement of the lesser of 3 ML per day or natural flow was provided |
| West Branch Moorabool River | Instrument where passing flows are specified | Bulk Entitlement (Lal Lal – Central Highlands) Conversion Order 1995 |
| | Responsible authority | Central Highlands Water |
| | Compliance point | Lal Lal Reservoir (shown as 3 in Figure 27-2) |
| | Passing flow compliance | Passing flow requirement under the bulk entitlement was provided. Under normal conditions this is 20 ML per day. Under dry conditions (when cumulative flow into the reservoir over the previous 24 months is less than 43,000 ML), it is the lesser of 5 ML per day or natural flow. |

# 28 Barwon basin

This chapter sets out the accounts for the Barwon basin. For detailed information about how they were compiled, refer to Chapter 5.

## 28.1 Barwon basin summary

Inflows in the Barwon basin in 2010–10 were approximately equal to the long-term average, and were more than double the annual inflow in 2009–10.

Storage levels in the Barwon basin consequently increased over the year, recovering to 69% of capacity by the end of June 2011. Geelong's storages in the Moorabool basin also improved significantly, finishing the year at 90% of capacity.

Barwon Water eased Stage 3 restrictions for the Geelong system to lower levels in spring, and removed restrictions at the end of February. Towns supplied from the Geelong system had been subject to restrictions since July 2006.

Transfers from the Campaspe basin via the Goldfields Superpipe enabled Central Highlands Water to ease Stage 3 restrictions for Ballarat and surrounding towns to Stage 1 early in the year. Central Highlands Water removed restrictions at the end of December, following above-average spring rainfall and improvement in storage levels. Ballarat and surrounds had been subject to restrictions for over five years.

With the improvement in surface water resources, Barwon Water did not rely as heavily on the Barwon Downs bore field in 2010–11. Groundwater use across the Barwon basin was significantly less than in 2009–10.

## 28.2 Responsibilities for management of water resources

Table 28-1 shows the responsibilities of various authorities within the Barwon basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 28-1 Responsibilities for water resources management within the Barwon basin, 2010–11

| 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 | | |
| Barwon Water | | | Geelong and surrounding towns(1) | Operates West Barwon Reservoir and Lake Wurdee Boluc<br>Obliged to meet passing flow requirements |
| Central Highlands Water | | | Ballarat and surrounding towns (2) | Operates White Swan and Gong Gong reservoirs<br>Obliged to meet passing flow requirements |
| 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.

## 28.3 Rainfall, flows and storages in 2010–11

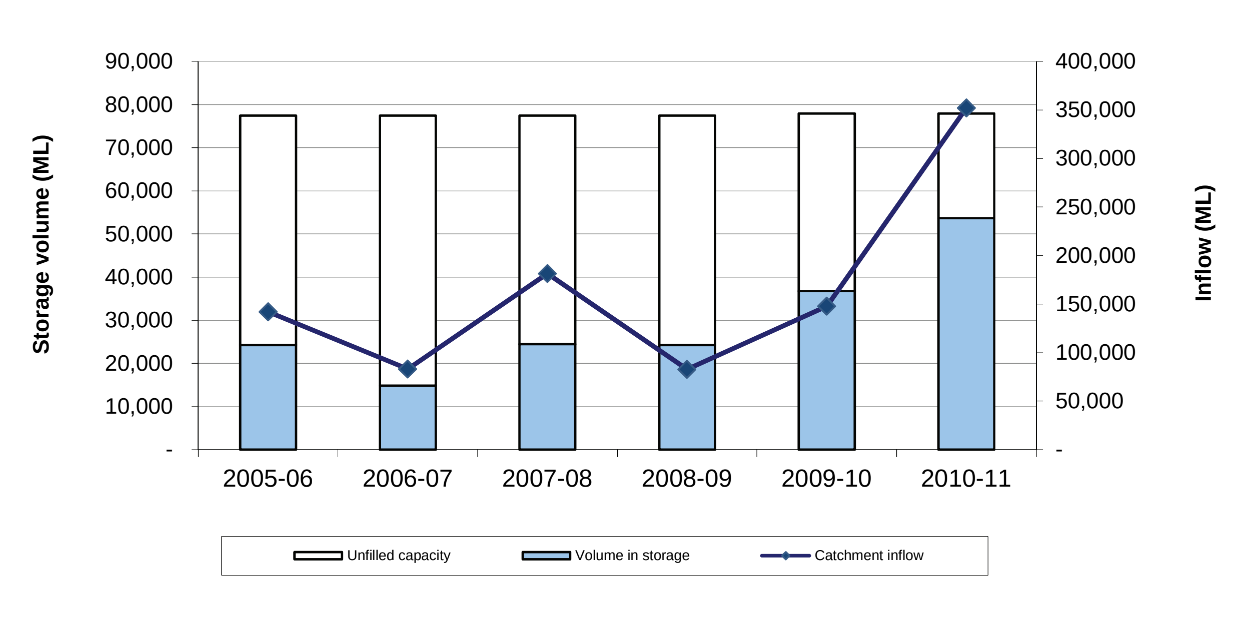
In 2010–11, rainfall in the Barwon basin ranged between 100% and 150% of the long-term average, compared to 80% and 125% in 2009–10. Inflows to the Barwon basin amounted to 352,100 ML in 2010–11, which is 100% of the long-term average (of 360,000 ML). This is an increase from inflows of only 41% of the long-term average in 2009–10.

The amount of water flowing from the Barwon basin into Corio Bay and Bass Strait was 329,800 ML in 2010–11. This represents 92% of the catchment inflows into the basin.

Storage levels for all major storages (greater than 1,000 ML capacity) in the basin increased from 36,800 ML in July 2010, to 53,700 ML (69% of capacity) by the end of June 2011.

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) increased by 10,700 ML in 2010–11, from 15,000 ML to 25,700 ML.

**Figure 28-1 All major storages and catchment inflows in the Barwon basin**




## 28.4 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 28-2.

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 28-2 Summary of total water resources and water use in the Barwon basin, 2010–11**

| Water source | Total water resource (ML) | Total use (ML) |
|---|---|---|
| Surface water | 435,400 | 73,200 |
| Groundwater(1) (2) | 21,600 | 1,500 |
| Recycled water | 30,310 | 2,600 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 28-7 and estimated domestic and stock use presented in Table 28-8.

(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5. The Gerangamete GMA is one exception in the Barwon basin and this is discussed in note 7 beneath Table 28-7.

### 28.4.1 Infrastructure projects to improve water availability

Barwon Water began work on the Melbourne to Geelong pipeline which will create a new water resource for Geelong by connecting it to Melbourne's supply at Werribee. A new pump station and pipeline to Geelong are required. The project commenced in September 2010 and is expected to be complete in early 2012. Works undertaken in 2010–11 include constructing a 31-km pipeline, connecting pipe works at Werribee, and starting work on the pump station.

## 28.5 Location of water resources

### Figure 28-2 Map of the Barwon basin

## 28.6 Surface water resources

### 28.6.1 Water balance

A surface-water balance for the Barwon Basin is shown in .

Table 28-3. Note that only on-stream storages with capacity greater than 1,000 ML have been included in the water balance. The major on-stream storages in the Barwon basin are the West Barwon Reservoir operated by Barwon Water, and the White Swan and Gong Gong reservoirs operated by Central Highlands Water.

Transfers from the Moorabool Basin to the Barwon Basin increased from 1,040 ML in 2009–10 to 3,840 ML in 2010–11. This water was transferred to White Swan Reservoir and used to supply the Ballarat system. The Goldfields Superpipe was used to transfer 870 ML from the Campaspe Basin to White Swan Reservoir, to augment supplies to Ballarat.

### Table 28-3 Balance of surface water in the Barwon basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | 15,000 | 11,100 |
| Volume in storage at end of year | 25,700 | 15,000[4] |
| **Change in storage** | **10,700** | **3,900** |
| **Inflows** | | |
| Catchment inflow[1] | 352,100 | 147,700 |
| Rainfall on major storages | 1,800 | 1,000 |
| Inflows from the Moorabool River | 40,900 | 200 |
| Transfers from the Corangamite basin via Woady Yaloak Channel | 7,500 | |
| Transfers from Moorabool basin to White Swan Reservoir | 3,840 | 1,040 |
| Transfers from Campaspe basin to White Swan Reservoir | 870 | 10,400 |
| Return flow from irrigation | - | - |
| Treated wastewater discharged back to river | 28,430 | 22,200 |
| **Sub-total** | **435,400** | **182,600** |
| **Usage** | | |
| Urban diversions | 40,890 | 36,470 |
| Licensed diversions from unregulated streams | 1,400 | 2,000 |
| Small-catchment dams[2] | 30,900 | 30,900 |
| **Sub-total** | **73,200** | **69,400** |
| **Losses** | | |
| Net evaporation losses from major storages | 1,100 | 1,300 |
| Evaporation from small-catchment dams[2] | 12,500 | 12,500 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation[3] | 8,100 | 4,100 |
| **Sub-total** | **21,700** | **17,900** |
| **Water passed at outlet of basin** | | |
| River outflows to the ocean | 329,800 | 91,300 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Data for water usage from small-catchment dams is provided by DSE. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(3) Losses were estimated using loss functions from the Lower Barwon REALM.

(4) Some elements of the 2009–10 water balance have been revised since the publication of the *Victorian Water Accounts 2009–2010*. These changes result from updated storage ratings and climate data.

### 28.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 28-4 are estimated by DSE, as outlined in Chapter 5.

### Table 28-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 10,400 | 5,200 | n/a |
| Registered commercial and irrigation | 30,600 | 25,700 | n/a |
| **Total** | **41,000** | **30,900** | **43,400** |

n/a: No information available

### 28.6.3 Water entitlement trades

There are no declared systems in the Barwon basin. Surface water trade was limited to transfers of licences within the basin. In 2010–11, 426 ML of licenses were traded on a temporary basis. There was no net trade of water into the basin during the year.

Table 28-5 summarises the trade of bundled entitlement volume in the Barwon basin in 2010–11.

**Table 28-5 Surface water bundled entitlement volume transfers in the Barwon basin 2010–11**

| Trading zone | Permanent transfers (ML) | Temporary transfers (ML) |
|---|---|---|
| Barwon unregulated | 0 | 426 |
| **Total 2010–11** | **0** | **426** |
| Total 2009–10 | 0 | 333 |

### 28.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 28-6.

Compliance with individual bulk entitlement volumes was deemed to have occurred if water diverted was not more than the maximum volume allowed to be diverted in 2010–11.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

**Table 28-6 Volume of water diverted under surface water entitlements in the Barwon basin**

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML)(1) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance?(2) |
|---|---|---|---|---|---|
| *Barwon Water* | | | | | |
| Upper Barwon system | 3 | 43,467 | 0 | 33,287 | Yes |
| *Central Highlands Water* | | | | | |
| Yarrowee-White Swan system(3) | 3 | 12,267 | | 7,598 | Yes |
| **Total annual volume of bulk entitlements 2010–11** | | **55,733** | **0** | **40,885** | |
| Total annual volume of bulk entitlements 2009–10 | | 55,733 | 0 | 36,467 | |
| *Licensed diversions from unregulated streams 2010–11* | | *5,587* | | *1,428* | |
| *Licensed diversions from unregulated streams 2009–10* | | *5,523* | | *2,005* | |

Notes:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one-year) period in the bulk entitlement, divided by the number of years in that period.

(2) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

(3) 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.

## 28.7 Groundwater resources

A summary of licensed entitlements and use for GMUs that overlap the Barwon basin, excluding domestic and stock use, is presented in Table 28-7.

The Barwon basin contains part of the Cardigan GMA, Gellibrand GMA, Gerangamete GMA and Bungaree WSPA. Groundwater levels in all these GMUs are declining with the exception of Bungaree WSPA which has increasing groundwater levels. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

Groundwater extractions in the Barwon basin were significantly reduced in 2010–11, compared to 2009–10. This is primarily due to the decrease in use in the Gerangamete GMA, with Barwon Water ceasing to pump from the Barwon Downs bore field on 11 August 2010.

### Table 28-7 Licensed groundwater volumes, Barwon basin 2010–11

| WSPA/GMA(1) | GMA/ WSPA depth limits(2) (m) | Entitlement limit(3) (ML/year) | Licensed entitlement(4) (ML/year) | Metered use (ML) | Estimated use in unmetered bores (ML)(5) | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Cardigan GMA (20%)(6) | All depths | 194 | 178 | 22 | - | 22 | 39 |
| Gellibrand GMA (8%) | All depths | - | - | - | - | - | - |
| Gerangamete GMA (86%)(7)(8) | >60 | 20,000 | 20,000 | 1,144 | - | 1,144 | 12,692 |
| Bungaree WSPA (24%)(9) | All depths | 1,281 | 1,281 | 176 | - | 176 | 619 |
| **Total(10)** | | **21,475** | **21,459** | **1,342** | **-** | **1,342** | **13,351** |

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 (with the exception of Gerangamete GMA – see note 6). GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11. The Deutgam WSPA was subject to a total use ban from 1July 2010 for the beginning of 2010–11, which moved to 75% by the end of the season.

(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.

(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.

(6) 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 Cardigan, Barwon and Corangamite basins. 604 ML was extracted from the Cardigan GMA within the Hopkins Basin for urban supplies. The remaining 109 ML of metered use (non-urban) was shared proportionally between Cardigan, Barwon and Corangamite basins.

(7) 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 28-7 represents the single year limit: however, compliance would also need to be assessed at the 10-year and 100-year level.

(8) Barwon Water is the sole licence holder in the Gerangamete GMA and uses groundwater to supplement Geelong's water supply (see Table 28-9). 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.

(9) The licensed entitlement volume for Bungaree WSPA includes a 70 ML mineral water levy, gazetted 20 June 2009.

(10) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 28-8.

### Table 28-8 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores(1)(2) | Estimated domestic and stock use (assuming 1.5 ML per bore(3)) (ML)(4) |
|---|---|---|
| Cardigan GMA (20%) | 18 | 27 |
| Gellibrand GMA (8%) | 0 | 0 |
| Gerangamete GMA (86%) | 2 | 3 |
| Bungaree WSPA (24%) | 61 | 92 |
| **Total** | **81** | **122** |

Notes:

(1) 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 28-7.

(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Estimated domestic and stock use is calculated using a factor of 1.5 ML per bore for these GMUs. Other authorities use a factor of 2 ML per bore.

(4) Total volumes are based on the sum of management unit data before rounding.

Groundwater again contributed to the urban water supply for Geelong in 2010–11, although the volume extracted was significantly lower than 2009–10. The licensed entitlements and metered use for this supply are provided in Table 28-9.

### Table 28-9 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Greater Geelong | 20,000 | 1,144 | 12,692 |

## 28.8 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions in 2010–11 are presented in Table 28-10.

Transfers from the Goulburn system via the Goldfields Superpipe enabled Central Highlands Water to ease Stage 3 restrictions for Ballarat and surrounding towns to Stage 1 at the end of winter. Restrictions were removed at the end of December, following above-average spring rainfall and considerable improvement in storage levels. Ballarat and surrounds had been subject to restrictions for over five years.

Above-average spring rainfall also resulted in significant improvement to the Geelong system storage levels. Barwon Water eased Stage 3 restrictions for the Geelong system to lower levels in September and October, and was able to remove restrictions at the end of February. Towns supplied from the Geelong system had been subject to restrictions since July 2006.

Only one stream was affected by a ban on licensed diversions in 2010–11: diverters from Boundary Creek were banned from taking water in July and August.

### Table 28-10 Seasonal allocations and restrictions on water use in Barwon basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Urban | Greater Geelong, the Bellarine Peninsula and surrounding towns (including Birregurra and Forrest) | Stage 3 restrictions from 1 July 2010 to 30 August 2010, Stage 2 restrictions from 1 September 2010 to 2 October 2010 and Stage 1 restrictions from 3 October 2010 to 28 February 2011 |
| | Ballarat and surrounding towns | Stage 3 restrictions from 1 July 2010 to 31 July 2010, Stage 1 restrictions from 1 August 2010 to 31 December 2010 |
| Licensed diversions from unregulated streams | Boundary Creek | Irrigation ban in July and August 2010 |

## 28.9 Recycled water

Both Barwon Water and Central Highlands Water operate wastewater treatment plants within the Barwon basin.

In 2010–11, 2% of wastewater in the Barwon basin was recycled. This is a decrease from 7% in 2009–10.

### Table 28-11 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 (ML)(3) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation(1) | Within process(2) | | |
| Ballarat North | 3,329 | 758 | 7% | - | - | 223 | 535 | 2,570 | - |
| Ballarat South | 7,311 | 60 | 0% | - | - | - | 60 | 7,251 | - |
| Bannockburn | 76 | 76 | 18% | - | 14 | - | 63 | - | - |
| Black Rock | 19,112 | 1,232 | 3% | - | 507 | - | 725 | 18,606 | -725 |
| Portarlington | 399 | 399 | 2% | - | 6 | - | 393 | - | - |
| Winchelsea | 78 | 78 | 6% | - | 5 | - | 73 | - | - |
| **Total 2010–11** | **30,305** | **2,603** | **2%** | **-** | **531** | **223** | **1,849** | **28,427** | **-725** |
| Total 2009–10 | 24,519 | 3,704 | 7% | 19 | 1,382 | 353 | 1,950 | 22,204 | -1,389 |

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.

## 28.10 Water for the environment

### 28.10.1 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 ecologically function. 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 all listed in the EPBC Act), Australian Mudfish and Tupong
- the native water bird population, particularly the Greenshank, Eastern Golden Plover, Curlew Sandpiper and Red-necked Stint
- platypus.

In 2010–11 the Barwon basin EWR 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: that is, water above cap.

### 28.10.2 Environmental entitlements

The Barwon River Environmental Entitlement was granted to the Minister for Environment in 2011. The entitlement allows for access to water from the Barwon River under specified conditions for the lower Barwon wetlands, including Reedy Lake and Hospital Swamps.

No environmental diversions were made under the entitlement in 2010–11.

### 28.10.3 Passing flow compliance

Some bulk entitlements require passing flows to be met at some points in the basin.

All passing flow requirements were complied with for the Barwon basin in 2010–11.

Table 28-12 shows the passing flow compliance in the Barwon basin for a selected bulk entitlement compliance point. While there are other compliance points, the point below has been chosen because it is of community interest. The location of this point is presented in Figure 28-2.

#### Table 28-12 Selected passing flow requirements in the Barwon basin

| River | Passing flow | |
|---|---|---|
| West Barwon River, East Barwon River, Callahan Creek, Dewing Creek, Matthews Creek and Pennyroyal Creek | Instrument where passing flows are specified | Bulk Entitlement (Upper Barwon System) Conversion Order 2002 |
| | Responsible authority | Barwon Water |
| | Compliance point | West Barwon diversion weir (West Barwon Dam) (shown as 1 in Figure 28-2) |
| | Passing flow compliance | Passing flows were based on the storage volume in the West Barwon diversion weir:<br>• during April to December inclusive, a minimum flow of 4 ML per day was passed if the storage volume was less than 40,000 ML, or 5 ML per day if volume was greater than 40,000 ML<br>• a minimum flow of 4 ML per day was passed in January, February and March |

### 28.10.4 Streamflow management plans

No further work will be done to prepare a SFMP for the Barwon River (which includes the main stem and tributaries to the south, including Leigh River, but excluding Moorabool River). The need for a SFMP will be considered in light of additional technical studies and resource appraisals.

# 29 Corangamite basin

This chapter sets out the accounts for the Corangamite basin. For detailed information about how they were compiled, refer to Chapter 5.

## 29.1 Corangamite basin summary

Inflows in the Corangamite basin in 2010–11 were 167% of the long-term average, more than three times the volume of inflows in 2009–10.

Groundwater licenses remained unrestricted in 2010–11. Groundwater extractions were lower than in 2009–10, with licensed groundwater use in 2010–11 reduced by approximately 63%. However, groundwater extraction still accounted for 14% of total usage in the basin.

Urban users are not directly affected by inflows in the Corangamite basin, as all towns are supplied by other basins. Restrictions were only in place for the towns located in the north of the basin connected to Ballarat's water supply system.

Only licenced diverters from Lake Tooliorook were affected in 2010–11, with a ban on taking water in place for the first few months of the year.

The amount of water flowing from the Corangamite basin into the Ramsar-listed Western District Lakes was 501,700 ML in 2010–11. This volume is 95% of the total inflows in the basin.

## 29.2 Responsibilities for management of water resources

Table 29-1 shows the responsibilities of various authorities within the Corangamite basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 29-1 Responsibilities for water resources management within the Corangamite basin, 2010–11

| 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 | | |
| 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.

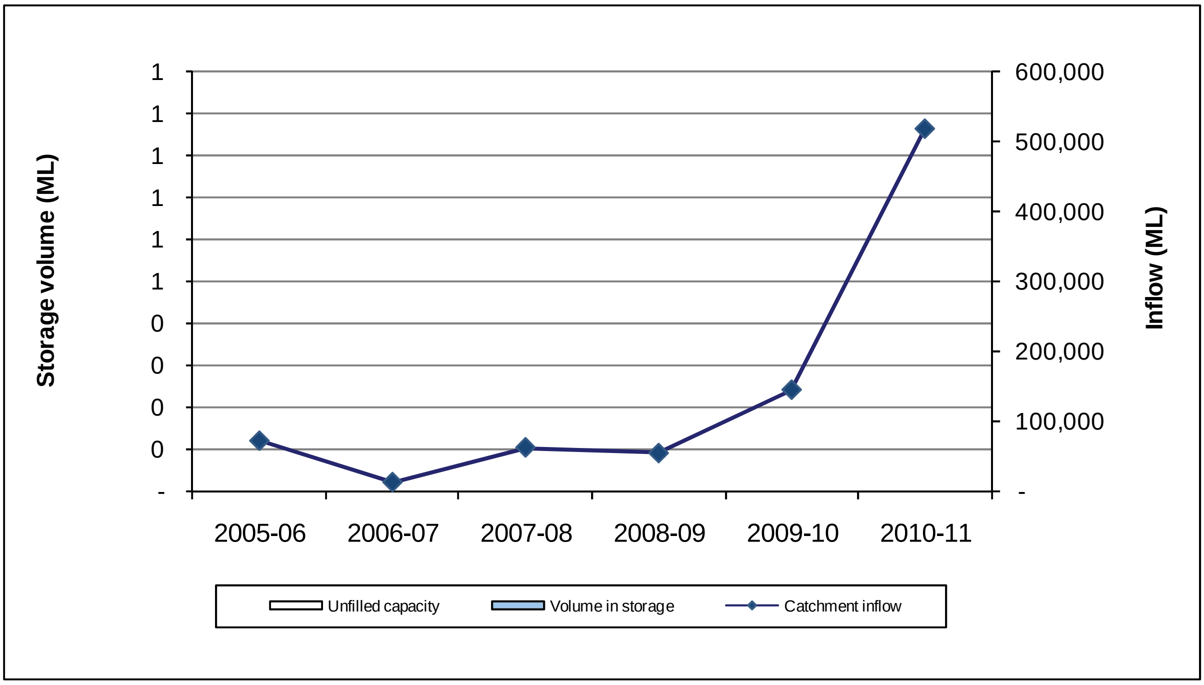
## 29.3 Rainfall, flows and storages in 2010–11

In 2010–11, rainfall in the Corangamite basin ranged between 150% and 200% of the long-term average. Inflows across the basin were 167% of the long-term average of 316,000 ML, which is significantly higher than the previous five years.

Outflows from the Corangamite basin into the Western District Lakes were 501,700 ML in 2010–11, or 95% of inflows. The ratio of outflow to inflows is higher than the previous 5 years.

There are no major water supply storages in the Corangamite basin.

### Figure 29-1 Catchment inflows in the Corangamite basin




## 29.4 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 29-2.

### Table 29-2 Summary of total water resources and water use in the Corangamite basin, 2010–11

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | 520,800 | 12,500 |
| Groundwater(2) | 16,500 | 1,800 |
| Recycled water | 2,690 | 180 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 29-6 and the estimated domestic and stock use as presented in Table 29-7.

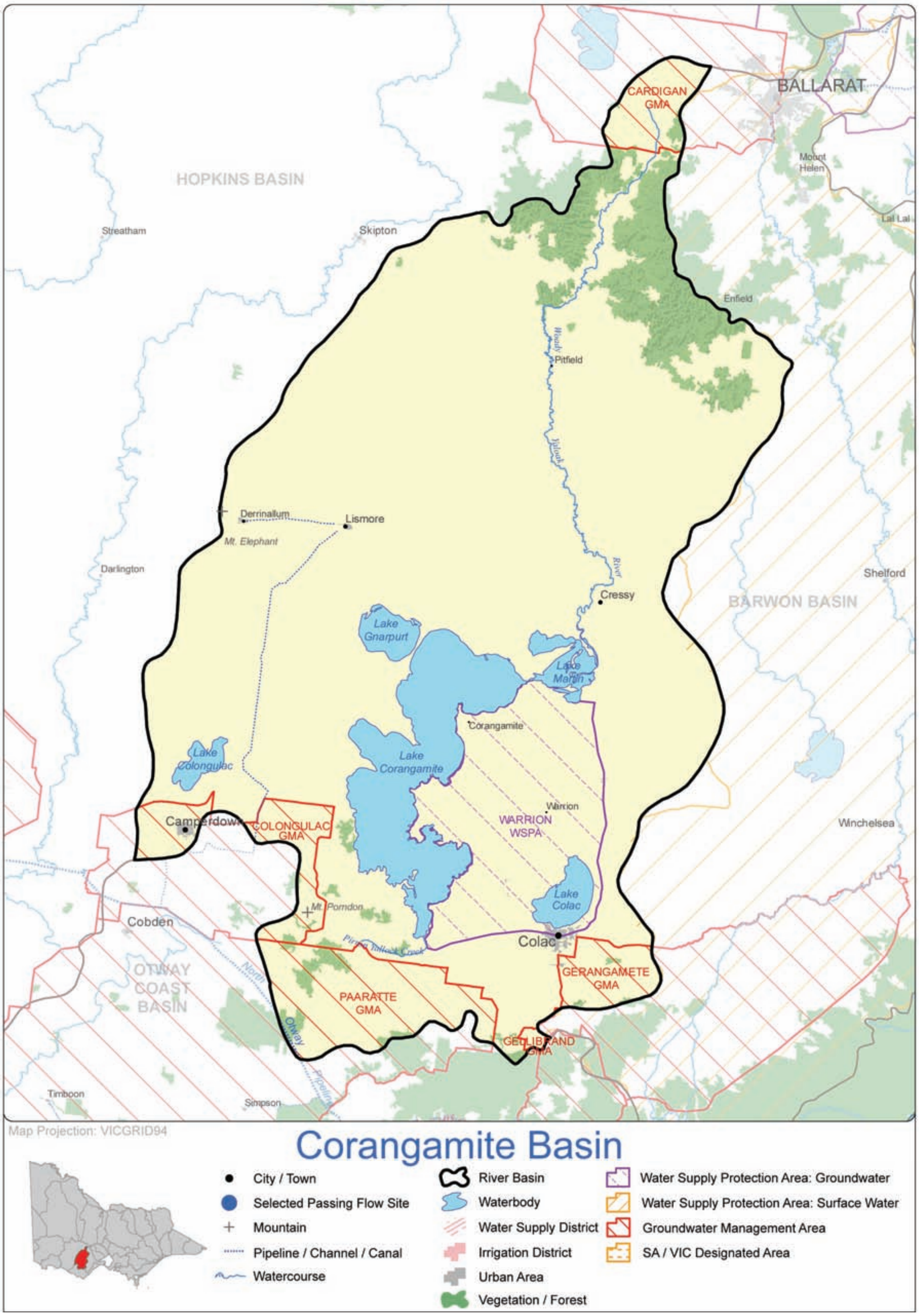
(2) The total groundwater available for consumption and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5. The Gerangamete GMA is one exception in the Corangamite basin and this is discussed in note 6 beneath Table 29-6.

### 29.4.1 Infrastructure projects to improve water availability

There were no infrastructure projects to improve water availability within the Corangamite basin in 2010–11.

## 29.5 Location of water resources

### Figure 29-2 Map of the Corangamite basin



## 29.6 Surface water resources

### 29.6.1 Water balance

A surface-water balance for the Corangamite basin is shown in Table 29-3.

Urban water use within the Corangamite basin is supplied from the Otway Coast basin due to the better quality water available.

#### Table 29-3 Balance of surface water in the Corangamite basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | - | - |
| Volume in storage at end of year | - | - |
| **Change in storage** | **-** | - |
| **Inflows** | | |
| Catchment inflow(1) | 518,600 | 144,100 |
| Rainfall on major storages | - | - |
| Transfers from other basins | - | - |
| Return flow from irrigation | - | - |
| Treated wastewater discharged back to river | 2,150 | 1,490 |
| **Sub-total** | **528,400** | **145,600** |
| **Usage** | | |
| Urban diversions | - | - |
| Licensed diversions from unregulated streams | 200 | 100 |
| Small-catchment dams(2) | 12,300 | 12,300 |
| **Sub-total** | **12,500** | **12,400** |
| **Losses** | | |
| Evaporation losses from major storages | - | - |
| Evaporation from small-catchment dams(2) | 6,600 | 6,600 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(3) | - | - |
| **Sub-total** | **6,600** | **6,600** |
| **Water passed at outlet of basin** | | |
| River outflows to the Corangamite Lakes | 494,100 | 126,600 |
| River outflows to Barwon Basin via Woady Yaloak Channel | 7,500 | n/a |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Data for water usage from small-catchment dams is provided by DSE. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(3) Losses estimated to be zero because data is not readily available.

n/a: No information available

### 29.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 29-4 have been estimated by DSE, as outlined in Chapter 5.

#### Table 29-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 8,100 | 4,000 | n/a |
| Registered commercial and irrigation | 9,900 | 8,300 | n/a |
| **Total** | **18,000** | **12,300** | **18,900** |

n/a: No information available

### 29.6.3 Water entitlement trades

There are no declared water systems in the Corangamite basin. As such, surface water trade was limited to transfers of licenses. In 2010–11, no licenced entitlements were traded or permanently transferred within the basin. Table summarises the trade of bundled entitlements in the Corangamite basin in 2010–11.

### Table 29-5 Surface water bundled entitlement volume transfers in the Corangamite basin 2010–11

| Trading zone | Permanent transfers (ML) | Temporary transfers (ML) |
|---|---|---|
| Corangamite unregulated | 0 | 0 |
| **Total 2010–11** | 0 | 0 |
| Total 2009–10 | 0 | 15 |

### 29.6.4 Volume diverted

The only surface water entitlements in the Corangamite basin are licences on unregulated streams. In 2010–11, the licensed volume totalled 1,261 ML and use was estimated to be 216 ML. This was higher than the 2009–10 volume of 1,155 ML and estimated use of 84 ML.

## 29.7 Groundwater resources

A summary of the licensed entitlements and use for GMUs that overlap the Corangamite basin, excluding domestic and stock use, is shown in Table 29-6.

The Corangamite basin contains the whole Warrion WSPA as well as part of the Colongulac GMA, Cardigan GMA and Paaratte GMA. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

Reported groundwater use in the Corangamite basin decreased significantly in 2010–11 compared to 2009–10, largely as a result of reduced extractions from the Warrion WSPA, which has the largest volume of entitlements within the basin. Groundwater levels in the Cardigan GMA are declining, while levels in the Warrion WSPA and Paaratte GMA are generally stable.

### Table 29-6 Licensed groundwater volumes, Corangamite basin 2010–11

| WSPA/GMA(1) | GMA/ WSPA depth limits(2) (m) | Entitlement limit(3)(7) (ML/year) | Licensed entitlement(4) (year) | Metered use (ML) | Estimated use in unmetered bores (ML)(5) | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Cardigan GMA (20%)(6) | All depths | 192 | 176 | 22 | - | 22 | 39 |
| Colongulac GMA (35%) | ≤60 | 1,653 | 1,418 | 100 | - | 100 | 241 |
| Paaratte GMA (14%) | >120 | 657 | 457 | 42 | - | 42 | 41 |
| Warrion WSPA (100%) | All depths | 13,836 | 13,835 | 992 | - | 992 | 2,781 |
| **Total (8)** | | **16,338** | **15,886** | **1,156** | **-** | **1,156** | **3,102** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11.

(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.

(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.

(6) 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 Cardigan, Barwon and Corangamite basins. 604 ML was extracted from the Cardigan GMA within the Hopkins Basin for urban supplies. The remaining 109 ML of metered use (non-urban) was shared proportionally between Cardigan, Barwon and Corangamite basins.

(7) 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 28-7 in the Barwon basin chapter for Gerangamete GMA volumes.

(8) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 29-7. Groundwater is not used to supply towns within the Corangamite basin.

### Table 29-7 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores(1)(2) | Estimated domestic and stock use (assuming 1.5 ML per bore(3)) (ML)(4) |
|---|---|---|
| Cardigan GMA (20%) | 18 | 27 |
| Colongulac GMA (35%) | 44 | 66 |
| Gerangamete GMA (14%) | 0 | 0 |
| Paaratte GMA (14%) | 1 | 2 |
| Warrion WSPA (100%) | 357 | 536 |
| **Total** | **420** | **630** |

Notes:

(1) 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 29-6.

(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Estimated domestic and stock use is calculated using a factor of 1.5 ML per bore for these GMUs. Other authorities use a factor of 2 ML per bore.

(4) Total volumes are based on the sum of management unit data before rounding.

## 29.8 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions from unregulated streams are presented in Table 29-8. The only towns subject to restrictions in 2010–11 were those located in the north of the basin and supplied from the Ballarat water system.

A ban on licensed diversions from Lake Tooliorook was lifted in September,

### Table 29-8 Seasonal allocations and restrictions on water use in Corangamite basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Urban | Linton, Rokewood, Smythesdale | Stage 3 restrictions from 1 July 2010 to 31 July 2010, Stage 1 restrictions from 1 August 2010 to 31 December 2010 |
| Licensed diversions from unregulated streams | Lake Tooliorook | Irrigation ban from July to September 2010 |

## 29.9 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 2009–10, the volume of recycled water reused decreased: the percentage reused increased in 2010–11, with around 23% recycled.

### Table 29-9 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 (ML)(3) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation(1) | Within process(2) | | |
| Camperdown Industrial | 20 | - | 0% | - | - | - | - | 37 | (17) |
| Camperdown Municipal | 676 | 159 | 23% | 7 | 152 | - | - | 136 | 382 |
| Colac | 1,999 | 26 | 0% | - | - | - | 26 | 1,973 | - |
| **Total 2010–11** | **2,695** | **185** | **6%** | **7** | **152** | **-** | **26** | **2,146** | **364** |
| Total 2009–10 | 1,961 | 322 | 15% | 0 | 300 | 0 | 22 | 1,493 | 146 |

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.

## 29.10 Water for the environment

### 29.10.1 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 lakes Corangamite, Gnarpurt, Milangil, Terangpom, Beeac, Colongulac and Cundare. Wetlands of national importance include the Koorwwera Lakes, Lough Calvert, Lake Thurrumbong and Cundare Pool. The native fish community and the Corangamite Water Skink also rely on the EWR.

In 2010–11 the Corangamite basin EWR comprised:

- the component of water in the basin not allocated for consumptive use: that is, water above cap
- water set aside for the environment through the operation of passing flow conditions on licensed diversions.

### 29.10.2 Compliance with passing flow requirements

There are currently no bulk entitlements in operation in the Corangamite basin.

### 29.10.3 Management plans

The Western Region Sustainable Water Strategy states that existing rules will be documented as local management plans for all relevant unregulated river systems in the basin.

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# 30 Otway Coast basin

This chapter sets out the accounts for the Otway Coast basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

## 30.1 Otway Coast basin summary

Inflows in the Otway Coast basin in 2009–10 were 166% of the long-term average. This is close to double the inflow volume in 2009–10.

Due to storage constraints, Apollo Bay was placed on Stage 2 restrictions between November and April, to reduce the risk of water shortage over the tourist season. Restrictions for towns supplied from the Geelong system were gradually eased to lower levels over spring, and removed at the end of February, following considerable improvement in water resources

Restrictions on licensed diversions from the Gellibrand River, Curdies River and Lake Purrumbete were removed in August and September.

While the total volume of surface water taken under entitlements in the basin was lower than in 2009-10, groundwater use increased slightly.

## 30.2 Responsibilities for management of water resources

Table 30-1 shows the responsibilities of various authorities within the Otway Coast basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 30-1 Responsibilities for water resources management within the Otway Coast basin, 2010–11

| 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<br>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.

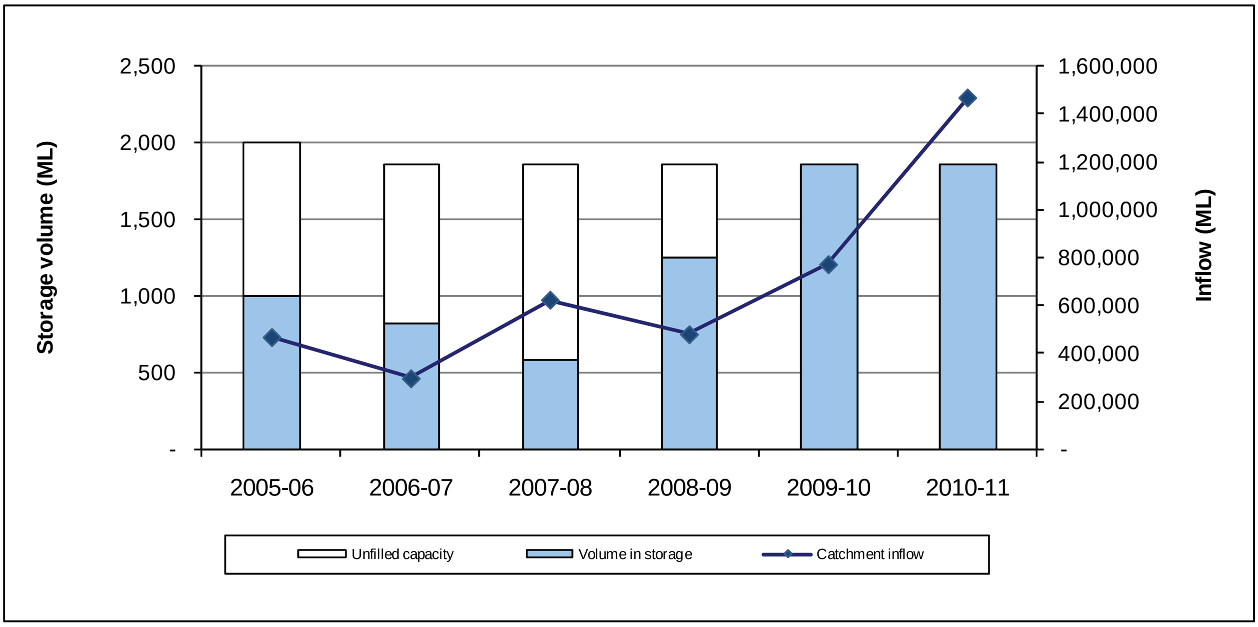
## 30.3 Rainfall, flows and storages in 2010–11

In 2010–11, rainfall in the Otway Coast basin ranged between 100% and 150% of the long-term average. Inflows in 2010–11 were 166% of the long-term average of 884,000 ML, compared to 87% in 2009–10.

The amount of water flowing from the Otway basin into Bass Strait increased to 1,434,000 ML in 2010–11. This represented 98% of the catchment inflows into the basin, compared to 96% in 2009–10.

The only major storage in the basin is the West Gellibrand Reservoir: the storage began and ended the year at full capacity.

### Figure 30-1 All major storages and catchment inflows in the Otway Coast basin




## 30.4 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 30-2.

### Table 30-2 Summary of total water resources and water use in the Otway Coast basin, 2010–11

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | 1,465,000 | 27,600 |
| Groundwater(2) | 23,800 | 6,900 |
| Recycled water | 1,570 | 290 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 30-6 and the estimated domestic and stock use presented in Table 30-7.

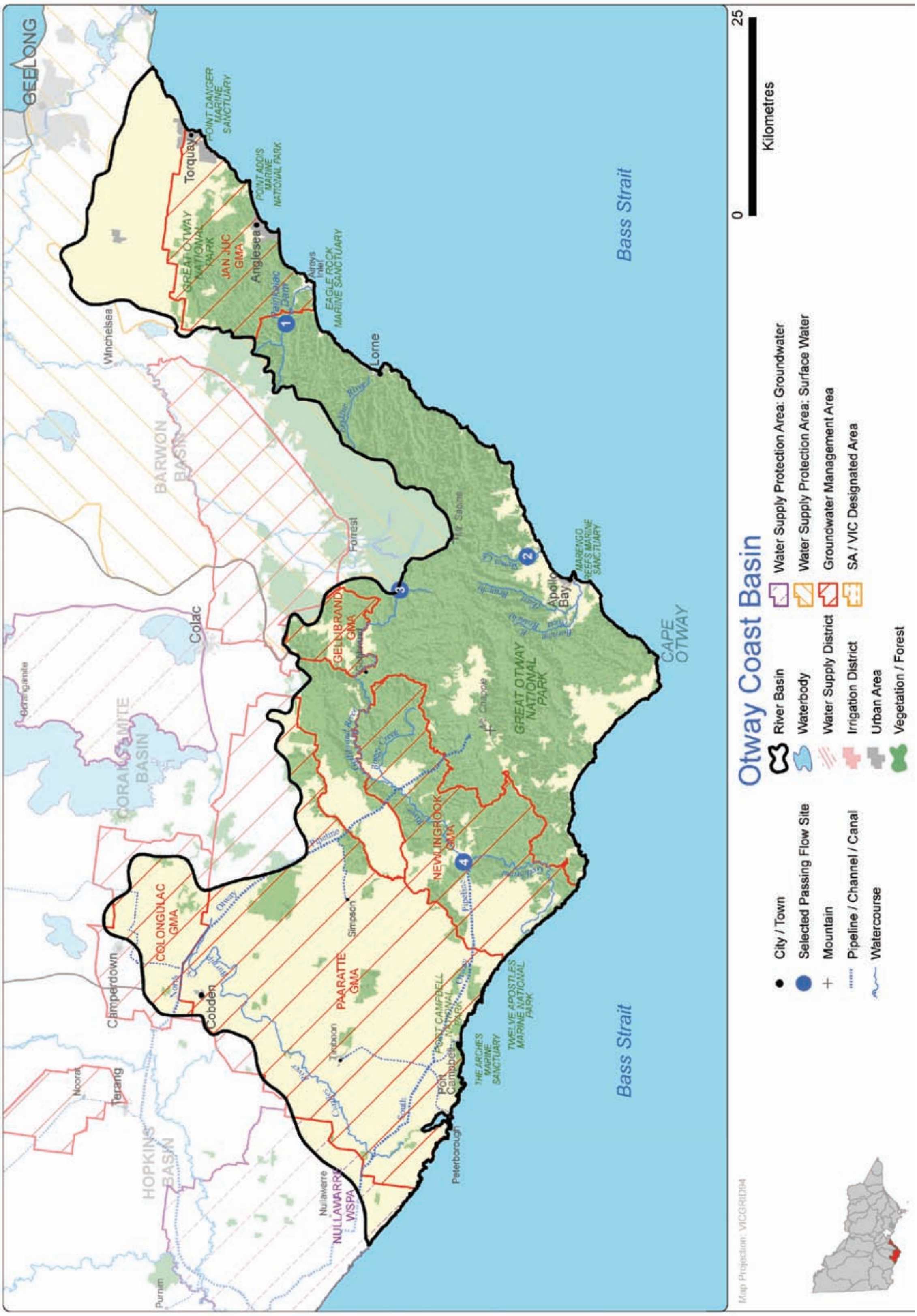
(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5. The Jan Juc bulk entitlement is based on a 5-year total of 35,000 ML.

### 30.4.1 Infrastructure projects to improve water availability

Barwon Water continued construction of groundwater bores, a pre-treatment plant, pump stations and transfer mains for the Anglesea Borefield Project in 2010–11 to provide a new water resource for Geelong. The project commenced investigations in December 2006 and was completed in 2011. In 2010–11, another bore was constructed and the bore field is now in production.

## 30.5 Location of water resources

### Figure 30-2 Map of the Otway Coast basin



## 30.6 Surface water resources

### 30.6.1 Water balance

A surface-water balance for the Otway Coast basin is shown in Table 30-3.

#### Table 30-3 Balance of surface water in the Otway Coast basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | 1,900 | 1,200 |
| Volume in storage at end of year | 1,900 | 1,900 |
| **Change in storage** | **0** | **700** |
| **Inflows** | | |
| Catchment inflow(1) | 1,463,700 | 770,400 |
| Rainfall on major storages | - | - |
| Transfers from other basins | - | - |
| Return flow from irrigation | - | - |
| Treated wastewater discharged back to river | 1,270 | 1,050 |
| **Sub-total** | **1,465,000** | **771,400** |
| **Usage** | | |
| Urban diversions | 12,920 | 14,250 |
| Licensed diversions from unregulated streams | 1,900 | 1,300 |
| Small-catchment dams(2) | 12,800 | 12,800 |
| **Sub-total** | **27,600** | **28,400** |
| **Losses** | | |
| Evaporation losses from major storages | - | 0 |
| Evaporation from small-catchment dams(2) | 3,400 | 3,400 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(3) | 0 | 0 |
| **Sub-total** | **3,400** | **3,400** |
| **Water passed at outlet of basin** | | |
| River outflows to the ocean | 1,434,000 | 738,900 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Data for water usage from small-catchment dams is provided by DSE. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(3) Assumed to be zero because data is not readily available.

### 30.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 30-4 below are estimated by DSE, as outlined in Chapter 5.

#### Table 30-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 10,700 | 5,400 | n/a |
| Registered commercial and irrigation | 8,800 | 7,400 | n/a |
| **Total** | **19,500** | **12,800** | **16,200** |

n/a: No information available

### 30.6.3 Water entitlement trades

There were no transfers of water entitlements within the Otway basin or across basin boundaries in 2010–11.

### 30.6.4 Volume diverted

The volume of water diverted under each bulk entitlement is shown in Table 30-5. Compliance with individual bulk entitlement volumes is deemed to occur if water diverted did not exceed the maximum volume allowed to be diverted in 2010–11.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

### Table 30-5 Volume of water diverted under surface water entitlements in the Otway Coast basin

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance? |
|---|---|---|---|---|---|
| *Barwon Water* | | | | | |
| Aireys Inlet | 1 | 317 | 0 | 165 | Yes |
| Apollo Bay(1) | 1 | 800 | 0 | 375 | Yes |
| Colac | 1 | 5,400 | 0 | 3,472 | Yes |
| Gellibrand | 1 | 60 | 0 | 28 | Yes |
| Lorne | 1 | 510 | 0 | 356 | Yes |
| *Wannon Water* | | | | | |
| Otway system | 1 | 12,580 | 0 | 8,524 | Yes |
| **Total annual volume of bulk entitlements 2010–11** | | **19,667** | **0** | **12,919** | |
| Total annual volume of bulk entitlements 2009–10 | | 19,232 | 0 | 14,254 | |
| *Licensed diversions from unregulated streams* 2010–11 | | *6,663* | | *1,866* | |
| *Licensed diversions from unregulated streams* 2009–10 | | *5,533* | | *1,254* | |

Notes:

(1) The Minister for Water granted Barwon Water a new bulk entitlement for Apollo Bay in October 2010. The new entitlement consolidates Barwon Water's existing licences and bulk entitlement for water from the Barwon River, and takes into account of a new pump station and storage that is planned for construction by 2014.

## 30.7 Groundwater resources

A summary of licensed entitlements and use from GMUs within the Otway Coast basin, excluding domestic and stock use, is presented in Table 30-6.

The Otway Coast basin contains all of the Jan Juc GMA and Newlingrook GMA as well as part of the Colongulac GMA, Gellibrand GMA, Paaratte GMA and Nullawarre WSPA. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

Total groundwater use in the Otway Coast basin for 2010–11 was 1,324 ML more than in 2009–10. 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 will supplement supply to homes and businesses in the Greater Geelong region. Groundwater extraction under the bulk entitlement in 2010–11 was 1,948 ML.

### Table 30-6 Licensed groundwater volumes, Otway Coast basin 2010–11

| WSPA/GMA(1) | GMA/ WSPA depth limits(2) (m) | Entitlement limit(3) (ML/year) | Licensed entitlement(4) (ML/year) | Metered use (ML) | Estimated use in unmetered bores (ML)(5) | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Colongulac GMA (56%) | All depths | 2,614 | 2,242 | 159 | - | 159 | 381 |
| Gellibrand GMA (92%) | All depths | - | - | - | - | - | - |
| Jan Juc GMA (100%)(6)(7) | Zone 1 All depths Zone 2 Eastern View formation | 39,250 | 14,250 | 5,717 | - | 5,717 | 3,457 |
| Newlingrook GMA (100%) | All depths | 1,977 | 1,958 | 8 | - | 8 | 95 |
| Paaratte GMA (86%) | >120 | 3,949 | 2,745 | 252 | - | 252 | 250 |
| Nullawarre WSPA (11%) | ≤250 | 2,310 | 2,309 | 441 | - | 441 | 1,070 |
| **Total(8)** | | **50,100** | **23,504** | **6,576** | **-** | **6,576** | **5,252** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.
(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11.
(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.
(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.
(6) 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.
(7) The Jan Juc GMA includes the 2009 Anglesea groundwater bulk entitlement.
(8) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 30-7.

### Table 30-7 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores(1)(2) | Estimated domestic and stock use (assuming 1.5 ML per bore(3)) (ML)(4) |
|---|---|---|
| Colongulac GMA (56%) | 70 | 105 |
| Gellibrand GMA (92%) | 2 | 3 |
| Jan Juc GMA (100%) | 5 | 8 |
| Newlingrook GMA (100%) | 4 | 6 |
| Paaratte GMA (86%) | 3 | 5 |
| Nullawarre WSPA (11%) | 104 | 156 |
| **Total** | **188** | **282** |

Notes:
(1) 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 30-6.
(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(3) Estimated domestic and stock use is calculated using a factor of 1.5 ML per bore for these GMUs. Other authorities use a factor of 2 ML per bore.
(4) Total volumes are based on the sum of management unit data before rounding.

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 30-8.

### Table 30-8 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Otway system (Carlisle) | 1,800 | 2 | 7 |
| Port Campbell, Timboon and Peterborough | 3,159 | 294 | 335 |
| Greater Geelong (Anglesea Bore Field)(1) | 10,000 | 1,948 | - |
| **Total** | **14,959** | **2,244** | **342** |

Note:
(1) Greater Geelong (Anglesea, Torquay, Lorne) is split into Greater Geelong (Anglesea Bore Field) and Greater Geelong (Barwon Downs Bore Field).

## 30.8 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions are shown in Table 31-9. Apollo Bay was placed on Stage 2 restrictions between November and April, to reduce the risk of water shortage over the tourist season. Restrictions for towns supplied from the Geelong system were gradually eased to lower levels over spring, and removed at the end of February, following considerable improvement in water resources. Towns in the west of the basin are supplied by groundwater and were unrestricted in 2010–11.

Restrictions on licensed diversions from Gellibrand River, Curdies River and Lake Purrumbete were removed in August and September.

### Table 30-9 Seasonal allocations and restrictions on water use in Otway Coast basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Urban | Skenes Creek, Apollo Bay, Marengo | Stage 2 restrictions from 31 October 2010 to 30 April 2011 |
| | Geelong and surrounding towns (including Anglesea and Torquay) | Stage 3 restrictions from 1 July 2010 to 30 August 2010, Stage 2 restrictions from 1 September 2010 to 2 October 2010 and Stage 1 restrictions from 3 October 2010 to 28 February 2011 |
| Licensed diversions from unregulated streams | Lake Purumbete | Irrigation ban from July to September 2010 |
| | Curdies River | Irrigation ban from July to August 2010 |
| | Gellibrand River | Stage 2 restriction from July to August 2010 |

## 30.9 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 2010–11, 9% of the volume of treated wastewater was used within the Otway Coast basin (Table 30-10), which is a lesser percentage of recycled water than in 2010–11. There was an increase in the volume of water produced, but a decrease in the volume recycled in 2010–11, compared to 2009–10.

### Table 30-10 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 (ML)[3] |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation[1] | Within process[2] | | |
| Aireys Inlet | 98 | 98 | 0% | 0 | 0 | 0 | 98 | 0 | 0 |
| Anglesea | 307 | 58 | 9% | 0 | 28 | 0 | 31 | 279 | -31 |
| Apollo Bay | 477 | 15 | 0% | 0 | 0 | 0 | 15 | 477 | -15 |
| Cobden | 244 | 35 | 14% | 0 | 35 | 0 | 0 | 120 | 89 |
| Lorne | 307 | 15 | 0% | 0 | 0 | 0 | 15 | 307 | -15 |
| Port Campbell | 47 | 14 | 30% | 0 | 14 | 0 | 0 | 31 | 1 |
| Simpson | 37 | 26 | 70% | 0 | 0 | 26 | 0 | 37 | -26 |
| Timboon | 56 | 33 | 59% | 0 | 33 | 0 | 0 | 23 | 0 |
| **Total 2010–11** | **1,572** | **294** | **9%** | **0** | **110** | **26** | **159** | **1,274** | **3** |
| Total 2009–10 | 1,491 | 328 | 18% | 0 | 265 | 0 | 63 | 1,047 | 116 |

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.

## 30.10 Water for the environment

### 30.10.1 Environmental Water Reserve

There are several important environmental assets in the Otway Basin that depend on the EWR, including:

- Aire River (a heritage river), and more specifically the Lower Aire wetlands, 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 and their habitat such as river blackfish, remnant riparian vegetation and the Australian Grayling
- lakes Constin 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 Elliott River, St Georges River and Wye River.

In 2010–11 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.

### 30.10.2 Passing flow compliance

All passing flow requirements were complied with for the Otway Coast basin in 2010–11.

Table 30-11 shows the passing flow requirements in the Otway Coast basin for selected bulk entitlement compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest.

#### Table 30-11 Selected passing flow compliance in the Otway Coast basin

| River | Passing flow | |
|---|---|---|
| Painkalac Creek | Instrument where passing flows are specified | Bulk Entitlement (Aireys Inlet) Conversion Order 1997 |
| | Responsible authority | Barwon Water |
| | Compliance point | Painkalac Creek Reservoir (shown as 1 in Figure 30-2) |
| | Passing flow compliance | • From December to February inclusive natural inflows were passed downstream of the reservoir<br>• From March to November inclusive the lesser of 0.5 ML per day or natural flows were passed downstream of the reservoir |
| Barham River, Skenes Creek | Instrument where passing flows are specified | Bulk Entitlement (Apollo Bay and Skenes Creek) Conversion Order 1997 |
| | Responsible authority | Barwon Water |
| | Compliance point | Skenes Creek diversion weir (shown as 2 in Figure 30-2) |
| | Passing flow compliance | • The lesser of 1.5 ML per day or natural flows were passed below the weir<br>• 1.5 ML per day were passed when flows were between 1.5 and 1.93 ML per day<br>• When flows were greater than 1.93 ML per day, flows equal to the entire flow, less 0.43 ML per day, were passed<br>• Note the minimum passing flow was 1.5 ML per day |
| Arkins Creek West, Arkins Creek East, First Creek, Gellibrand River | Instrument where passing flows are specified | Bulk Entitlement (Otway System) Conversion Order 1998 |
| | Responsible authority | Wannon Water |
| | Compliance point | Gellibrand River – North Otway pump station (shown as 3 in Figure 30-2) |
| | Passing flow compliance | • When flows were equal to or less than 12 ML per day, no passing flows were made<br>• When flows were between 12 and 22.5 ML per day, 12 ML per day were passed below the pump station<br>• When flows were between 22.5 and 44.9 ML per day, 17.5 ML per day were passed below the pump station<br>• When flows were between 44.9 and 54.9 ML per day, 20 ML per day were passed below the pump station<br>• When flows were 54.9 ML per day or greater, 22.5 ML per day were passed below the pump station |
| | Compliance point | Gellibrand River – South Otway pump station (shown as 4 in Figure 30-2) |
| | Passing flow compliance | • When flows were equal to or less than 12 ML per day, no passing flows were made<br>• When flows were between 12 and 22 ML per day, 12 ML per day were passed below the pump station<br>• When flows were between 22 and 32.7 ML per day, 17 ML per day were passed below the pump station<br>• When flows were between 32.7 and 41.2 ML per day, 19 ML per day were passed below the pump station<br>• When flows were 41.2 ML per day or greater, 21.5 ML per day were passed below the pump station |

### 30.10.3 Streamflow management plans

The Western Region Sustainable Water Strategy states that local management plans will be developed for the following unregulated river systems within the Otway Coast basin:

- Otways (Aire River – Anglesea River)
- Gellibrand River
- Curdies River
- Lake Purumbete.

These systems will have existing rules documented as local management plans. Note that a statutory streamflow management plan was originally proposed for the Gellibrand River, but the Western Region Sustainable Water Strategy states that this is no longer required.

# 31 Hopkins basin

This chapter sets out the accounts for the Hopkins basin. For detailed information about how they were compiled, refer to Chapter 5.

## 31.1 Hopkins basin summary

Inflows in 2010–11 were 169% of the long-term average (of 635,000 ML), and more than four times greater than inflows in 2009–10.

Groundwater is a significant resource in the Hopkins basin. Many of Wannon Water's towns are supplied solely by groundwater and groundwater is an important supplement for Central Highlands Water and Grampians Wimmera Mallee Water towns. Groundwater use was unrestricted in 2010–11, but use decreased significantly compared to 2009–10, particularly in the Nullawarre WSPA. Central Highlands Water's use of the Ballarat West bore field was similar to 2009–10.

By the end of 2010–11, no towns in the Hopkins basin were subject to water restrictions. Grampians Wimmera Mallee Water removed Stage 4 restrictions for Streatham and Westmere in May 2011, following the commissioning of a new groundwater bore. Restrictions were also eased for towns supplied from sources outside the Hopkins basin.

Licenced diversions were restricted or banned for a few rivers and creeks for only the first few months of the year.

## 31.2 Responsibilities for management of water resources

Table 31-1 shows the responsibilities of various authorities within the Hopkins basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 31-1 Responsibilities for water resources management within the Hopkins basin, 2010–11

| 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 (except Loddon Highlands WSPA, which is managed by Goulburn-Murray Water) | | |
| Wannon Water | | | Supplies towns in the south of the basin including Warrnambool | |
| Grampians Wimmera Mallee Water | | | 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 |

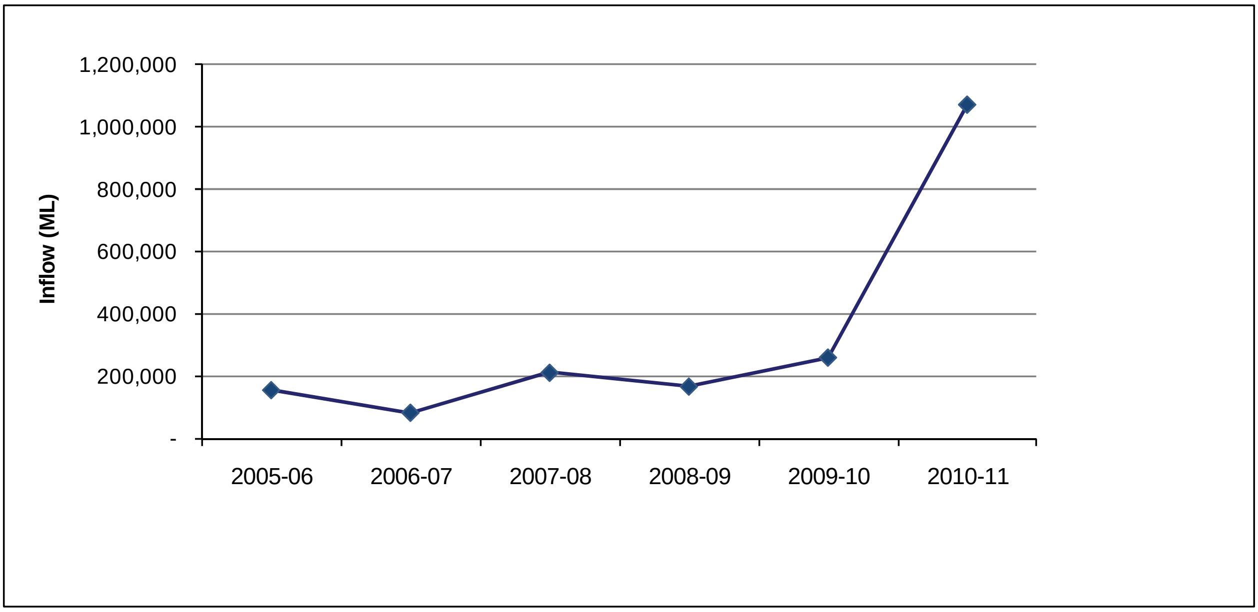
## 31.3 Rainfall, flows and storages in 2010–11

In 2010–11, rainfall in the Hopkins basin ranged between 125% and 200% of the long-term average. Inflows in 2010–11 were 169% of the long-term average (of 635,000 ML), which is the highest since 2004–05.

The volume of water flowing from the Hopkins basin into Bass Strait was 982,100 ML in 2010–11, which represented 92% of the inflow. This is an increase from 167,800 ML in 2009–10, which represented 65% of catchment inflows.

There are no major storages (greater than 1,000 ML) in the Hopkins basin.

### Figure 31-1 Catchment inflows in the Hopkins basin




## 31.4 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 31-2.

### Table 31-2 Summary of total water resources and water use in the Hopkins basin, 2010–11

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | 1,077,900 | 65,700 |
| Groundwater(2) | 38,200 | 8,500 |
| Recycled water | 6,580 | 440 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 31-7, and the estimated domestic and stock use presented in .

Table 31-8.

(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

### 31.4.1 Infrastructure projects to improve water availability

There were no infrastructure projects to improve water availability within the Hopkins basin in 2010–11.

## 31.5 Location of water resources

### Figure 31-2 Map of the Hopkins basin

## 31.6 Surface water resources

### 31.6.1 Water balance

A water balance for the Hopkins basin is shown in Table 31-3. There are no major water storages (greater than 1,000 ML in size) in the basin.

Small-catchment dams harvest most of the water used for consumptive purposes.

Transfers into the basin for urban water supply did not affect streamflows and are therefore not accounted for in the water balance for the Hopkins basin.

#### Table 31-3 Balance of surface water in the Hopkins basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | - | - |
| Volume in storage at end of year | - | - |
| **Change in storage** | **-** | **-** |
| **Inflows** | | |
| Catchment inflow(1) | 1,072,400 | 259,400 |
| Rainfall on major storages | - | - |
| Transfers from other basins(2) | - | - |
| Return flow from irrigation | - | - |
| Treated wastewater discharged back to river | 5,460 | 5,220 |
| **Sub-total** | **1,077,900** | **264,600** |
| **Usage** | | |
| Urban diversions | 150 | 300 |
| Licensed diversions from unregulated streams | 900 | 1,800 |
| Small-catchment dams(3) | 64,600 | 64,600 |
| **Sub-total** | **65,700** | **66,700** |
| **Losses** | | |
| Evaporation losses from major storages | - | - |
| Evaporation from small-catchment dams(3) | 30,100 | 30,100 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(4) | n/a | n/a |
| **Sub-total** | **30,100** | **30,100** |
| **Water passed at outlet of basin** | | |
| River outflows to the ocean | 982,100 | 167,800 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Water from other basins used to supply urban needs are not shown as they were provided directly into the relevant urban supply systems and did not affect streamflows in the Hopkins basin.

(3) Data for water usage from small-catchment dams is provided by DSE. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(4) Assumed to be zero because data is not readily available.

n/a: No information available

### 31.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 31-4 below have been estimated by DSE, as outlined in Chapter 5.

#### Table 31-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 30,900 | 15,500 | n/a |
| Registered commercial and irrigation | 58,400 | 49,100 | n/a |
| **Total** | **89,300** | **64,600** | **94,700** |

n/a: No information available

### 31.6.3 Water entitlement trades

There are no declared systems in the Hopkins basin. Surface water trade was limited to transfers of licences within the basin. In 2010–11, there were no entitlements transferred on a permanent basis, and 136 ML was traded on a temporary basis. There was no net water trade into the basin.

Table 31-5 summarises the trade of bundled entitlements in the Hopkins basin in 2010–11.

#### Table 31-5 Surface water bundled entitlement volume transfers in the Hopkins basin 2010–11

| Trading zone | Permanent transfers (ML) | Temporary transfers (ML) |
|---|---|---|
| Hopkins unregulated | 0 | 136 |
| **Total 2010–11** | **0** | **136** |
| Total 2009–10 | 0 | 355 |

### 31.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 31-6. Compliance with individual bulk entitlement volumes was deemed to have occurred if water diverted was not more than the maximum volume allowed to be diverted in 2010–11.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

#### Table 31-6 Volume of water diverted under surface water entitlements in the Hopkins basin

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML)(1) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance? |
|---|---|---|---|---|---|
| *Central Highlands Water* | | | | | |
| Beaufort | 1 | 419 | 0 | 154 | Yes |
| Skipton(3) | 1 | 210 | 0 | 0 | Yes |
| *GWMWater* | | | | | |
| Willaura, Moyston, Lake Bolac and Wickliffe(2) | - | - | - | - | - |
| **Total annual volume of bulk entitlements 2010–11** | | **629** | **0** | **154** | |
| Total annual volume of bulk entitlements 2009–10 | | 629 | 0 | 295 | |
| *Licensed diversions from unregulated streams 2010–11* | | *10,691* | | *895* | |
| *Licensed diversions from unregulated streams 2009–10* | | *10,348* | | *1,798* | |

Notes:

(1) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

(2) Supply to these towns from the Mt William Creek system is yet to be converted to a bulk entitlement.

(3) No water was taken under the Skipton bulk entitlement as the town was supplied from the Ballarat system.

## 31.7 Groundwater resources

A summary of the licensed entitlements and use from GMUs within the Hopkins basin, excluding domestic and stock use, is presented in Table 31-7.

The Hopkins basin contains all of the Glenormiston GMA as well as parts of the Nullawarre WSPA, Yangery WSPA, Cardigan GMA, Loddon Highlands WSPA and Colongulac GMA. Loddon Highlands WSPA replaced Spring Hill WSPA and Upper Loddon WSPA in 2010–11. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A. Good-quality groundwater of reasonable yields is found in the unincorporated areas around the Nullawarre and Yangery WSPAs, and use from these unincorporated areas is expected to increase in future. Groundwater levels in Nullawarre and Yangery WSPAs are generally increasing, while levels are stable in Loddon Highlands WSPA and declining in Cardigan GMA. Insufficient observation bores were available to determine a trend for Colongulac and Glenormiston GMAs.

Groundwater use in the Hopkins basin decreased by about 51% in 2010–11, compared to 2009–10. This is largely due to the decrease in extractions in the Nullawarre WSPA.

### Table 31-7 Licensed groundwater volumes, Hopkins basin 2010–11

| WSPA/GMA[1] | GMA/ WSPA depth limits[2] (m) | Entitlement limit[3] (ML/year) | Licensed entitlement[4] (ML/year) | Metered use (ML) | Estimated use in unmetered bores (ML)[5] | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Cardigan GMA (60%)[6] | All depths | 3,581 | 3,533 | 669 | - | 669 | 644 |
| Colongulac GMA (9%) | ≤60 | 427 | 366 | 26 | - | 26 | 61 |
| Glenormiston GMA (100%) | ≤60 | 2,565 | 2,556 | 458 | - | 458 | 658 |
| Nullawarre WSPA (89%) | ≤250 | 18,970 | 18,966 | 3,619 | - | 3,619 | 8,818 |
| Yangery WSPA (60%) | ≤100 | 8,485 | 8,483 | 1,169 | - | 1,169 | 2,432 |
| Loddon Highlands WSPA (9%)[7] | All depths | 1,794 | 1,869 | 159 | - | 159 | 1,184 |
| **Total[8]** | | **35,822** | **35,783** | **6,100** | **-** | **6,100** | **13,796** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.
(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11. The entitlement limit in Loddon Highlands WSPA is represented by 80% PCV due to restrictions in place in 2010–11.
(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.
(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.
(6) 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 Cardigan, Barwon and Corangamite basins. 604 ML was extracted from the Cardigan GMA within the Hopkins Basin for urban supplies. The remaining 109 ML of metered use (non-urban) was shared proportionally between Cardigan, Barwon and Corangamite basins
(7) Loddon Highlands WSPA replaced Spring Hill WSPA and Upper Loddon WSPA in 2010–11.
(8) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 31-8.

### Table 31-8 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores[1][2] | Estimated domestic and stock use (assuming 1.5 ML per bore[3]) (ML)[4] |
|---|---|---|
| Cardigan GMA (60%) | 55 | 83 |
| Colongulac GMA (9%) | 11 | 17 |
| Glenormiston GMA (100%) | 85 | 128 |
| Nullawarre WSPA (89%) | 855 | 1,283 |
| Yangery WSPA (60%) | 534 | 801 |
| Loddon Highlands WSPA (9%)[5] | 67 | 134 |
| **Total** | **1,607** | **2,446** |

Notes:

(1) 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 31-7.
(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(3) Estimated domestic and stock use is calculated using a factor of 1.5 ML per bore for all GMUs listed except Loddon Highlands WSPA which uses a factor of 2 ML per bore.
(4) Total volumes are based on the sum of management unit data before rounding.
(5) Loddon Highlands WSPA replaced Spring Hill WSPA and Upper Loddon WSPA in 2010–11.

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 31-9.

### Table 31-9 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Caramut | 50 | 19 | 23 |
| Darlington | 10 | 2 | 2 |
| Koroit | 524 | 1 | 2 |
| Mortlake | 335 | 27 | 19 |
| Warrnambool, Allansford and Koroit | 750 | 454 | 465 |
| Willaura | 140 | 103 | 30 |
| Ballarat(1) | 3,000 | 604 | 525 |
| Beaufort | 200 | 5 | 1 |
| Streatham | 60 | 38 | 43 |
| **Total** | **5,069** | **1,251** | **1,110** |

Notes:

(1) Volume of the license 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.

## 31.8 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions are shown in Table 31-10. The towns of Streatham and Westmere were subject to the most severe restrictions in 2010–11, with Stage 4 in place for most of the year while GWMWater commissioned a new groundwater bore. Ararat and Skipton were the only other towns subject to restrictions in 2010–11: supplies for these towns are sourced from systems outside the Hopkins basin. Licenced diversions were restricted or banned for the first few months of the year from the Merri River, Hopkins River and Lake Cartcarrong.

### Table 31-10 Seasonal allocations and restrictions on water use in Hopkins basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Urban | Skipton (Ballarat system) | Stage 3 restrictions from 1 July 2010 to 31 July 2010, Stage 1 restrictions from 1 August 2010 to 31 December 2010 |
| | Ararat (Wimmera–Mallee system) | Stage 1 restrictions from 1 July 2010 to 11 October 2010 |
| | Streatham and Westmere | Stage 4 restrictions from 1 July 2010 to 26 May 2011 |
| Licensed diversions from unregulated streams | Merri River | Stage 1 restrictions in July and August 2010 |
| | Merri Creek | Irrigation ban in March 2011 |
| | Hopkins River | Stage 2 restriction in July and August 2010 |
| | Lake Cartcarrong | Irrigation ban from July to September 2010 |
| Groundwater | Loddon Highlands WSPA | Extractions were restricted to 80% of licence volume in 2010–11 |

## 31.9 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 3% less water recycled in 2010–11, compared to 2009–10.

### Table 31-11 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 (ML)(3) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation(1) | Within process(2) | | |
| Ararat | 586 | 300 | 50% | 24 | 270 | 0 | 6 | 0 | 286 |
| Beaufort | 142 | 0 | 0% | | | 0 | 0 | 142 | 0 |
| Cardigan Village | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| Mortlake | 153 | 35 | 23% | 0 | 35 | 0 | 0 | 0 | 117 |
| Terang(4) | 376 | 102 | 27% | 0 | 102 | 0 | 0 | 39 | 235 |
| Warrnambool | 5,277 | 0 | 0% | 0 | 0 | 0 | 0 | 5,277 | 0 |
| Willaura | 51 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 51 |
| **Total 2010–11** | **6,585** | **437** | **7%** | **24** | **408** | **0** | **6** | **5,458** | **689** |
| Total 2009–10 | 5,421 | 561 | 10% | 125 | 432 | 0 | 4 | 5,222 | -362 |

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.

## 31.10 Water for the environment

### 31.10.1 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 EWR.

In 2010–11, the Hopkins 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 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.

### 31.10.2 Passing flow requirements

Bulk entitlements require passing flows to be met at some points in the basin.

All passing flow requirements were complied with for the Hopkins basin in 2010–11.

Table 31-12 shows the passing flow requirements in the Hopkins basin for a selected bulk entitlement compliance point. While there are other compliance points, the point below has been chosen because it is of community interest. The location of these compliance points is presented in Figure 31-2.

#### Table 31-12 Selected passing flow compliance in the Hopkins basin at selected sites

| River | Passing flow | |
|---|---|---|
| Cave Hill Creek, Glut Creek, Side Spring Creek | Instrument where passing flows are specified | Bulk Entitlement (Beaufort) Conversion Order 2005 |
| | Responsible authority | Central Highlands Water |
| | Compliance point | Cave Hill Creek Weir (shown as 1 in Figure 31-2) |
| | Passing flow compliance | The lesser of 0.2 ML per day or natural inflow were passed below Cave Hill Creek weir, when this did not affect supply to Raglan |

.

### 31.10.3 Streamflow management plans

The Western Region Sustainable Water Strategy states that a local management plan will be developed for the Merri River by the end of 2012: a statutory streamflow management plan will not be prepared. Action 8.4 of the strategy sets out some of the key diversion rules that will be included in the local management plan for the Merri River. The strategy states that existing rules will be documented as local management plans for the Hopkins River / Mt Emu Creek / Brucknell Creek unregulated river system, and for Cudgee Creek.

# 32 Portland Coast basin

This chapter sets out the accounts for the Portland Coast basin. For detailed information about how they were compiled, refer to Chapter 5.

## 32.1 Portland Coast basin summary

Estimated inflows to the Portland Coast basin were 145% of the long-term average in 2010–11, and close to double the volume of inflow in 2009–10.

As with other river basins in Western Victoria, groundwater is a significant resource in the Portland Coast basin. Groundwater extraction accounted for almost half the total water usage in the Portland Coast basin.

The major towns in the basin are also supplied by groundwater, and in particular the Dilwyn aquifer. Groundwater yields were adequate to provide unrestricted supplies to these towns.

Irrigation bans were in place for licensed diversions during winter for the Surrey, Fitzroy, Eumarella and Moyne rivers, and during summer for the Fitzroy River at Heywood.

## 32.2 Responsibilities for management of water resources

Table 32-1 shows the responsibilities of various authorities within the Portland Coast basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 32-1 Responsibilities for water resources management within the Portland Coast basin, 2010–11

| 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 diversion | | |
| Wannon Water | | | Supplies Koroit, Port Fairy, Heywood and Portland | |
| Glenelg Hopkins Catchment Management Authority | | | | Manages waterways in the whole Portland Coast basin |

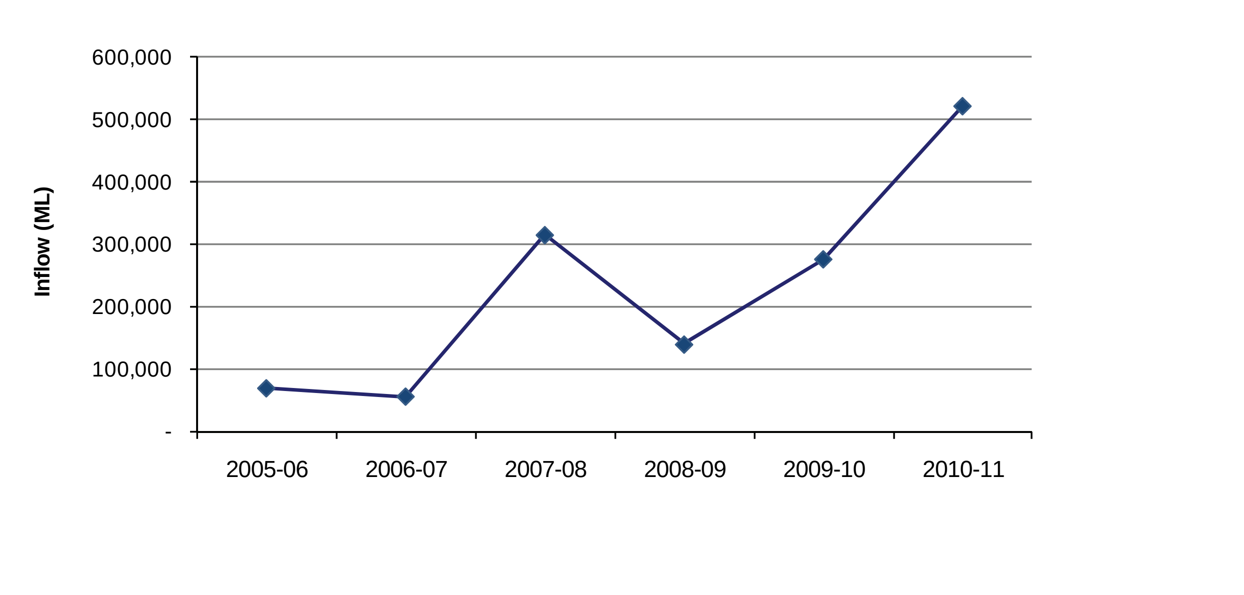
## 32.3 Rainfall, flows and storages in 2010–11

In 2010–11, rainfall in the Portland Coast basin ranged between 125% and 150% of the long-term average, which is higher than in 2009–10. Inflows in 2010–11 were 145% of the long-term average of 361,000 ML, compared to 77% in 2009–10.

The amount of water flowing from the Portland Coast basin into Bass Strait was 504,200 ML in 2010–11, a significant increase from the previous year. This represents 96% of catchment inflows into the basin.

There are no major storages (greater than 1,000 ML) in the basin.

**Figure 32-1 Catchment inflows in the Portland Coast basin**




## 32.4 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 32-2.

**Table 32-2 Summary of total water resources and water use in the Portland Coast basin, 2010–11**

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | 524,900 | 16,300 |
| Groundwater(2) | 40,800 | 11,700 |
| Recycled water | 2,780 | 50 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 32-5 and the estimated domestic and stock use presented in Table 32-6.

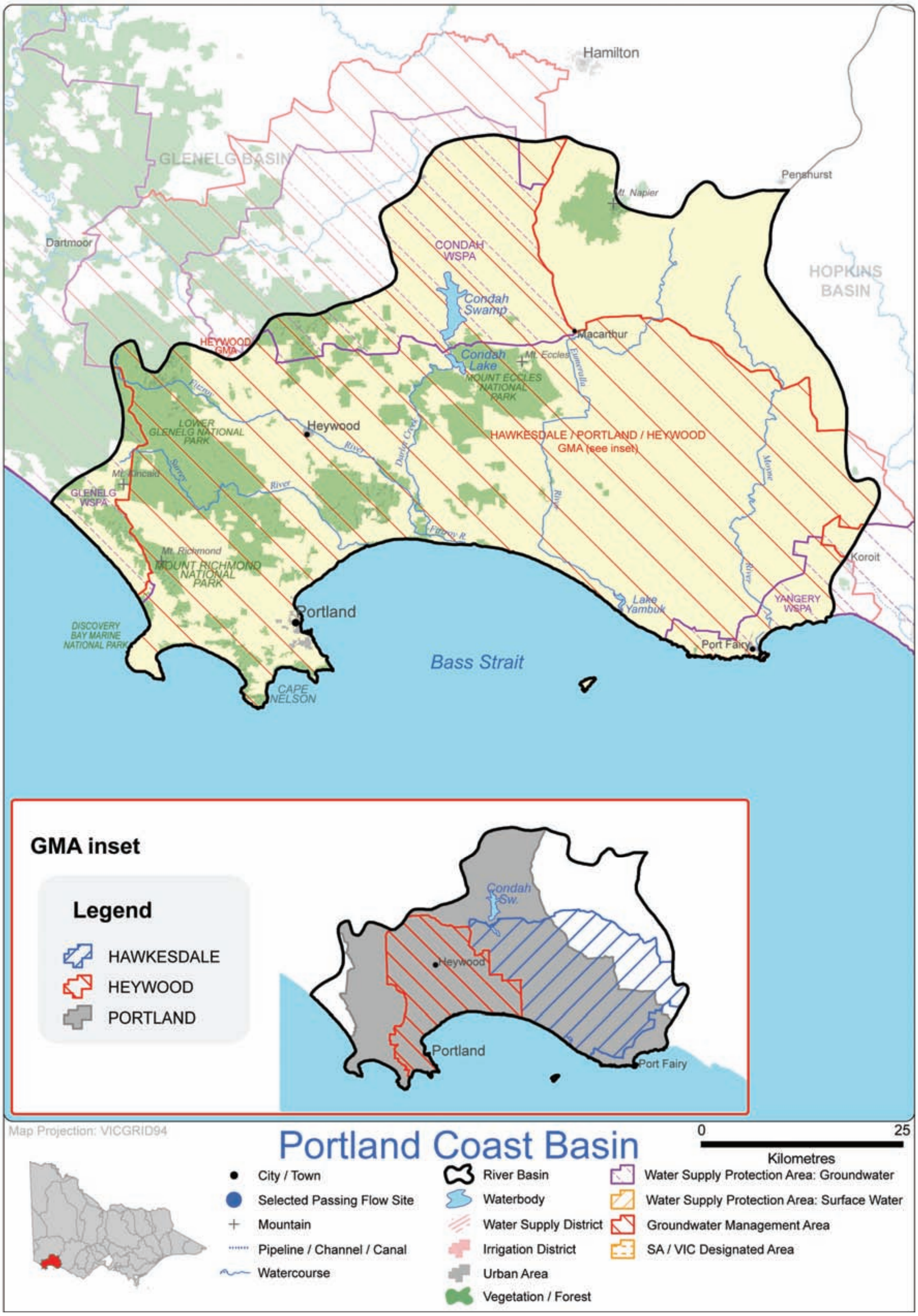
(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

### 32.4.1 Infrastructure projects to improve water availability

There were no infrastructure projects to improve water availability within the Portland Coast basin in 2010–11.

## 32.5 Location of water resources

### Figure 32-2 Map of the Portland Coast basin



# 32.6 Surface water resources

## 32.6.1 Water balance

A water balance for the Portland Coast basin is shown in Table 32-3.

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 supplied by groundwater, or from other river basins.

### Table 32-3 Balance of surface water in the Portland Coast basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | - | - |
| Volume in storage at end of year | - | - |
| **Change in storage** | **-** | - |
| **Inflows** | | |
| Catchment inflow(1) | 522,300 | 276,500 |
| Rainfall on major storages | - | - |
| Transfers from other basins | - | - |
| Return flow from irrigation | - | - |
| Treated wastewater discharged back to river | 2,630 | 2,400 |
| **Sub-total** | **524,900** | **278,900** |
| **Usage** | | |
| Urban diversions | - | - |
| Licensed diversions from unregulated streams | 100 | 100 |
| Small-catchment dams(2) | 16,200 | 16,200 |
| **Sub-total** | **16,300** | **16,300** |
| **Losses** | | |
| Net evaporation losses from major storages | - | - |
| Evaporation from small-catchment dams(2) | 4,400 | 4,400 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(3) | n/a | 0 |
| **Sub-total** | **4,400** | **4,400** |
| **Water passed at outlet of basin** | | |
| River outflows to the ocean | 504,200 | 258,200 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Data for water usage from small-catchment dams is provided by DSE. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(3) Assumed to be zero because data is not readily available.

n/a: No information available

## 32.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in .

Table 32-4 below have been estimated by DSE, as outlined in Chapter 5.

### Table 32-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 4,500 | 2,300 | n/a |
| Registered commercial and irrigation | 16,500 | 13,900 | n/a |
| **Total** | **21,000** | **16,200** | **20,600** |

n/a: No information available

## 32.6.3 Water entitlement trades

There were no transfers of water entitlements within the Portland basin or across basin boundaries in 2010–11.

## 32.6.4 Volume diverted

The only surface-water entitlements in the Corangamite basin are licences on unregulated streams. In 2010–11, the licensed volume totalled 1,744 ML and use was estimated to be 78 ML, which was higher than the 2009–10 volume of 2,014 ML and estimated use of 92 ML.

## 32.7 Groundwater resources

A summary of the licensed entitlements and use from GMUs within the Portland Coast basin, excluding domestic and stock use, is presented in Table 32-5.

The Portland Coast basin contains all of the Heywood GMA and Hawkesdale GMA as well as part of the Condah WSPA (53%), Yangery WSPA (40%) and Portland GMA (73%).

The Portland Coast basin recorded a decrease of 41% in groundwater use, compared to 2009–10. Groundwater levels in the Condah WSPA, Portland GMA and Hawkesdale GMA are stable. Groundwater levels in the Yangery WSPA are increasing and insufficient observation bores were available to determine trends for the Heywood GMA. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

The Portland GMA comprises the deep, geothermal waters of the Dilwyn aquifer, which is recharged in its northern parts where it is closer to the ground surface. Changing land use in its recharge zones could deplete recharge to the aquifer, which is being considered in the management of groundwater resources.

### Table 32-5 Licensed groundwater volumes, Portland Coast basin 2010–11

| WSPA/GMA(1) | GMA/ WSPA depth limits(2) (m) | Entitlement limit(3) (ML/year) | Licensed entitlement(4) (ML/year) | Metered use (ML) | Estimated use in unmetered bores (ML)(5) | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Hawkesdale GMA (100%) | As per Plan | 16,161 | 12,314 | 2,689 | - | 2,689 | 5,214 |
| Heywood GMA (100%) | ≤70 | 8,500 | 6,937 | 912 | - | 912 | 1,578 |
| Portland GMA (73%)(6) | >200 | 7,737 | 7,736 | 2,466 | - | 2,466 | 2,726 |
| Condah WSPA (53%) | 70-200 | 3,920 | 3,920 | 588 | - | 588 | 1,379 |
| Yangery WSPA (40%) | ≤100 | 5,618 | 5,617 | 774 | - | 774 | 1,594 |
| **Total(7)** | | **41,936** | **36,523** | **7,429** | **-** | **7,429** | **12,490** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11.

(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.

(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.

(6) 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 Cardigan, Barwon and Corangamite basins. 2,466 ML was extracted from the Portland GMA within the Portland Basin for urban supplies. There was zero non-urban metered use for 2010–11.

(7) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 32-6.

### Table 32-6 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores(1)(2) | Estimated domestic and stock use (assuming 1.5 ML per bore(3)) (ML)(4) |
|---|---|---|
| Hawkesdale GMA (100%) | 1,186 | 1,779 |
| Heywood GMA (100%) | 1,275 | 1,913 |
| Portland GMA (73%) | 4 | 6 |
| Condah WSPA (53%) | 25 | 38 |
| Yangery WSPA (40%) | 354 | 531 |
| **Total** | **2,844** | **4,266** |

Notes:

(1) 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 32-5.

(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Estimated domestic and stock use is calculated using a factor of 1.5 ML per bore for these GMUs. Other authorities use a factor of 2 ML per bore.
(4) Total volumes are based on the sum of management unit data before rounding.

Groundwater is used as an urban water supply for the townships of Portland, Port Fairy and Heywood. The licensed entitlements and metered use for these groundwater supplies are provided in Table 32-7.

### Table 32-7 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Heywood | 333 | 150 | 172 |
| Port Fairy | 1,026 | 665 | 757 |
| Portland | 6,222 | 1,651 | 1,797 |
| **Total** | **7,581** | **2,466** | **2,726** |

## 32.8 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to licensed diversions from unregulated streams are presented in Table 32-8. Irrigation bans were in place for licensed diversions during July and August for the Surrey, Fitzroy, Eumarella and Moyne rivers, and during February and March for the Fitzroy River at Heywood.

### Table 32-8 Seasonal allocations and restrictions on water use in Portland Coast basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Licensed diversions from unregulated streams | Surrey River | Irrigation ban in July and August 2010 |
| | Fitzroy River, Eumarella River, Moyne River | Irrigation ban in July and August 2010 |
| | Fitzroy River (at Heywood) | Irrigation ban in February and March 2011 |

## 32.9 Recycled water

Wannon Water operates all treatment plants within the Portland Coast basin. In 2010–11, 2% of the total wastewater produced in the basin was reused, including 14% from the Heywood treatment plant for wood lot irrigation (a decrease from 41% in 2009–10). The percentage of recycled water was 2%: this has decreased from previous years, when it was reasonably consistent, at 6%.

### Table 32-9 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 (ML)(3) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation(1) | Within process(2) | | |
| Heywood | 367 | 53 | 14% | 0 | 53 | 0 | 0 | 224 | 90 |
| Port Fairy | 1,006 | 0 | 0% | 0 | 0 | 0 | 0 | 1,006 | 0 |
| Portland | 1,403 | 0 | 0% | 0 | 0 | 0 | 0 | 1,403 | 0 |
| **Total 2010–11** | **2,776** | **53** | **2%** | **0** | **53** | **0** | **0** | **2,633** | **90** |
| Total 2009–10 | 2,558 | 143 | 6% | 0 | 143 | 0 | 0 | 2,402 | 12 |

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.

## 32.10 Water for the environment

### 32.10.1 Environmental Water Reserve

In 2010–11 the Portland Coast basin EWR comprised:

- water in the basin not otherwise allocated for consumptive use: that is, water above cap
- 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.

### 32.10.2 Passing flow compliance

There are currently no bulk entitlements in operation and therefore no passing flow obligations on water corporations in the Portland Coast basin.

### 32.10.3 Management plans

The Western Region Sustainable Water Strategy states that existing rules will be documented as local management plans for the following unregulated river systems in the Portland Coast basin:

- Condah Drain
- Fitzroy River
- Moyne River
- Shaw River
- Surrey River
- Eumeralla River.

# 33 Glenelg basin

This chapter sets out the accounts for the Glenelg basin. For detailed information about how they were compiled, refer to Chapter 5.

## 33.1 Glenelg basin summary

Inflows in the Glenelg basin in 2010–11 were 103% of the long-term average, and almost three times the volume of inflow in 2009–10. The basin's largest water storage, Rocklands Reservoir (which was holding just 2% of capacity at the beginning of the year) recovered to 38% by the end of June 2011.

Urban water restrictions were removed for Hamilton, Cavendish, Dunkeld and Tarrington early in the year. Stage 1 restrictions for Harrow continued throughout 2010–11 due to capacity constraints of the existing groundwater bore. No other towns in the Glenelg basin were subject to restrictions.

Bans on licensed diversions were in place in July and August for the Glenelg and Wannon rivers, and for several tributaries. Groundwater use was unrestricted in the Glenelg basin in 2010–11.

## 33.2 Responsibilities for management of water resources

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Table 33-1 shows the responsibilities of various authorities within the Glenelg basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 33-1 Responsibilities for water resources management within the Glenelg basin, 2010–11

| 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 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<br>Obliged to meet passing flow requirements |
| Minister for Environment | | | | Manages environmental entitlement in the regulated Glenelg River |
| Glenelg-Hopkins Catchment Management Authority | | | | Manages waterways in the whole of the Glenelg basin |

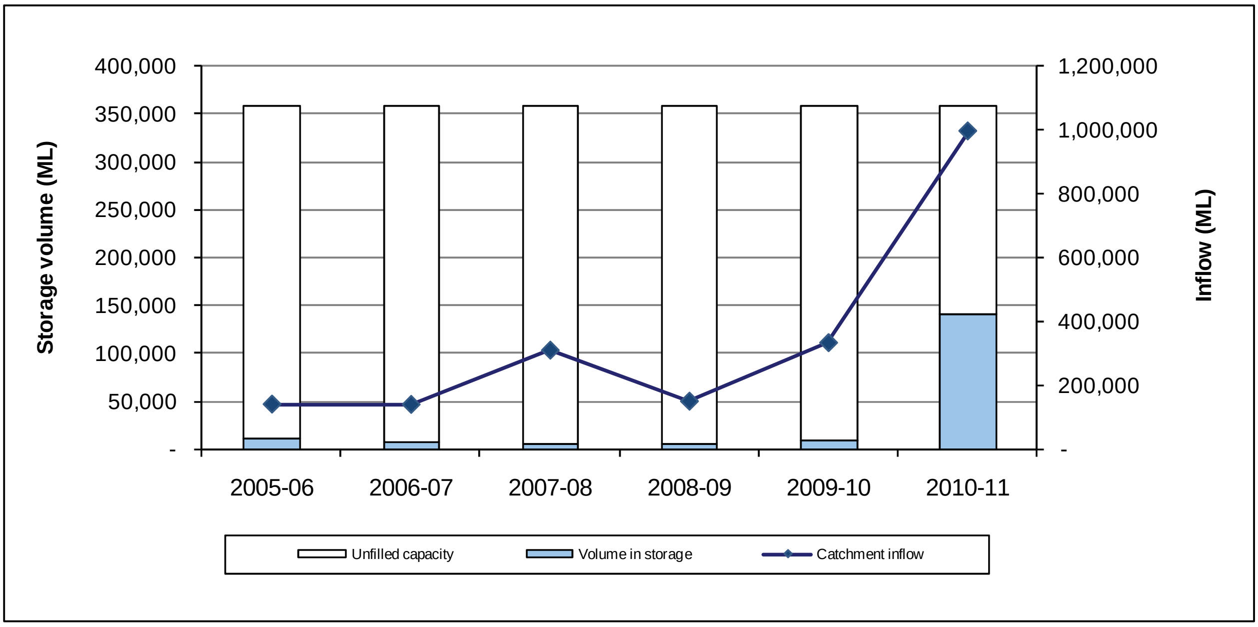
## 33.3 Rainfall, flows and storages in 2010–11

In 2010–11, rainfall in the Glenelg basin was between 125% and 200%of the long-term average. Inflows across the basin were 993,800 ML. This was 103% of the long-term average, and almost three times the volume of inflow in 2009–10.

The volume of water flowing from the Glenelg basin into Bass Strait was 704,900 ML in 2010–11, a significant increase from the previous year. This represented 71% of the catchment inflows into the basin, compared to 66% 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 38% of capacity at the end of 2010–11.

### Figure 33-1 All major storages and catchment inflows in the Glenelg basin




## 33.4 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 33-2.

### Table 33-2 Summary of total water resources and water use in the Glenelg basin, 2010–11

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---|---|
| Surface water | 1,014,200 | 62,300 |
| Groundwater(2) | 27,800 | 4,170 |
| Recycled water | 1,550 | 370 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 33-7 and the estimated domestic and stock use presented in Table 33-8.

(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

### 33.4.1 Infrastructure projects to improve water availability

Wannon Water completed construction of the 52-km Hamilton-Grampians pipeline in June 2010. The pipeline enables Wannon Water to transfer up to 2,000 ML of water annually from Rocklands Reservoir to supplement existing supplies from the Southern Grampians system. Wannon Water was able to remove urban water restrictions for the towns of Hamilton, Cavendish, Dunkeld and Tarrington following completion of the project. These towns had been subject to restrictions for more than four years.

## 33.5 Location of water resources

### Figure 33-2 Map of the Glenelg basin

# 33.6 Surface water resources

## 33.6.1 Water balance

A water balance for the Glenelg basin is shown inTable 33-3. A volume of 3,700 ML was diverted to the Wimmera-Mallee System in 2010–11.

### Table 33-3 Balance of surface water in the Glenelg basin

| Water account component | 2010–11 (ML) | 2009–10 (ML) |
|---|---|---|
| **Major on-stream storage** | | |
| Volume in storage at start of year | 10,300 | 6,100 |
| Volume in storage at end of year | 141,800 | 10,300 |
| **Change in storage** | **131,500** | **4,200** |
| **Inflows** | | |
| Catchment inflow(1) | 993,800 | 330,800 |
| Rainfall on major storages | 20,200 | 1,200 |
| Transfers from other basins | | 0 |
| Return flow from irrigation | | 0 |
| Treated wastewater discharged back to river | 210 | 80 |
| **Sub-total** | **1,014,200** | **332,100** |
| **Usage** | | |
| Urban diversions | 2,840 | 1,230 |
| Diversions to the Wimmera-Mallee System | 3,700 | 3,300 |
| Licensed diversions from unregulated streams | 300 | 200 |
| Small-catchment dams(2) | 55,500 | 55,500 |
| **Sub-total** | **62,300** | **60,200** |
| **Losses** | | |
| Evaporation losses from major storages | 33,800 | 3,900 |
| Evaporation from small-catchment dams(2) | 24,600 | 24,600 |
| In-stream infiltration to groundwater, flows to floodplain and evaporation(3) | 57,100 | 22,000 |
| **Sub-total** | **115,500** | **50,500** |
| **Water passed at outlet of basin** | | |
| River outflows to the ocean | 704,900 | 217,200 |

Notes:

(1) Inflows have been back-calculated from outflows plus diversions.

(2) Data for water usage from small-catchment dams is provided by DSE. Evaporation losses are calculated by subtracting estimated usage from the total water harvested.

(3) Estimated from loss functions in the Glenelg River REALM.

## 33.6.2 Small-catchment dams

Specific information on usage and losses for small-catchment dams for 2010–11 is not readily available. The values in Table 33-4 below have been estimated by DSE, as outlined in Chapter 5.

### Table 33-4 Estimated small-catchment dam information, 2010–11

| Type of small-catchment dam | Capacity (ML) | Usage (ML) | Total water harvested (ML) |
|---|---|---|---|
| Domestic and stock (not licensed) | 27,100 | 13,600 | n/a |
| Registered commercial and irrigation | 49,900 | 41,900 | n/a |
| **Total** | **77,000** | **55,500** | **80,100** |

n/a: No information available

## 33.6.3 Water entitlement trades

There are no declared systems in the Glenelg basin. Surface water trade was limited to transfers of licences within the basin. In 2010–11, 9 ML of entitlements were transferred on a permanent basis, and 7 ML was traded on a temporary basis. There was no net import of water into the basin in 2010–11.

Table 33-6 summarises the trade of bundled entitlements in the Glenelg basin in 2010–11.

### Table 33-5 Surface water bundled entitlement volume transfers in the Glenelg basin 2010–11

| Trading zone | Permanent transfers (ML) | Temporary transfers (ML) |
|---|---|---|
| Glenelg unregulated | 9 | 7 |
| **Total 2010–11** | **9** | **7** |
| Total 2009–10 | 10 | 7 |

### 33.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 33-6. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2010–11.

The volume diverted for the Coleraine bulk entitlement is not directly measured and was estimated based on the metered volume of water supplied to customers. Although supply to Casterton and Sandford is permitted under this bulk entitlement, these towns are supplied from the Tullich bore system.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Southern Rural Water.

**Table 33-6 Volume of water diverted under surface water entitlements in the Glenelg basin**

| Bulk entitlement | Bulk entitlement period (years) | Average annual bulk entitlement volume (ML) | Net temporary transfer (ML) | Volume diverted (ML) | Bulk entitlement volume compliance?(1) |
|---|---|---|---|---|---|
| *Coliban Water* | | | | | |
| Wimmera and Glenelg Rivers(2)(3) | 1 | 300 | 0 | 124 | Yes |
| *Wannon Water* | | | | | |
| Coleraine, Casterton, Sandford | 1 | 855 | 0 | 45 | Yes |
| Dunkeld | 1 | 170 | 0 | 90 | Yes |
| Glenthompson | 1 | 94 | 0 | 23 | Yes |
| Hamilton | 1 | 3,435 | 0 | 2,631 | Yes |
| Wimmera and Glenelg Rivers (2)(3) | 1 | 2,120 | 0 | 54 | Yes |
| *GWMWater* | | | | | |
| Wimmera and Glenelg Rivers (2)(3) | 1 | 81,570 | 0 | 9,624 | Yes |
| *Minister for Environment* | | | | | |
| Wimmera and Glenelg Rivers (2)(3) | 1 | 41,560 | 0 | 9,030 | Yes |
| **Total annual volume of bulk entitlements 2010–11**(3) | | **130,104** | **0** | **2,840** | |
| Total annual volume of bulk entitlements 2009–10 (4) | | 173,434 | 0 | 1,235 | |
| *Licensed diversions from unregulated streams* 2010–11 | | *1,043* | | *264* | |
| *Licensed diversions from unregulated streams* 2009–10 | | *1,042* | | *232* | |

Notes:

(1) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.

(2) Diversions under these bulk entitlements are not included in the total volume of entitlements 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 in the Wimmera basin in Chapter 15.

(3) In October 2010, the Minister for Water revoked the previous Wimmera and Glenelg rivers bulk and environmental entitlements for water from the Wimmera–Mallee system, and granted new entitlements that result from water savings and operational changes from the completion of the Wimmera–Mallee pipeline.

(4) The bulk entitlements and transfers for 2009–10 differs from the value reported in the Victorian Water Accounts 2009–2010 due to the previous reporting of all bulk entitlements in the total.

## 33.7 Groundwater resources

A summary of the licensed entitlements and use for GMUs that overlap the Glenelg basin, excluding domestic and stock use, is presented in Table 33-7.

The Glenelg basin contains part of the Condah WSPA, Glenelg WSPA and Portland GMA. Groundwater levels in Glenelg WSPA are declining, while levels in Portland GMA and Condah WSPA are stable. Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

Groundwater use in the Glenelg basin reduced significantly in 2010–11, compared to 2009–10.

### Table 33-7 Licensed groundwater volumes, Glenelg basin 2010–11

| WSPA/GMA[1] | GMA/WSPA depth limits[2] (m) | Entitlement limit[3] (ML/year) | Licensed entitlement [4] (ML/year) | Metered use (ML) | Estimated use in unmetered bores (ML)[5] | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Portland GMA (27%)[6] | >200 | 58 | 58 | 0 | - | 0 | 0 |
| Condah WSPA (47%) | 70-200 | 3,517 | 3,516 | 527 | - | 527 | 1,249 |
| Glenelg WSPA (70%) | All depths | 22,940 | 22,940 | 2,360 | - | 2,360 | 5,468 |
| **Total[7]** | | **26,515** | **26,514** | **2,887** | **-** | **2,887** | **6,718** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11.

(4) Licensed entitlement includes domestic and stock usage in cases where it is part of an existing licence.

(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.

(6) 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 Cardigan, Barwon and Corangamite basins. 2,466 ML was extracted from the Portland GMA within the Portland Basin for urban supplies. There was zero non-urban metered use for 2010–11.

(7) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 33-8.

### Table 33-8 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores[1][2] | Estimated domestic and stock use (assuming 1.5 ML per bore[3]) (ML)[4] |
|---|---|---|
| Portland GMA (27%) | 1 | 2 |
| Condah WSPA (47%) | 23 | 35 |
| Glenelg WSPA (70%) | 831 | 1,247 |
| **Total** | **855** | **1,283** |

Notes:

(1) 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 33-7.

(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) Estimated domestic and stock use is calculated using a factor of 1.5 ML per bore for these GMUs. Other authorities use 2 ML per bore.

(4) Total volumes are based on the sum of management unit data before rounding.

Groundwater is used as an urban water supply for some townships in the basin. Urban groundwater usage was reduced slightly in 2010–11. The licensed entitlements and metered use for these groundwater supplies are provided in Table 33-9.

### Table 33-9 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Casterton | 1,000 | 392 | 271 |
| Dartmoor | 150 | 17 | 19 |
| Hamilton, Tarrington, Dunkeld | 1,102 | 13 | 213 |
| Harrow[1] | 29 | 28 | 51 |
| Macarthur | 130 | 24 | 40 |
| Merino | 100 | 0 | 0 |
| Penshurst | 250 | 90 | 112 |
| **Total** | **2,761** | **565** | **707** |

Note:
(1) In 2009–10 Harrow's groundwater licence was insufficient to supply the town's needs and an application was submitted to the Minister for Water to issue an increased groundwater licence.

## 33.8 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions from unregulated streams are presented in Table 33-10. Stage 1 restrictions for Harrow continued throughout 2010–11, due to capacity constraints of the existing groundwater bore. Restrictions were removed for Hamilton, Cavendish, Dunkeld and Tarrington at the end of July 2010, following the completion of the Hamilton-Grampians pipeline. Bans on licensed diversions were in place in July and August for the Glenelg and Wannon rivers and several tributaries.

### Table 33-10 Seasonal allocations and restrictions on water use in Glenelg basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Urban | Harrow | Stage 1 restrictions from 1 July 2010 to 30 June 2011 |
| | Cavendish, Dunkeld, Hamilton and Tarrington | Stage 2 restrictions from 1 July 2010 to 31 July 2010 |
| Licensed diversions from unregulated streams | Wannon River, Crawford River and Grange Burn River | Irrigation ban in July and August 2010 |
| | Glenelg River | Irrigation ban in July and August 2010 |
| | Glenelg River Upper, Jimmy Creek, McLeod Creek, Rocklands Reservoir | Irrigation ban in July and August 2010 |

## 33.9 Recycled water

Wannon Water operates four wastewater treatment plants in the Glenelg basin. There was an increase in the volume of wastewater produced in 2010–11 compared to 2009–10, but less was recycled. In 2010–11, 24% of wastewater was recycled, compared to 44% in 2009–10.

### Table 33-11 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 (ML)[3] |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation[1] | Within process[2] | | |
| Casterton | 249 | 0 | 0% | 0 | 0 | 0 | 0 | 158 | 91 |
| Coleraine | 81 | 0 | 0% | 0 | 0 | 0 | 0 | 7 | 73 |
| Dunkeld | 37 | 14 | 37% | 14 | 0 | 0 | 0 | 6 | 17 |
| Hamilton | 1,184 | 354 | 30% | 157 | 197 | 0 | 0 | 44 | 786 |
| **Total 2010–11** | **1,550** | **368** | **24%** | **170** | **197** | **0** | **0** | **215** | **968** |
| Total 2009–10 | 1,424 | 631 | 44% | 148 | 483 | 0 | 0 | 83 | 710 |

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, such as Wannon Water holding wastewater in storage for the next year.

## 33.10 Water for the environment

### 33.10.1 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 EWR of this basin are:

- Glenelg Spiny Crayfish (threatened under the FFG Act and only found in the Glenelg River basin)
- Yarra and Ewens Pigmy Perch (vulnerable under the 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 2010–11 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.

### 33.10.2 Entitlements for the environment

The Wimmera and Glenelg Rivers Environmental Entitlement was granted to the Minister for Environment in 2010, replacing the former environmental bulk entitlement. The entitlement consists of passing flows, unregulated entitlement, a 1,000 ML wetland entitlement, and a 40,560 ML regulated entitlement.

The Inter Catchment Advisory Group determines the share of environmental allocations between the two catchments.

A total of 9,030 ML of regulated environmental water was used from the Wimmera and Glenelg Rivers Environmental Entitlement in 2010–11 (including environmental releases in the Wimmera system). Of this, 1,965 ML was released into the Glenelg River during summer and autumn 2010–11 to maintain water quality, connectivity and habitat for native fish. An additional 8,783 ML of accumulated passing flow was released to provide a spring fresh and base flows throughout summer and early autumn.

### 33.10.3 Passing flow requirements

Bulk entitlements require passing flows to be met at some points in the basin.

All passing flow requirements were complied with for the Glenelg basin in 2010–11.

Table 33-12 shows passing flow compliance in the Glenelg basin for a selected bulk entitlement compliance point. While there are other compliance points, the point was chosen as it was judged to be of community interest.

#### Table 33-12 Selected passing flow compliance in the Glenelg basin

| River | Passing flow | |
|---|---|---|
| Brown Creek, Headworks Creek, Gap Creek, Chimney Pot Creek, No 1 Creek, No 2 Creek, No 3 Creek | Instrument where passing flows are specified | Bulk Entitlement (Hamilton) Conversion Order 1997 |
| | Responsible authority | Wannon Water |
| | Compliance point | Brown Creek (shown as 1 in Figure 33-2) |
| | Passing flow compliance | The lesser of 0.4 ML per day or natural flows were passed from Brown Creek |
| | Compliance point | Headworks Creek (shown as 2 in Figure 33-2) |
| | Passing flow compliance | The lesser of 0.4 ML per day or natural flow were passed from Headworks Creek |
| | Compliance point | Gap Creek (shown as 3 in Figure 33-2) |
| | Passing flow compliance | The lesser of 0.4 ML per day or natural flow were passed from Gap Creek |
| | Compliance point | No 1 Creek (shown as 4 in Figure 33-2) |
| | Passing flow compliance | The lesser of 0.4 ML per day or natural flow were passed from No 1 Creek |

### 33.10.4 Management plans

The Western Region Sustainable Water Strategy states that existing rules will be documented as local management plans for the following unregulated river systems in the Glenelg River basin:

- Glenelg River
- Crawford River
- Stokes River
- Wannon River
- Grange Burn.

# 34 Millicent Coast basin

This chapter sets out the accounts for the Millicent Coast basin. For detailed information about how they were compiled, refer to Chapter 5.

## 34.1 Millicent Coast basin summary

Groundwater is the main source of water supply in the Millicent Coast basin. Licensed groundwater use in the Millicent Coast basin was unrestricted in 2010–11, and use decreased by 51% in 2010–11 compared to 2009–10. The most significant decreases in groundwater use occurred in the Neuarpur WSPA.

Edenhope was the only town to experience restrictions, remaining on Stage 1 for the entire year. Towns that rely solely on groundwater for supplies were not subject to restrictions. Bans were in place the first two months of the year for licensed diverters from Lake Charlegrark, Lake Wallace and Lake Yampitcha.

## 34.2 Responsibilities for management of water resources

Table 34-1 shows the responsibilities of various authorities within the Millicent Coast basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

### Table 34-1 Responsibilities for water resources management within the Millicent Coast basin, 2010–11

| Authority | Irrigation and rural water supply | Licensing | Urban water supply | Storage management; waterway management; environmental obligations |
|---|---|---|---|---|
| Grampians Wimmera Mallee Water | | 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.

## 34.3 Rainfall, flows and storages in 2010–11

In 2010–11, rainfall across the Millicent Coast basin ranged between 125% and 200% of the long-term average. This is higher than 2009–10.

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.

## 34.4 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 34-2. The volume of the surface water resource has notionally been set to the water diverted from unregulated streams in 2010–11.

### Table 34-2 Summary of total water resources and water use in the Millicent Coast basin, 2010–11

| Water source | Total water resource (ML)(1) | Total use (ML) |
|---|---:|---:|
| Surface water | 20 | 0 |
| Groundwater(2) | 55,200 | 10,600 |
| Recycled water | 130 | 40 |

Notes:

(1) For groundwater, the total water resource is the licensed entitlement volume as presented in Table 34-3 and estimate of domestic and stock use as presented in Table 34-4.

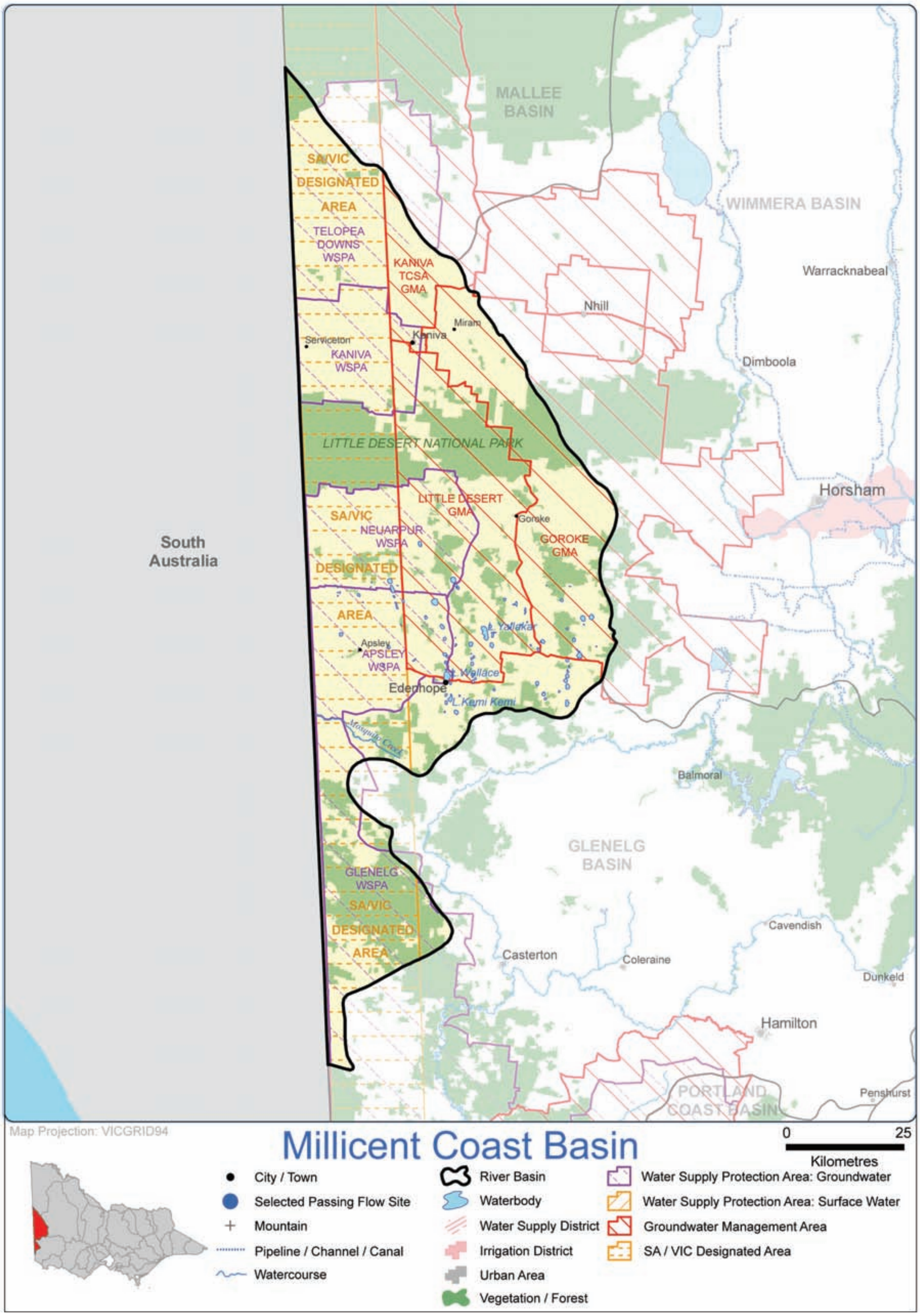
(2) Total groundwater resource and total groundwater use have been apportioned based on the percentage of the total surface area of the individual GMUs within the basin, as discussed in Chapter 5.

### 34.4.1 Infrastructure projects to improve water availability

There were no infrastructure projects to improve water availability within the Millicent Coast basin in 2010–11.

## 34.5 Location of water resources

### Figure 34-1 Map of the Millicent Coast basin



## 34.6 Surface water resources

### 34.6.1 Water balance

There is no reliable estimate of the average annual inflows in the Victorian Millicent Coast basin, although 4,000 ML a year was estimated for the National Land and Water Resources Audit (National Land and Water Audit, 2001). As there is no flow gauging within the Millicent Coast basin in Victoria, an estimate of 2010–11 inflows could not reliably be made.

Limited information is currently available for surface-water availability and use, so a water balance has not been included for the Millicent Coast basin.

### 34.6.2 Small-catchment dams

No information regarding small-catchment dams is readily available within the Millicent Coast basin.

### 34.6.3 Water entitlement trades

There were no transfers of water entitlements within the Millicent Coast basin or across basin boundaries in 2010–11.

### 34.6.4 Volume diverted

There are no bulk entitlements to surface water in the Millicent Coast basin. All water is diverted from unregulated streams under licences. In 2010–11, the licenced volume totalled 20 ML and use was estimated to be 0 ML. For 2009–10, the licenced volume was estimated at 100 ML and use was estimated to be 0 ML.

## 34.7 Groundwater resources

A summary of the licensed entitlements and use from GMUs within the Millicent Coast basin, excluding domestic and stock use, is shown in Table 34-3.

The main water supply in the Millicent Coast basin is groundwater. The Millicent Coast basin contains the whole Kaniva WSPA, Neuarpur WSPA, Apsley WSPA and Little Desert GMA, as well as part of the Glenelg WSPA, Telopea Downs WSPA, Kaniva TCSA GMA and Goroke GMA. Groundwater levels in Kaniva, Apsley and Telopea Downs WSPAs, as well as Little Desert, Goroke and Kaniva TCSA GMAs, are stable, with declining trends in the Glenelg and Neuarpur WSPAs.

Groundwater entitlements and use for unincorporated areas are summarised in Appendix A.

### Table 34-3 Licensed groundwater volumes, Millicent Coast basin 2010–11

| WSPA/GMA(1) | GMA/WSPA depth limits(2) (m) | Entitlement limit(3) (ML/year) | Licensed entitlement (4) (ML/year) | Metered use (ML) | Estimated use in unmetered bores (ML)(5) | Total licensed groundwater use (ML) 2010–11 | Total licensed groundwater use (ML) 2009–10 |
|---|---|---|---|---|---|---|---|
| Goroke GMA (37%) | TCSA | 816 | - | - | - | - | 0 |
| Kaniva TCSA GMA (17%) | TCSA | 190 | - | - | - | - | 0 |
| Little Desert GMA (100%) | TCSA | 1,100 | - | - | - | - | 0 |
| Apsley WSPA (100%) | All depths | 5,591 | 5,591 | 759 | - | 759 | 1,356 |
| Glenelg WSPA (30%) | All depths | 9,720 | 9,720 | 1,000 | - | 1,000 | 2,291 |
| Kaniva WSPA (100%) | 25-140 | 7,659 | 7,659 | 1,737 | - | 1,737 | 1,991 |
| Neuarpur WSPA (100%)(6) | 50-175 | 24,750 | 24,691 | 5,681 | - | 5,681 | 12,700 |
| Telopea Downs WSPA (61%)(6) | All depths | 6,565 | 6,565 | 500 | - | 500 | 1,408 |
| Total(7) | | **56,391** | **54,226** | **9,677** | **-** | **9,677** | **19,746** |

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. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.

(3) Entitlement limit is represented by the PCV, or the allocation limit where there is no PCV, or where there is a reduced allocation limit for 2010–11.

(4) Licensed entitlement includes domestic and stock usage in cases where this forms part of a licensed volume.

(5) Bores with a licensed entitlement of less than 20 ML a year are not metered in WSPAs and GMAs. No estimates have been provided for these bores; however, it is thought that this volume is negligible in most WSPAs and GMAs.

(6) Metered use has decreased significantly in the Neuarpur and Telopea Downs WSPAs due to high rainfall during the 2010–11 irrigation season. Also, the reduced value of clover seed and lucerne crops has resulted in many licence holders no longer growing these crops.
(7) Total volumes are based on the sum of management unit data before rounding.

An estimate of domestic and stock groundwater use is provided in Table 34-4.

### Table 34-4 Number of domestic and stock bores and estimated use, 2010–11

| WSPA/GMA | No. of domestic and stock bores(1)(2) | Estimated domestic and stock use (assuming 2 ML per bore(3)) (ML)(4) |
|---|---|---|
| Goroke GMA (37%) | 0 | 0 |
| Kaniva TCSA GMA (17%) | 0 | 0 |
| Little Desert GMA (100%) | 1 | 2 |
| Apsley WSPA (100%) | 89 | 178 |
| Glenelg WSPA (30%) | 352 | 528 |
| Kaniva WSPA (100%) | 74 | 148 |
| Neuarpur WSPA (100%) | 25 | 50 |
| Telopea Downs WSPA (61%) | 17 | 34 |
| **Total** | **558** | **940** |

Notes:
(1) 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 34-3.
(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. The numbers reported are based on the surface area percentage within the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(3) Estimated domestic and stock use is calculated using a factor of 2 ML per bore for all GMUs listed except for Glenelg WSPA which uses a factor of 1.5 ML per bore.
(4) Total volumes are based on the sum of management unit data before rounding.

In the Millicent Coast basin, groundwater is used as an urban water supply for the townships of Apsley, Kaniva, Lillimur, Goroke, Serviceton, Miram and Edenhope. The licensed entitlements and metered use for these groundwater supplies are provided in Table 34-5.

### Table 34-5 Urban groundwater usage

| Town supplied | Licensed volume (ML) | Metered use 2010–11 (ML) | Metered use 2009–10 (ML) |
|---|---|---|---|
| Apsley(1) | 40 | 11 | 42 |
| Edenhope(2) | 250 | 133 | 127 |
| Goroke | 86 | 38 | 65 |
| Kaniva | 600 | 87 | 218 |
| Serviceton | 25 | 6 | 9 |
| Lillimur | 32 | 7 | 10 |
| Miram | 7 | 1 | 2 |
| **Total** | **1,040** | **283** | **473** |

Notes:
(1) Since Apsley is in a WSPA no new licenses can be considered. A licence amendment application has been made to the Minister to increase the entitlement due to overuse in 2009–10.
(2) Edenhope was operating under a groundwater licence in 2010–11, which was approved by the Minister for Water after temporary trading in 2009–10.

## 34.8 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions from unregulated streams are presented in Table 34-6. Edenhope was the only town to experience restrictions, which were low at Stage 1. An irrigation ban on diversions from several lakes within the Millicent Coast basin was in place for July and August.

### Table 34-6 Seasonal allocations and restrictions on water use in Millicent Coast basin, 2010–11

| Type of restriction | Area | Nature of restriction |
|---|---|---|
| Urban | Edenhope | Stage 1 restrictions from 1 July 2010 to 30 June 2011 |
| Diversions from unregulated streams | Lake Charlegrark, Lake Wallace and Lake Yampitcha | Irrigation ban in July and August 2010 |

## 34.9 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 34-7.

### Table 34-7 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 (ML)[3] |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Urban and industrial | Agriculture | Beneficial allocation[1] | Within process[2] | | |
| Edenhope | 133 | 45 | 34% | 45 | 0 | 0 | 0 | 0 | 88 |
| Kaniva North | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| Kaniva South | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| Serviceton | 0 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total 2010–11** | **133** | **45** | **34%** | **45** | **0** | **0** | **0** | **0** | **88** |
| Total 2009–10 | 35 | 35 | 100% | - | 35 | - | - | - | 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.

## 34.10 Water for the environment

### 34.10.1 Environmental Water Reserve

The Millicent Coast basin contains numerous wetlands dependent on the basin's EWR.

In 2010–11 the Millicent Coast basin EWR comprised all water in the basin not allocated for consumptive use.

### 34.10.2 Passing flows

There are currently no bulk entitlements in operation and therefore no passing flow obligations on water corporations in the Millicent Coast basin.

### 34.10.3 Management plans

The Western Region Sustainable Water Strategy states that existing rules will be documented as a local management plan for Mosquito Creek.

# Part 3:

# Distribution system water accounts 2010 – 11

The basin chapters of the Victorian Water Accounts 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. For the first time, this chapter adds accounts for distribution systems. These 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 systems (such as the Melbourne retailers operate), to very small, and possibly less well resourced, systems in small towns throughout the state
- how do piped urban systems compare with piped irrigation systems, and with the large gravity irrigation systems we are putting so much effort into producing savings from? (the loss calculations are consistent with those used in water savings calculations, though they go into less detail)
- 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?

# 35 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 previous parts 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.

## 35.1 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 river 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) for which sustainable water strategies (SWSs) have been prepared. The accounts for distribution systems are therefore grouped into SWS regions, then by corporation (rather than by river basin). 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 SWS regions.

Most water corporation websites have diagrams or maps of the distribution systems.

## 35.2 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 Grampians Wimmera Mallee Water) 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 to deliveries to rural customers), inflows and distribution losses can often not be separated. For simplicity, reports on these systems consolidate urban and rural components as 'combined distribution systems'.

## 35.3 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, so they are 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.

## 35.4 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.

## 35.5 Efficiency calculations

System efficiency calculations are based on the formula, *Efficiency = 100 * (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 Sustainability and the Environment 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.

## 35.6 Interpreting and using distribution system accounts

The accounts in this part are summarised: the full account for a system has usually been condensed to a single line in a table. Nonetheless, they 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 economically be improved

- 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 interesting 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.

# 36 Northern Region

## 36.1 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 involving 70% of Victoria's stored water.

North East Water serves an estimated 115,131 people in an area of about 20,000 square kilometres. The region extends from Corryong in the east, along the River Murray to Yarrawonga, then south to Benalla and the alpine towns of Bright, Mt. Beauty and Dartmouth.

Table 36-1 summarises North East Water's urban distribution systems.

### Table 36-1 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 unreg. 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 | Regulated Ovens River, groundwater | Wangaratta |
| Mitta Mitta River | Dartmouth | Mt Tabor Creek | Dartmouth |
| | Eskdale | Regulated Mitta Mitta River | Eskdale |
| River Murray | Bellbridge | Lake Hume | Bellbridge |
| | Tallangatta | Lake Hume | Tallangatta |
| | Wahgunyah system – Wahgunyah and Rutherglen | Regulated River Murray | Wahgunyah |
| | Wodonga system – Wodonga, Baranduda, Kiewa, Tangambalanga, Bonegilla, Ebden, Barnawartha and Chiltern | Regulated River Murray | Wodonga |
| | Yarrawonga system – Yarrawonga, Tungamah, St James and Devenish | Regulated River Murray | Yarrawonga |
| Sub-alpine | Beechworth | Nine Mile Creek<br>Frenchmans Creek<br>Lake Kerferd catchment | Beechworth |
| | Yackandandah | Nine Mile Creek | Yackandandah |
| Upper Murray | Corryong system – Corryong and Cudgewa | Nariel Creek | Corryong |
| | Walwa | Unregulated Murray | Walwa |

Table 36-2 shows North East Water's urban distribution systems' water balances.

### Table 36-2 North East 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 | | | | | | |
| | | | ... to urban residential | ... to urban other | ... from treatment plants | ... from dist'n systems (1) | ... passed to other systems | Total outflows | | | |
| **Alpine area** | | | | | | | | | | | |
| Bright system | 3 | 567 | 230 | 140 | 22 | 175 | - | 567 | - | 3 | 65.3 |
| Harrietville | 1 | 54 | 25 | 19 | - | 10 | - | 54 | - | 1 | 81.5 |
| Mount Beauty system | 7 | 324 | 146 | 55 | 24 | 96 | - | 321 | - | 10 | 62.6 |
| Myrtleford | 493 | 483 | 238 | 191 | - | 58 | - | 487 | 4 | 485 | 88.1 |
| **Broken River** | | | | | | | | | | | |
| Benalla | 9 | 1,142 | 716 | 276 | 170 | 58 | - | 1,220 | (78) | 9 | 81.3 |
| **Central area** | | | | | | | | | | | |
| Goorambat | 103 | 8 | 7 | 1 | - | - | - | 8 | - | 103 | 100.0 |
| Springhurst | - | 20 | 11 | 1 | 6 | 2 | - | 20 | - | - | 60.0 |
| **King and Ovens Rivers** | | | | | | | | | | | |
| Glenrowan (2) | 52 | 33 | 18 | 16 | 13 | 18 | - | 65 | 20 | - | 52.3 |
| Moyhu | - | 25 | 17 | 3 | 2 | 3 | - | 25 | - | - | 80.0 |
| Oxley (3) | - | 69 | 22 | 1 | 11 | 35 | - | 69 | - | - | 33.3 |
| Whitfield | 11 | 10 | 7 | 4 | - | (2) | - | 9 | (2) | 14 | 122.2 |
| Wangaratta | 37 | 3,098 | 1,375 | 1,112 | 466 | 95 | - | 3,048 | 50 | 37 | 81.6 |
| **Mitta Mitta River** | | | | | | | | | | | |
| Dartmouth | 1 | 20 | 6 | 5 | - | 9 | - | 20 | - | 1 | 55.0 |
| Eskdale | - | 10 | 5 | 1 | 4 | - | - | 10 | - | - | 60.0 |
| **River Murray** | | | | | | | | | | | |
| Bellbridge | 1 | 43 | 30 | 2 | 3 | 8 | - | 43 | - | 1 | 74.4 |
| Tallangatta | 2 | 164 | 68 | 60 | 6 | 30 | - | 164 | - | 2 | 78.0 |
| Wahgunyah system | 7 | 511 | 276 | 149 | 39 | 47 | - | 511 | - | 7 | 83.2 |
| Wodonga system | 97 | 4,858 | 2,699 | 1,534 | 207 | 514 | - | 4,954 | (88) | 89 | 85.4 |
| Yarrawonga system | 16 | 1,002 | 636 | 231 | 80 | 126 | - | 1,073 | (71) | 16 | 80.8 |
| **Sub-alpine area** | | | | | | | | | | | |
| Beechworth (4) | 829 | 594 | 200 | 88 | 34 | 202 | - | 524 | - | 899 | 55.0 |
| Yackandandah | 24 | 155 | 58 | 32 | 5 | 8 | - | 103 | 52 | 24 | 87.4 |
| **Upper River Murray** | | | | | | | | | | | |
| Corryong system | 97 | 174 | 96 | 39 | 18 | 61 | - | 214 | (24) | 81 | 63.1 |
| Walwa | 1 | 14 | 6 | 4 | 1 | 3 | - | 14 | - | 1 | 71.4 |

Notes:

(1) Distribution system losses are used as the balancing item in systems that show a zero explicit balancing item.

(2) In the Glenrowan system, two raw water storages were decommissioned in 2010-11 as part of a supply system augmentation. This has reduced the end volume in store and affected the distribution system efficiency.

(3) In the Oxley system, a non-return valve failed on a suction line leading to high distribution system losses which affected the distribution system efficiency for this small system.

(4) For the Beechworth system, the distribution system efficiency includes evaporation losses from Lake Kerferd (off-stream storage).

## 36.2 Goulburn Valley Water

Goulburn Valley Water provides urban water and wastewater services to nearly 129,000 people. It services 57,596 properties in 54 towns, from the outskirts of Melbourne in the south to the River Murray 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 36-3 summarises Goulburn Valley Water's urban distribution systems.

## Table 36-3 Goulburn Valley Water urban distribution systems

| Area | System / towns supplied | Source of supply | Treatment plant location |
|---|---|---|---|
| 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 IA – Dookie and Katandra West | Shepparton IA | At each town |
| | Towns supplied from Central Goulburn IA – Tatura, Kyabram, Tongala, Girgarre, Stanhope, Merrigum and Rushworth | Central Goulburn IA | At each town except Merrigum which is supplied from Kyabram |
| | Colbinabbin | Rochester IA | Colbinabbin |
| | Corop | Rochester IA | Disinfection only |
| Lake Eildon | Bonnie Doon | Bran Keet Creek / Lake Eildon | Bonnie Doon |
| River Murray | Cobram system - Cobram, Strathmerton and Yarroweyah | River Murray | Cobram |
| | Barmah | River Murray | Barmah |
| Murray channels | Katamatite and Picola | Murray Valley IA | 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 & Regulated Goulburn River at Tallarook | Broadford |
| | Kilmore system - Kilmore, Wandong and Heathcote Junction | Sunday Creek Reservoir on Sunday Creek, Hazels Creek | Kilmore |

Table 36-4 shows Goulburn Valley Water's urban distribution systems' water balances.

## Table 36-4 Goulburn Valley 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 | | | | | | |
| | | | … to urban residential | … to urban other | … from treatment plants | … from dist'n systems (1) | … passed to other systems (2) | Total outflows | | | |
| **Goulburn River** | | | | | | | | | | | |
| Alexandra | - | 294 | 173 | 68 | 1 | 35 | 17 | 294 | - | - | 87.7 |
| Murchison | - | 164 | 68 | 33 | 2 | 34 | 27 | 164 | - | - | 78.0 |
| Nagambie system | - | 481 | 127 | 331 | 2 | 1 | 20 | 481 | - | - | 99.4 |
| Seymour system | - | 1,164 | 664 | 296 | 7 | 142 | 55 | 1,164 | - | - | 87.2 |
| Shepparton system | - | 9,760 | 4,315 | 3,179 | 53 | 946 | 1,267 | 9,760 | - | - | 89.8 |
| Wood Point | - | 13 | 10 | 1 | - | 2 | - | 13 | - | - | 84.6 |
| **Goulburn Channels** | | | | | | | | | | | |
| Towns supplied from Shepparton IA | - | 113 | 53 | 33 | (5) | 32 | - | 113 | - | - | 76.1 |
| Towns supplied from Central Goulburn IA | 623 | 4,114 | 1,215 | 2,058 | 26 | 511 | 304 | 4,114 | - | 623 | 86.9 |
| Towns supplied from Rochester IA | - | 21 | 10 | 9 | (4) | 6 | - | 21 | - | - | 90.5 |
| **Lake Eildon** | | | | | | | | | | | |
| Eildon & Bonnie Doon | 43 | 180 | 79 | 64 | 1 | 27 | 9 | 180 | - | 43 | 84.4 |
| **River Murray** | | | | | | | | | | | |
| Cobram system | - | 2,880 | 558 | 1,855 | 69 | 6 | 392 | 2,880 | - | - | 97.4 |
| Barmah | - | 39 | 26 | 3 | | 2 | 8 | 39 | - | - | 94.5 |
| Murray channels | | | | | | | | | | | |
| Katamatite & Picola | 16 | 48 | 28 | 8 | 2 | 2 | 8 | 48 | - | 16 | 91.7 |
| **Supplied from Groundwater** | | | | | | | | | | | |
| Katunga | - | 39 | 20 | 11 | | 5 | 3 | 39 | - | - | 86.9 |
| Broken Creek | | | | | | | | | | | |
| Nathalia | - | 361 | 157 | 76 | 8 | 52 | 68 | 361 | - | - | 83.5 |
| Numurkah system | - | 688 | 367 | 248 | 8 | 2 | 63 | 688 | - | - | 98.6 |
| **Goulburn River Tributaries** | | | | | | | | | | | |
| Euroa system | - | 541 | 304 | 135 | 1 | 64 | 37 | 541 | - | - | 88.0 |
| Longwood | 24 | 49 | 23 | 14 | | 11 | 1 | 49 | - | 24 | 77.5 |
| Mansfield | 538 | 613 | 268 | 108 | 2 | 110 | 65 | 553 | - | 598 | 79.7 |
| Upper Delatite system | - | 63 | 29 | 4 | 1 | 19 | 10 | 63 | - | - | 68.8 |
| Thornton | - | 45 | 18 | 22 | | 2 | 3 | 45 | - | - | 95.2 |
| Marysville(3) & Buxton | 102 | 183 | 38 | 19 | 13 | 86 | 34 | 190 | - | 95 | 47.8 |
| Yea system | - | 184 | 113 | 43 | | 17 | 11 | 184 | - | - | 90.5 |
| Pyalong | 15 | 61 | 23 | 1 | 2 | 8 | 7 | 41 | - | 35 | 75.0 |
| Broadford system | 94 | 445 | 289 | 81 | (11) | 88 | - | 447 | - | 92 | 82.8 |
| Kilmore system | 78 | 705 | 486 | 107 | 2 | 74 | 43 | 712 | - | 71 | 89.4 |

Notes:

(1) Distribution system losses are used as the balancing item.

(2) Passed to other systems includes (based on GVW's 2012 water plan demand strategy forecast) estimated water treatment supernatant/backwash water returned to wastewater management facilities, rivers and channel systems.

(3) Marysville, due to recovery from bushfire, has higher than usual losses and investigation is continuing.

## 36.3 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 River Murray 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 seven other rural distribution systems, as shown in Table 36-7.

### 36.3.1 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. It includes major supply channels (Stuart Murray Canal and Cattenach Canal). It supplies water to three irrigation areas, three stock and domestic areas and through the Goldfields Superpipe to Bendigo and Ballarat. It includes Waranga Basin, a substantial off-stream storage. 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 36-5.

**Table 36-5 Waranga Western Channel water balance**

| | Goulburn segment (ML) | Campaspe segment (ML) | Loddon segment (ML) | Eliminations (ML) | Total (ML) |
|---|---|---|---|---|---|
| **Opening balance** | | | | | |
| Waranga Basin (total) | 198,556 | | | | 198,556 |
| Greens Lake (total) | | 16,546 | | | 16,546 |
| **Closing balance** | | | | | |
| Waranga Basin (total) | 351,374 | | | | 351,374 |
| Greens Lake (total) | | 22,829 | | | 22,829 |
| **Change (increase) in storage** | **152,818** | **6,283** | | | **159,101** |
| **Inflows** | | | | | |
| From Goulburn River | 420,285 | | | | 420,285 |
| Natural to Waranga | 18,025 | | | | 18,025 |
| Rain on Waranga | 50,625 | | | | 50,625 |
| From WWC Goulburn segment | | 104,174 | | (104,174) | - |
| From Campaspe East | | 386 | | | 386 |
| From Campaspe West | | 464 | | | 464 |
| From Campaspe pumps | | 377 | | | 377 |
| From Wanalta Creek to WWC | | 5,388 | | | 5,388 |
| From Cornella Creek to WWC | | 6,910 | | | 6,910 |
| From Lake Cooper to Greens Lake | | 21,710 | | | 21,710 |
| Rain on Greens Lake | | 5,758 | | | 5,758 |
| From WWC Campaspe segment | | | 52,845 | (52,845) | - |
| From Loddon River | | | 523,169 | | 523,169 |
| **Total inflows** | **488,935** | **145,167** | **576,014** | **(157,019)** | **1,053,097** |
| **Outflows** | | | | | |
| **Passed to other systems** | | | | | |
| To Central Goulburn IA | 169,297 | | | | 169,297 |
| To Goldfields Superpipe | 73 | | | | 73 |
| To Campaspe segment | 104,174 | | | (104,174) | - |
| To Rochester IA (1) | | 69,848 | | | 69,848 |
| To Campaspe River (ex-Goulburn River) | | - | | | - |
| To Campaspe River (via Campaspe Channel) | | 831 | | | 831 |
| To Lake Cooper | | 9,671 | | | 9,671 |
| To Loddon segment | | 52,845 | | (52,845) | - |
| To Pyramid Boort IA (2) | | | 62,252 | | 62,252 |

| | | | | | |
|---|---|---|---|---|---|
| To Loddon River | | | 502,627 | | 502,627 |
| To Wimmera-Mallee | | | - | | - |
| WWC to East Loddon WWD | | | 118 | | 118 |
| WWC to West Loddon WWD | | | 78 | | 78 |
| WWC to Normanville | | | 245 | | 245 |
| WWC to Boort Lakes | | | 10,694 | | 10,694 |
| **Losses** | | | | | |
| Evap. / seepage Waranga | 50,986 | | | | 50,986 |
| Evap. Greens Lake | | 5,689 | | | 5,689 |
| **Total outflows** | **324,530** | **138,884** | **576,014** | **(157,019)** | **882,409** |
| **Balancing item (unaccounted outflow)** | **11,587** | **-** | **-** | **-** | **11,587** |
| **System efficiency (%)** | **84.3** | **95.9** | **100.0** | | |

Notes:

(1) The balancing item for the Campaspe segment is Rochester IA.

(2) The balancing item for the Loddon segment is Pyramid Boort IA.

### 36.3.2 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 River Murray resulting from the decommissioning of Lake Mokoan in the Broken River basin. These unregulated flows occur mainly from May to November.

The VMMS consist of Kow Swamp, Lake Boga, Lake Charm and Kangaroo Lake: these have a combined capacity of nearly 58,000 ML. They 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 36-6 shows the water balance for the VMMS.

#### Table 36-6 Victorian Mid Murray Storages water balance

| Victorian Mid-Murray Storages | Vol (ML) | Total (ML) |
|---|---|---|
| **Opening balance** | | |
| Total Kow Swamp, Lake Charm, Kangaroo Lake, Lake Boga | 94,889 | |
| **Closing balance** | | |
| Total Kow Swamp, Lake Charm, Kangaroo Lake, Lake Boga | 104,959 | |
| **Change (increase) in storage** | 10,070 | **10,070** |
| **Inflows** | | |
| Rain on all storages | 36,377 | |
| Murray to Lake Boga | 13,715 | |
| Torrumbarry IA to Lake Boga | 8,311 | |
| Torrumbarry IA to Lake Charm | 8,463 | |
| Torrumbarry IA to VMMS | 3,972 | |
| **Total inflows** | | **70,838** |
| **Outflows** | | |
| **Passed to other systems** | | |
| Lake Charm to River Murray (1) | 5,000 | |
| Lake Boga to River Murray | - | |
| 6/7 channel to River Murray | - | |
| Kerang Weir to River Murray | - | |
| VMMS to Torrumbarry IA | - | **5,000** |
| **Losses** | | |
| Evaporation on storages | 47,722 | |
| Distribution losses (2) | 11,442 | **59,164** |

| Total outflows | | 64,164 |
|---|---|---|
| Balancing item (unaccounted outflow) | (3,396) | |
| System efficiency (%) | N/A | |

Notes:
(1) Flushing to lower Lake Charm salinity.
(2) Calculated distribution loss.
Summer flooding in 2010-11 led to no release of water from the storages for supply purposes.
Flooding has also significantly affected the accuracy of the water balance due to the high volume of unmeasured water entering and leaving the system that could only be estimated: this problem will recur in future wet years.

### 36.3.3 Other distribution systems

Goulburn-Murray's other distribution systems are rural, and are summarised in Table 36-7.

#### Table 36-7 Goulburn-Murray Water rural distribution systems

| System | Customers supplied | Source of supply |
|---|---|---|
| **Irrigation distribution systems** | | |
| Shepparton Irrigation Area | Primarily irrigation and D&S to irrigators. 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 IA. | WWC, Loddon River supplement and Torrumbarry IA |
| 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. | River Murray via Yarrawonga Main Channel and pumps. Shepparton IA via Lower Broken Creek. |
| Torrumbarry Irrigation Area (excluding Woorinen, Tresco, Gunbower Ck and VMMS) | Primarily irrigation and D&S to irrigators. Also provides bulk supply to VMMS, Tresco IA, two towns in its area and significant supplies to environmental sites. | National Channel and other minor sources from the River Murray. Unregulated Loddon flows. Small volumes from Pyramid Boort IA. |
| Woorinen Irrigation Area | Irrigation and D&S to irrigators | Pumped from Murray |
| Tresco Irrigation Area | Irrigation and D&S to irrigators | Torrumbarry IA |
| 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 IA |
| 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 IA. Minor unregulated inflows from upper Broken Creek. |
| Gunbower Creek | Primarily irrigation and D&S to irrigators. Also provides bulk supply to two towns in its area and substantial supplies to environmental sites. | Torrumbarry IA (National Channel at Gunbower Creek). Also minor inflows from lagoons. |

Table 36-8 shows Goulburn-Murray Water's rural distribution systems' water balances.

### Table 36-8 Goulburn-Murray Water rural distribution systems' water balances

| Distribution system | Start volume in store (ML) | Total inflows (ML) | Outflows | | | | | Balancing item (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 IA | - | 63,465 | 42,765 | - | 5,265 | 15,435 | 63,465 | - | - | 91.7 |
| Central Goulburn IA | - | 169,297 | 120,773 | - | 44,809 | 3,715 | 169,297 | - | - | 73.5 |
| Rochester IA | - | 69,848 | 53,085 | - | 15,415 | 1,348 | 69,848 | - | - | 77.9 |
| Pyramid-Boort IA | - | 62,542 | 44,499 | - | 17,788 | 255 | 62,542 | - | - | 71.6 |
| Campaspe IA | - | 7,707 | 3,353 | - | 3,504 | 850 | 7,707 | - | - | 54.5 |
| Murray Valley IA | - | 170,151 | 92,033 | - | 50,636 | 27,482 | 170,151 | - | - | 70.2 |
| Torrumbarry IA (2) | 11,647 | 285,646 | 131,738 | 11,225 | 52,737 | 90,099 | 285,799 | - | 11,494 | 81.5 |
| Woorinen IA | - | 5,706 | 4,979 | - | 727 | - | 5,706 | - | - | 87.3 |
| Tresco IA | - | 3,387 | 3,240 | - | 147 | - | 3,387 | - | - | 95.7 |
| Nyah IA | - | 2,491 | 2,231 | - | 260 | - | 2,491 | - | - | 89.6 |
| **Other rural distribution systems** | | | | | | | | | | |
| Normanville D&S | 77 | 256 | - | 111 | 94 | 65 | 270 | - | 63 | 65.2 |
| East Loddon D&S(3) | - | 118 | - | 118 | - | - | 118 | - | - | 100.0 |
| West Loddon D&S(3) | - | 78 | - | 78 | - | - | 78 | - | - | 100.0 |
| Tungamah D&S | - | 234 | - | 142 | 92 | - | 234 | - | - | 60.7 |
| Upper Broken Creek(4) | - | 3,471 | - | 38 | (19,976) | 23,409 | 3,471 | - | - | N/A |
| Lower Broken Creek(4) | - | 119,462 | - | - | (95,029) | 214,491 | 119,462 | - | - | N/A |
| Gunbower Creek(4) | - | 51,911 | 8,606 | - | (15,361) | 58,666 | 51,911 | - | - | N/A |

Notes:
(1) Losses are back-calculated and include outfalls not deliberately passed to other systems.
(2) Torrumbarry IA excludes Woorinen IA, Tresco IA, Gunbower Creek and Victorian Mid Murray Storages.
(3) Deliveries are assumed to equal inflows in East Loddon and West Loddon systems.
(4) Apparent negative losses in creek systems are because of unmeasured inflows.
(5) Deliveries to irrigation also include deliveries to urban customers.

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 91.7% efficiency.

On the other hand, the Torrumbarry system efficiency is 81.5%.This lower efficiency can be explained by the relatively recent modernisation, as well as by the use of natural carriers like Gunbower Creek as part of the system. In fact, in 2010-11 the system's measured efficiency was boosted because floods led to unmeasured inflows.

## 36.4 Coliban Water

Coliban Water has its headquarters in Bendigo. It provides water and wastewater services to 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 1,600 rural licence holders from 500 km of open channel 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.

### 36.4.1 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 36-9 shows the superpipe's water balance.

### Table 36-9 Goldfields Superpipe water balance

| Goldfields Superpipe | Vol (ML) | Total (ML) |
|---|---|---|
| **Opening balance** | **-** | |
| **Closing balance** | **-** | |
| **Change (increase) in storage** | **-** | |
| **Inflows** | | |
| from WWC at Colbinabbin – Coliban Water | 73 | |
| from WWC at Colbinabbin - Central Highlands Water | 60 | |
| from Lake Eppalock - Coliban Water | 2,221 | |
| from Lake Eppalock - Central Highlands Water | 844 | |
| from Sandhurst | - | **3,198** |
| **Outflows** | | |
| to Eppalock - Coliban Water | 59 | |
| to Eppalock - Central Highlands Water | - | |
| direct to Coliban Water rural customers | 371 | |
| to Sandhurst - Coliban Water | 1,669 | |
| to Sandhurst - Central Highlands Water (1) | - | |
| transfer to Central Highlands Water at White Swan Reservoir | 904 | |
| to Heathcote (Caledonia Reservoir) | - | |
| to Emu Valley rural channel subsystem | 8 | |
| to Axe Creek rural channel subsystem | 35 | |
| to Specimen Hill rural channel subsystem | 152 | **3,198** |
| **Balancing item (unaccounted outflow)** | **-** | |
| **System efficiency (%)** | **100.0** | |

Note:

(1) Outflows to Sandhurst Reservoir – Coliban Water are the balancing item in this water balance.

## 36.4.2 Coliban Main Channel

This channel conveys water from the Coliban storages (Upper Coliban, Lauriston and Malmsbury reservoirs) to supply rural subsystems and the Coliban Northern and Southern urban water supply systems. Table 36-10 shows the water balance for the Coliban Main Channel.

### Table 36-10 Coliban Main Channel water balance

| Coliban Main Channel | Vol (ML) | Total (ML) |
|---|---|---|
| **Opening balance** | **-** | |
| **Closing balance** | **-** | |
| **Change (increase) in storage** | **-** | |
| **Inflows** | | |
| from Malmsbury Reservoir | 8,737 | **8,737** |
| **Outflows** | | |
| **Deliveries to customers** | | |
| direct deliveries to rural customers off channel | 275 | **275** |
| **Passed to other systems** | | |
| to Coliban North system at Sandhurst Reservoir | 6,451 | |
| to Poverty Gully rural subsystem | 1,795 | |
| to Harcourt rural subsystem | 561 | |
| to Emu Valley rural subsystem | 32 | **8,839** |
| **Losses** | | |
| System losses (back-calculated) (1) | | (377) |
| **Total outflows** | | **8,737** |
| **Balancing item (unaccounted outflow)** | **-** | |
| **System efficiency (%)** | **104.3** | |

Note:

(1) System losses (back calculated) represent unmeasured inflow run-off direct to main channel.

### 36.4.1 Rural distribution systems

Coliban Water's rural distribution system supplies rural licence customers (including stock, domestic and irrigation customers) with entitlements of 14,000 ML in rural areas extending from Castlemaine to Bendigo, and further north to Raywood. Table 36-11 shows Coliban Water Water's rural distribution systems' water balances.

#### Table 36-11 Coliban Water rural distribution systems' water balances

| Distribution system | Start volume in store (ML) | Total inflows (ML) | Outflows | | | | | | Balancing item (ML) | End volume in store (ML) | Distribution system efficiency (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Deliveries | | Losses(1) | ... passed to other systems | ... passed to urban systems | Total outflows | | | |
| | | | ... to rural customers | ... to other | | | | | | | |
| Ascot | - | 133 | 102 | - | 31 | - | | 133 | - | - | 76.6 |
| Axe Creek | - | 35 | 8 | - | 27 | - | | 35 | - | - | 22.8 |
| Cockatoo Hill | - | 17 | 9 | - | 8 | - | | 17 | - | - | 54.1 |
| Coliban Main Channel | - | 8,737 | 275 | - | (377) | 2,388 | 6,451 | 8,737 | | | 104.3 |
| Emu Valley | - | 32 | 12 | - | 19 | - | | 32 | - | - | 39.0 |
| Harcourt | 536 | 561 | 219 | - | (813) | - | | (593) | - | 1,690 | 244.9 |
| Jackass Flat | - | 2.8 | .4 | - | 2.4 | - | | 2.8 | - | - | 13.4 |
| Lockwood | - | 41 | 58 | - | (17) | - | | 41 | - | - | 142.2 |
| Poverty Gully | - | 1,795 | 3 | - | 175 | - | 1,617 | 1,795 | - | - | 90.3 |
| Specimen Hill | - | 152 | 42 | - | 65 | 45 | | 152 | - | - | 57.2 |
| Spring Gully Reservoir | 680 | 151 | - | - | (346) | 160 | | (186) | | 1,017 | 329.2 |

Note:
(1) Losses are the balancing item in all cases. In 2010-11, there was significant rain run-off into channels and holding storages that show as (-) negative losses. In these instances, system efficiency calculations are based on the formula *Efficiency = 100 * (End Vol – Start Vol) + (deliveries + passed to other systems) / total inflows*.

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 2010-11.

Efficiencies of more than 100% in the Harcourt, Lockwood and Spring Gully systems are due to 2010-11 being a particularly wet year, with low customer demand for water. Significant rain run-off caused channel inflows to be high and this run-off is described above as a negative loss.

### 36.4.2 Urban distribution systems

Table 36-12 summarises Coliban Water's nine urban distribution systems.

#### Table 36-12 Coliban Water urban distribution systems

| Area | System / towns supplied | Source of supply | Treatment plant location |
|---|---|---|---|
| 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 & 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, Campbell's 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 IA - Lockington and Rochester | Goulburn system (Lake Eildon & Waranga Basin) | Lockington and Rochester |
| | Towns supplied from Pyramid-Boort IA – Boort, Dingee, Macorna, Mitiamo, Mysia and Pyramid Hill | Goulburn system (Lake Eildon & Waranga Basin) | Boort and Pyramid Hill<br>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 | River Murray - Gunbower Creek | Cohuna |
| | Echuca | River Murray | Echuca |
| | Leitchville | River Murray – Gunbower Creek & Cohuna irrigation channel | Leitchville |
| | Gunbower | River Murray – 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 36-13 shows Coliban Water's urban distribution systems' water balances.

## Table 36-13 Coliban 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[1] | | | | | | | |
| | | | ... to urban residential | ... to urban non-residential | ... from treatment plants | ... from dist'n systems | ... passed to rural systems | ... passed to other urban systems | Total outflows | | | |
| **Campaspe** | | | | | | | | | | | | |
| Goornong | - | 58 | 22 | 5 | | 31 | - | - | 58 | - | - | 46.6 |
| **Coliban Northern** | | | | | | | | | | | | |
| Bendigo system | 2,110 | 8,150 | 5,440 | 2,212 | | 399 | - | 2 | 8,053 | - | 2,207 | 95.0 |
| Heathcote system | 120 | 101 | 115 | 49 | | (27) | - | - | 137 | - | 84 | 126.7 |
| **Coliban Southern** | | | | | | | | | | | | |
| Castlemaine system - McKay Reservoir | 882 | 1,617 | 771 | 556 | | (93) | - | - | 1,234 | - | 1,265 | 105.8 |
| Kyneton system | - | 725 | 339 | 295 | | 91 | - | - | 725 | - | - | 87.4 |
| **Elmore groundwater system** | | | | | | | | | | | | |
| Elmore | - | 98 | 51 | 24 | | 23 | - | - | 98 | - | - | 76.5 |
| **Goulburn system** | | | | | | | | | | | | |
| Supplied from Rochester IA | - | 1,067 | 264 | 593 | | 210 | - | - | 1,067 | - | - | 80.3 |
| Supplied from PH-Boort IA | - | 208 | 104 | 56 | | 48 | - | - | 208 | - | - | 76.9 |
| **Loddon system** | | | | | | | | | | | | |
| Bridgewater system | - | 204 | 61 | 27 | | 116 | - | - | 204 | - | - | 43.1 |
| Jarklin | - | 2 | 1 | 1 | | - | - | - | 2 | - | - | 100.0 |
| Laanecoorie system | - | 102 | 55 | 13 | | 34 | - | - | 102 | - | - | 66.7 |
| Serpentine | - | 21 | 7 | 2 | | 12 | - | - | 21 | - | - | 42.9 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Murray system** | | | | | | | | | | | | |
| Cohuna | - | 520 | 216 | 104 | | 93 | 107 | - | 520 | - | - | 82.1 |
| Echuca | - | 2,255 | 1,105 | 1,029 | | 121 | - | - | 2,255 | - | - | 94.6 |
| Leitchville | - | 220 | 33 | 122 | | 38 | - | 27 | 220 | - | - | 82.7 |
| Gunbower | - | 56 | 24 | 11 | | 21 | - | - | 56 | - | - | 62.5 |
| **Trentham groundwater system** | | | | | | | | | | | | |
| Trentham | 79 | 81 | 49 | 14 | | 58 | - | - | 121 | 39 | - | 52.1 |
| **Wimmera system** | | | | | | | | | | | | |
| Wychitella | - | 2.0 | 1.0 | .5 | | .5 | - | - | 2.0 | - | - | 75.0 |
| Borung | - | 2.0 | 2.0 | .5 | | (.5) | - | - | 2.0 | - | - | 125.0 |
| Koorong Vale - Wedderburn | - | 120 | 52 | 13 | | 55 | - | - | 120 | - | - | 54.2 |

Note:

(1) Distribution system losses are the balancing item in all cases. In 2010-11, there were instances of rain run-off into service basin or directly on storages that show as (-) negative losses. In these instances, system efficiency calculations are based on the formula *Efficiency = 100 * (End Vol – Start Vol) + (deliveries + passed to other systems) / total inflows*.

## 36.5 Lower Murray Water

Lower Murray Water is based in Mildura. Its area of operation extends along the River Murray 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 36-14 summarises Lower Murray Water's rural distribution systems.

### Table 36-14 Lower Murray Water rural distribution systems

| System | Customers supplied | Source of supply |
|---|---|---|
| **Irrigation distribution systems** | | |
| First Mildura Irrigation District (ID) | Primarily irrigators, both inside and adjacent to its district, who are supplied with irrigation and D&S water | River Murray at Mildura pumps |
| Red Cliffs ID | 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 WWD. | River Murray at Red Cliffs pumps |
| Merbein ID | 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 WWD. | River Murray at Merbein pumps |
| Robinvale ID | Primarily irrigators, both inside and adjacent to its district, who are supplied with irrigation and D&S water | River Murray at Robinvale pumps |
| **Other rural distribution systems** | | |
| Cardross part of the Cardross-Yelta WWD | D&S customers | Red Cliffs ID |
| Wargan-Yelta part of the Cardross-Yelta WWD | D&S customers | Merbein ID |
| Millewa WWD | Primarily piped supply to D&S customers. Also supplies three small towns and irrigation water diverted from Lake Cullulleraine. | River Murray at Lake Cullulleraine pumps |

Table 36-15 shows Lower Murray Water's rural distribution systems' water balances.

## Table 36-15 Lower Murray Water rural distribution systems' water balances

| Distribution system | Start volume in store (ML) | Total inflows (ML) | Outflows | | | | | Balancing item (ML) | End volume in store (ML) | Distribution system efficiency (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Deliveries | | Losses | ... passed to other systems | Total outflows | | | |
| | | | ... to irrigation | ... to other | | | | | | |
| **Irrigation distribution systems** | | | | | | | | | | |
| First Mildura ID | - | 16,365 | 13,260 | - | 3,105 | - | 16,365 | - | - | 81.0 |
| Red Cliffs ID | - | 14,609 | 12,219 | 1,012 | 1,378 | - | 14,609 | - | - | 90.6 |
| Merbein ID | - | 8,377 | 6,957 | - | 1,420 | - | 8,377 | - | - | 83.0 |
| Robinvale ID | - | 10,713 | 9,988 | - | 725 | - | 10,713 | - | - | 93.2 |
| **Other rural distribution systems** | | | | | | | | | | |
| Cardross part of Cardross-Yelta WWD | - | - | - | - | - | - | - | - | - | - |
| Yelta part of Cardross-Yelta WWD | - | - | - | - | - | - | - | - | - | - |
| Millewa WWD(1) | 4,545 | 8,574 | 571 | 3,978 | 4,025 | 20 | 8,594 | (20) | 4,545 | 53.3 |

Note:
(1) Millewa WWD includes an evaporative loss provision of up to 4,800 ML for the off river storage of Lake Cullulleraine.

Table 36-16 summarises Lower Murray Water's urban distribution systems.

## Table 36-16 Lower Murray Water urban distribution systems

| System / towns supplied | Source of supply | Treatment plant location |
|---|---|---|
| Millewa urban system – Werrimull, Meringur and Cullulleraine | Millewa WWD | Millewa |
| Mildura urban system – Mildura (including Cardross, Koorlong and Nicholls Point), Merbein and Irymple | River Murray | Mildura |
| Red Cliffs | River Murray | Red Cliffs |
| Robinvale | River Murray | Robinvale |
| Piangil | River Murray | Piangil |
| Swan Hill urban system – Swan Hill, Lake Boga, Nyah, Nyah West, Woorinen Sth and Wakool Shire (NSW) | River Murray | Swan Hill |
| Kerang | River Murray, Loddon River, Torrumbarry IA | Kerang |
| Koondrook | River Murray | Koondrook |
| Murrabit | River Murray | Murrabit |
| Mystic Park | Vic Mid Murray Storage (Lake Kangaroo) | Raw water supply only (no treatment plant) |

Table 36-17 shows Lower Murray Water's urban distribution systems' water balances.

## Table 36-17 Lower Murray 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(1) | | | | | | |
| | | | … to urban residential | … to urban other | … from treatment plants | … from dist'n systems | … passed to other systems | Total outflows | | | |
| Millewa system | 1 | 20 | 20 | - | - | - | | 20 | - | 1 | 100.0 |
| Mildura system | 48 | 8,462 | 5,779 | 1,730 | - | 953 | | 8,462 | - | 48 | 88.7 |
| Red Cliffs | 7 | 846 | 409 | 360 | - | 77 | | 846 | - | 7 | 90.9 |
| Piangil | 1 | 79 | 29 | 30 | - | 20 | | 79 | - | 1 | 74.7 |
| Swan Hill system | 14 | 2,854 | 1,638 | 512 | - | 704 | | 2,854 | - | 14 | 75.3 |
| Kerang | 6 | 721 | 455 | 136 | - | 130 | | 721 | - | 6 | 82.0 |
| Koondrook | 3 | 139 | 88 | 16 | - | 35 | | 139 | - | 3 | 74.8 |
| Murrabit | 2 | 18 | 9 | 2 | - | 7 | | 18 | - | 2 | 61.1 |
| Mystic Park | - | 9 | 4 | 1 | - | - | | 5 | 4 | - | 100.0 |

Note:

(1) Distribution system losses are used as the balancing item.

# 37 Gippsland Region

## 37.1 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 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 37-1 summarises East Gippsland Water's urban distribution systems.

### Table 37-1 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 bores | 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 | Bore | Dinner Plain |

Table 37-2 shows 18 East Gippsland Water's urban distribution systems' water balances.

### Table 37-2 East 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 | | | | | | |
| | | | ... to urban residential | ... to urban other | ... from treatment plants | ... from dist'n systems[1] | ... passed to other systems | Total outflows | | | |
| Mitchell system | 1,513 | 4,131 | 2,276 | 1,186 | 10 | 967 | - | 4,439 | - | 1,205 | 78.0 |
| Orbost system | 6 | 810 | 240 | 438 | 55 | 52 | - | 785 | - | 31 | 86.4 |
| Mallacoota | 61 | 160 | 89 | 45 | - | 27 | - | 161 | - | 60 | 83.2 |
| Omeo | 3 | 60 | 23 | 14 | 2 | 8 | - | 47 | - | 16 | 78.7 |
| Swifts Creek | 4 | 26 | 14 | 10 | - | 3 | - | 27 | - | 3 | 88.9 |
| Bemm River | 6 | 23 | 11 | 13 | - | - | - | 24 | - | 5 | 100.0 |
| Cann River | 3 | 39 | 16 | 19 | - | 6 | - | 41 | - | 1 | 85.4 |
| Buchan | 1 | 25 | 10 | 8 | 7 | - | - | 25 | - | 1 | 72.0 |
| Dinner Plain[2] | 1 | 44 | 22 | 8 | 5 | 9 | - | 44 | - | 1 | 68.2 |

Notes:

(1) Distribution system losses are used as the balancing item.

(2) Dinner Plain, with an efficiency of 68.2%, is a small system where any loss affects the efficiency rating. The system is under snow for a few months of the year: This impacts on the infrastructure, and breaks and leaks are difficult to identify.

## 37.2 Gippsland Water

Gippsland Water services an area of just over 5000 km$^2$ 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 37-3 summarises Gippsland Water's urban distribution systems.

### Table 37-3 Gippsland Water urban distribution systems

| Area | System / towns supplied | Source of supply | Treatment plant location |
|---|---|---|---|
| Macalister / Thomson | Maffra system – Boisdale, Maffra and Stratford | Macalister River | Maffra |
| | Coongulla system – Coongulla and Glenmaggie | Lake Glenmaggie | Coongulla |
| | Heyfield | Thomson River | Heyfield |
| | Briagalong | Bore | Briagalong |
| Sale | Sale and Wurruk | Bore | Sale |
| Moondarra Reservoir | Moondarra system – Boolarra, Churchill, Cowwarr, Glengarry, Hazelwood N, 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 | Walkley's / O'Grady's 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 37-4 shows Gippsland Water's urban distribution systems' water balances.

### Table 37-4 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 | | | | | | |
| | | | ... to urban residential | ... to urban other(1) | ... from treatment plants | ... from dist'n systems(2) | ... passed to other systems | Total outflows | | | |
| Macalister / Thomson area | 40 | 1,477 | 727 | 480 | 127 | 134 | - | 1,468 | 17 | 32 | 82.2 |
| Sale system | 11 | 1,826 | 1,074 | 527 | 204 | 16 | - | 1,821 | - | 16 | 87.9 |
| Moondara Reservoir system | 991 | 48,358 | 4,082 | 42,264 | 296 | 955 | - | 47,597 | 950 | 802 | 97.4 |
| Moe system | 47 | 3,373 | 1,542 | 1,429 | 64 | 336 | - | 3,371 | (3) | 52 | 88.1 |
| Warragul / Drouin system | 48 | 2,988 | 1,575 | 797 | 405 | 200 | - | 2,977 | (34) | 93 | 79.7 |
| Willow Grove | - | 50 | 30 | 1 | 2 | 17 | - | 50 | - | - | 62.0 |
| Neerim South / Noojee | 3 | 180 | 135 | 25 | 1 | 19 | - | 180 | - | 3 | 88.9 |
| Boolara | 3 | 95 | 37 | 3 | 22 | 33 | - | 95 | - | 3 | 42.1 |
| Erica / Rawson | 39 | 87 | 35 | 19 | 14 | 19 | - | 87 | - | 39 | 62.1 |
| Mirboo North | 2 | 190 | 104 | 30 | 5 | 51 | - | 190 | - | 2 | 70.5 |
| Thorpdale | 3 | 17 | 8 | 3 | 5 | 1 | - | 17 | 1 | 2 | 64.7 |
| Seaspray | 3 | 31 | 16 | 4 | 3 | 7 | - | 30 | 2 | 2 | 66.7 |

Notes:
(1) Urban other includes major industries in some systems.
(2) Distribution system losses are used as a the balancing item in those systems that show a zero explicit balancing item.

The Boolarra system (with the least efficiency, of 42.1%) was interconnected to the Moondarra system in July 2012, and future losses for this system will be reduced.

Systems with the lowest efficiencies (of less than 70%, including Willow Grove, Boolarra, Erica / Rawson, Thorpdale and Seaspray) are also Gippsland Water's smallest systems by volume supplied. The inflows to these systems combined totalled 280 ML, which is small compared to the total supplied to all systems of 54,920 ML. An overall efficiency was calculated at 94.9% for all systems combined.

## 37.3 Southern Rural Water (Macalister system)

Southern Rural Water is based in Maffra, and 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, but it also operates three irrigation districts.

The largest of these is the Macalister Irrigation District: it is supplied principally from Lake Glenmaggie on the Macalister River, but 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 37-5 shows the water balance for the Macalister Irrigation District.

### Table 37-5 Southern Rural Water Macalister Irrigation District water balance

| Distribution 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[3] | … passed to other systems | Total outflows | | | |
| | | | … to irrigation[2] | … to other | | | | | | |
| Macalister Irrigation District | - | 159,530 | 101,173 | - | 46,143 | - | 147,316 | 12,214 | - | 68.7 |

Notes

(1) Inflows include 30,935 ML from the Thomson River at Cowwarr Weir, with the balance from the Macalister River.

(2) Deliveries to irrigation include D&S supply to irrigation customers.

(3) Losses include 25,055 ML of outfalls, and are the balancing item.

## 37.4 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 some 4,000 km$^2$.

Table 37-6 summarises South Gippsland Water's urban distribution systems.

### Table 37-6 South Gippsland Water urban distribution systems

| System / towns supplied | Source of supply | Treatment plant location |
|---|---|---|
| Yarram system – Devon North, Alberton, Yarram and Port Albert | Tara 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 37-7 shows South Gippsland Water's urban distribution systems' water balances.

## Table 37-7 South 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(1) | | | | | | |
| | | | ... to urban residential | ... to urban other | ... from treatment plants | ... from dist'n systems | ... passed to other systems | Total outflows | | | |
| Yarram system | - | 473 | 145 | 216 | - | 87 | - | 448 | 25 | - | 80.6 |
| Dumbalk | - | 21 | 9 | 4 | - | 2 | - | 15 | 6 | - | 86.7 |
| Fish Creek | 122 | 90 | 11 | 54 | - | 10 | - | 75 | 14 | 123 | 86.7 |
| Foster | 237 | 165 | 69 | 61 | - | 21 | - | 151 | 14 | 237 | 86.1 |
| Korrumburra | 592 | 741 | 236 | 315 | - | 158 | - | 709 | 32 | 592 | 77.7 |
| Leongatha | 1,910 | 1,650 | 323 | 1,166 | - | 41 | - | 1,530 | 120 | 1,910 | 97.3 |
| Loch system | 218 | 164 | 62 | 81 | - | 8 | - | 151 | 13 | 218 | 94.7 |
| Meeniyan | - | 50 | 28 | 11 | - | 6 | - | 45 | 5 | - | 86.7 |
| Toora system | 58 | 526 | 63 | 320 | - | 18 | - | 401 | 125 | 58 | 95.5 |
| Wonthaggi system | 4,200 | 1,611 | 830 | 575 | - | 122 | - | 1,527 | (66) | 4,350 | 92.0 |

Note:

(1) Distribution system losses include treatment plant losses.

# 38 Central Region

## 38.1 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 bores
- (in future) two connections from Melbourne Water's main desalination pipeline either direct to the water supply system or to Candowie Reservoir.

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. The permanent population supplied is about 16,000, which swells to about 60,000 in peak holiday periods.

Table 38-1 summarises Westernport Water's distribution system's water balances.

### Table 38-1 Westernport Water distribution system's water balance

| | Volume (ML) | Total (ML) |
|---|---|---|
| **Starting volume in store** | | |
| Service basins | - | **-** |
| **Inflows** | | |
| From Candowie Reservoir(1) | 1,654 | |
| From Bass River | 37 | **1,691** |
| **Deliveries** | | |
| Residential customers | 919 | |
| Non-residential customers | 548 | |
| Owners Corporations | 46 | |
| WPW Operations | 45 | **1,558** |
| **Losses** | | |
| Treatment plant | 52 | |
| Distribution system | 81 | **133** |
| **Ending volume in store** | - | **-** |
| **System efficiency (%)** | | **92.1** |

(1) The inflow from the Candowie Reservoir is used as the balancing item

## 38.2 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 38-2 summarises Melbourne Water's distribution system's water balance.

### Table 38-2 Melbourne Water distribution system's water balance

| | Volume (ML) | Total (ML) |
|---|---|---|
| **Starting volume in store** | | |
| Silvan Reservoir | 36,406 | |
| Cardinia Reservoir | 101,123 | |
| Sugarloaf Reservoir | 58,676 | |
| Greenvale Reservoir | 16,999 | **213,204** |
| **Ending volume in store** | | |
| Silvan Reservoir | 34,538 | |
| Cardinia Reservoir | 204,353 | |
| Sugarloaf Reservoir | 95,583 | |
| Greenvale Reservoir | 20,720 | **355,194** |
| **Change (increase) in storage(1)** | | **141,990** |
| **Inflows** | | |
| From Yarra basin to Silvan(2) | 275,417 | |
| From Yarra basin to Cardinia(3) | 0 | |
| From Yarra basin to Sugarloaf | 175,687 | |
| From Goulburn River to Sugarloaf | 7,459 | |
| From Yan Yean to Greenvale | 0 | |
| From Tarago Reservoir | 13,902 | |
| Rainfall on four main storages | 23,489 | **495,954** |
| **Outflows** | | |
| **Passed to other systems** | | |
| To South East Water | 123,462 | |
| To Yarra Valley Water | 127,621 | |
| To City West Water | 92,562 | |
| To Western Water | 7,881 | |
| To Gippsland Water | 235 | |
| To Cardinia Creek from Cardinia | 1,825 | |
| To Stonyford Creek from Silvan | 730 | **354,316** |
| **Losses(4)** | | |
| Evaporation from four main storages | 12,669 | |
| System losses | 1,067 | **13,736** |
| **Total outflows** | | **368,052** |
| **Balancing Item (unaccounted gain)** | 14,088 | |
| **System efficiency (%)** | | **96.3** |

Notes:
(1) Storage figures do not include service reservoirs and tanks.
(2) Inflows from Yarra basin to Silvan include a transfer of 1,592 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 3,908 ML upstream of the common distribution system.

Factors contributing to the unaccounted gain 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.

## 38.3 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 38-3 shows South East Water's urban distribution system's water balance.

### Table 38-3 South East Water urban distribution system's water balance

| | Volume (ML) | Total (ML) |
|---|---|---|
| **Starting volume in store** | | |
| Service basins | 542 | **542** |
| **Ending volume in store** | | |
| Service basins | 542 | **542** |
| **Change (increase) in storage** | 0 | **0** |

| | | |
|---|---|---|
| **Inflows** | | |
| From Melbourne Water | 123,483 | |
| Recycled - imported | 618 | |
| Recycled - from local treatment plant | 1,641 | **125,742** |
| **Outflows** | | |
| **Deliveries** | | |
| To residential customers | 81,650 | |
| To non-residential customers | 27,195 | |
| To authorised non-metered | 1,074 | |
| Recycled water used | 2,259 | **112,178** |
| **Losses** | | |
| System losses(1) | 13,564 | **13,564** |
| **Total outflows** | | **125,742** |
| **System efficiency** | | **89.2** |

Note:
(1) System losses include real losses of 10,980 ML (bursts and leaks of 1,073 ML and background leakage of 9,907 ML) and apparent losses of 2,583 ML.

## 38.4 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 38-4 shows Yarra Valley Water's urban distribution system's water balance.

### Table 38-4 Yarra Valley Water urban distribution system's water balance

| | Volume (ML) | Total (ML) |
|---|---|---|
| **Starting volume in store** | | |
| Service basins | - | |
| **Ending volume in store** | | |
| Service basins | - | |
| **Change (increase) in storage** | - | - |
| **Inflows** | | |
| From Melbourne Water | 127,617 | |
| Recycled - from local treatment plant | 94 | **127,711** |
| **Outflows** | | |
| **Deliveries** | | |
| To residential customers | 89,709 | |
| To non-residential customers | 24,196 | |
| Recycled water used | 94 | **113,999** |
| **Losses** | | |
| System losses (1) | 13,712 | |
| **Total outflows** | | **127,711** |
| **System efficiency** | | **89.3** |

Note:
(1) System losses include both real losses of 10,289 ML (from leakage, bursts and background leakage) and apparent losses of 3,423 ML (which may include metering errors).

## 38.5 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 38-5 shows City West Water's urban distribution system's water balance.

### Table 38-5 City West Water urban distribution system's water balance

| | Volume (ML) | Total (ML) |
|---|---|---|
| **Starting volume in store** | | |
| Service basins | - | |
| **Ending volume in store** | | |
| Service basins | - | |
| **Change (increase) in storage** | - | - |
| **Inflows** | | |
| From Melbourne Water | 92,577 | |
| Recycled – imported (1) | 137 | **92,714** |
| **Outflows** | | |
| **Deliveries** | | |
| To residential customers | 46,318 | |
| To non-residential customers | 37,804 | |
| Recycled water used | 137 | **84,259** |
| **Losses** | | |
| System losses (2) | 8,455 | |
| **Total outflows** | | **92,714** |
| **System efficiency** | | **90.9** |

Notes:

(1) The recycled – imported inflow amount represents a bulk purchase from Melbourne Water.

(2) System losses are back-calculated and are the balancing item

## 38.6 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 38-6 summarises Western Water's urban distribution systems.

### Table 38-6 Western Water urban distribution systems

| Area | System / towns supplied | Source of supply | Treatment plant location |
|---|---|---|---|
| Main integrated system | Sunbury, Gisborne, Bacchus Marsh, Diggers Rest, Riddles Creek, Macedon, Melton, Mount Macedon, Romsey and Myrniong (*Myrniong is separate and not connected to the integrated system)* | Bulk supply from Melbourne Water, Rosslynne Reservoir system, Pykes Creek Reservoir, Merrimu Reservoir, Djerriwarrh Reservoir and Kerrie Reservoir | Melton, Gisborne, Romsey, Myrniong |
| 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 38-7 shows Western Water's urban distribution systems' water balances.

### Table 38-7 Western 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 | | | | | | |
| | | | … to urban residential | … to urban other | … from treatment plants | … from dist'n systems | … passed to other systems | Total outflows | | | |
| Main integrated system | 446 | 11,251 | 9,750 | - | - | 848 | - | 10,598 | 120 | 979 | 92.0 |
| Woodend | 177 | 310 | 348 | - | - | 30 | - | 378 | (252) | 361 | 92.1 |
| Lancefield | 62 | 177 | 153 | - | - | 13 | - | 166 | (37) | 110 | 92.2 |

## 38.7 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 38-8 summarises Barwon Water's urban distribution systems.

### Table 38-8 Barwon Water urban distribution systems

| Area | System / towns supplied | Source of supply | Treatment plant location |
|---|---|---|---|
| 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)<br>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 treatment plant |
| | | Moorabool River system – various streams in the Moorabool basin | Moorabool WTP 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 WTP |
| Aireys Inlet | Aireys Inlet and Fairhaven | Painkalac Reservoir on the Painkalac Creek | Aireys Inlet WTP |
| Lorne | Lorne township | Allen Reservoir on the St George River, just west of Lorne | Lorne WTP |
| Apollo Bay | Apollo Bay, Marengo and Skenes Creek | Diversion weir on the West Barham River in the Otway Ranges | WTP near Marengo |

Table 38-9 shows Barwon Water's urban distribution systems' water balances.

### Table 38-9 Barwon 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 | | … passed to other systems | Total outflows | | | |
| | | | … to urban residential | … to urban other | … from treatment plants | … from dist'n systems | | | | | |
| Geelong / Bellarine | 23,644 | 37,670 | 15,907 | 8,138 | - | 2,181 | - | 26,226 | (1,765) | 36,853 | 91.7 |
| Colac (incl. Gellibrand) | 393 | 3,500 | 1,522 | 1,237 | - | 145 | - | 2,904 | 450 | 539 | 95.0 |
| Aireys Inlet | 2 | 164 | 112 | 10 | 27 | 12 | - | 161 | 3 | 2 | 75.8 |
| Lorne | 6 | 356 | 180 | 82 | 20 | 61 | - | 343 | 13 | 6 | 76.4 |
| Apollo Bay | 120 | 375 | 166 | 100 | 11 | 82 | - | 359 | 25 | 111 | 74.1 |

## 38.8 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 38-10 summarises Central Highlands Water's urban distribution systems.

## Table 38-10 Central Highlands Water urban distribution systems

| Area | System / towns supplied | Source of supply | Treatment plant location |
|---|---|---|---|
| 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 McCallum's Creek) and Tullaroop Reservoir on the Loddon River | Single WTP 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 Barry's 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; WTP is adjacent to the bore |
| | Daylesford system – supplies Daylesford, Hepburn and Hepburn Springs (Loddon basin) | Three small storages supplied from various streams | Single WTP for the three towns |
| | Dean (Loddon basin) | Groundwater bore | Chlorine disinfection |
| | Forest Hill system (Loddon basin) – supplies Allendale, Newlyn, Smeaton, Kingston, Springmount, Broomfield and rural homes in the district | Three groundwater bores at Forest Hill | Hardness removed and disinfected; WTP 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 | WTP 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 38-11 shows Central Highlands Water's urban distribution systems' water balances.

### Table 38-11 Central Highlands Water urban distribution systems' water balances

| Area / system | Start volume in store (ML) | Total inflows (ML)[1] | Outflows (ML) | | | | | | Balancing item (ML) | End volume in store (ML) | Distribution system efficiency (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Deliveries | | Losses | | | | | | |
| | | | ... to urban residential | ... to urban other | ... from treatment plants | ... from dist'n systems | ... passed to other systems | Total outflows | | | |
| Greater Ballarat | 0 | 9,708 | 5,758 | 2,569 | 0 | 1,404 | 0 | 9,731 | 23 | 0 | 85.6 |
| Maryborough and District | 0 | 955.6 | 617 | 191 | 0 | 148 | 0 | 956 | 1 | 0 | 84.5 |
| Amphitheatre | 0 | 9.2 | 6 | 0 | 0 | 2 | 0 | 8 | -1 | 0 | 71.4 |
| Avoca | 0 | 88.0 | 56 | 15 | 0 | 16 | 0 | 87 | -1 | 0 | 82.0 |
| Beaufort & Raglan | 0 | 154 | 81 | 24 | 0 | 48 | 0 | 153 | -1 | 0 | 68.5 |
| Blackwood & Barrys Reef | 0 | 25 | 20 | 3 | 0 | 2 | 0 | 25 | 0 | 0 | 91.3 |
| Clunes[2] | 0 | 156 | 105 | 23 | 0 | 43 | 0 | 171 | 15 | 0 | 74.9 |
| Daylesford system | 0 | 540 | 269 | 107 | 0 | 153 | 0 | 529 | -10 | 0 | 71.1 |
| Dean | 0 | 21 | 2 | 1 | 0 | 18 | 0 | 21 | 0 | 0 | N/A |
| Forest Hill system | 0 | 128 | 80 | 7 | 0 | 40 | 0 | 127 | -1 | 0 | 68.5 |
| Landsborough[3] & Navarre | 0 | 24 | 10 | 5 | 0 | 9 | 0 | 24 | 0 | 0 | 63.0 |
| Learmonth | 0 | 31 | 17 | 7 | 0 | 8 | 0 | 32 | 1 | 0 | 74.1 |
| Lexton | 0 | 11 | 9 | 1 | 0 | 1 | 0 | 11 | 0 | 0 | 87.7 |
| Redbank | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 119.0 |
| Waubra | 0 | 15 | 11 | 1 | 0 | 3 | 0 | 15 | 0 | 0 | 79.6 |

Notes:

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 – channels connecting Moorabool Reservoir to White Swan – is also not covered here.

(1) Inflow is flow measured into the distribution system, generally excluding water treatment plants.

(2) At Clunes, the balancing item is due to metering anomalies.

(3) At Landsborough, groundwater was pumped to clean the mains before commissioning the desalination plant, then outfalled from the system.

## 38.9 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 38-11 shows Southern Rural Water's Werribee and Bacchus Marsh irrigation districts' water balances.

### Table 38-12 Southern Rural Water Werribee and Bacchus Marsh irrigation districts' water balances

| Distribution system | Start volume in store (ML) | Total inflows (ML) | Outflows (ML) | | | | | Balancing item (ML) | End volume in store (ML) | Distribution system efficiency (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Deliveries | | Losses[3] | ... passed to other systems | Total outflows | | | |
| | | | ... to irrigation | ... to other | | | | | | |
| Werribee ID | - | 11,311[1] | 6,829 | - | 3,132 | - | 9,961 | 1,350 | - | 68.6 |
| Bacchus Marsh ID | - | 1,571[2] | 981 | - | 590 | - | 1,571 | - | - | 62.4 |

Notes:

(1) Werribee inflows include 1,779 ML of recycled water from Melbourne Water's Western Treatment Plant, of which 1,306 ML was delivered to irrigators.

(2) Bacchus Marsh inflows include 46 ML from Merrimu via Western Water.

(3) Losses include outfalls of 151 ML from Werribee and 51 ML from Bacchus Marsh, and are the balancing item.

# 39 Western Region

## 39.1 Wannon Water

Wannon Water's region extends over 24,500 km$^2$ 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 39-1 summarises Wannon Water's combined distribution systems.

### Table 39-1 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 |

Table 39-2 shows Wannon Water's combined distribution systems' water balances.

### Table 39-2 Wannon Water combined distribution systems' water balances

| Area/system | Start volume in store (ML) | Total Inflows (ML) | Outflows (ML) | | | | | | | | Balancing item (ML) | End volume in store (ML) | Distribution efficiency (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Deliveries | | | | Losses | | | | | | |
| | | | … to urban residential | … to urban other | … to rural customers | … to env. / other | … from treatment plants | … from retic. system[1] | … passed to other systems | Total outflows | | | |
| **Otway system** | | | | | | | | | | | | | |
| Allansford | | | 46 | 39 | 15 | | | | | | | | |
| Camperdown | | | 205 | 81 | 523 | | 98 | | | | | | |
| Cobden | | | 100 | 320 | 127 | | 102 | | | | | | |
| Koroit | | | 80 | 62 | 1 | | | | | | | | |
| Lismore & Derrinallum | | | 32 | 11 | 38 | | | | | | | | |
| Mortlake | | | 62 | 26 | 4 | | | | | | | | |
| Noorat & Glenormiston | | | 22 | 35 | 55 | | | | | | | | |
| North Otway pipeline | | | | 13 | 1,315 | | | | | | | | |
| Purnim | | | | | 11 | | - | | | | | | |
| Simpson | | | 9 | 55 | 16 | | 29 | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Terang | | | 128 | 41 | 7 | | 35 | | | | | | |
| Warrnambool | | | 1,947 | 1,250 | 18 | | 59 | | | | | | |
| **Total** | **2,028** | **9,022** | **2,631** | **,933** | **2,130** | **22** | **323** | **1,457** | **-** | **8,496** | **580** | **1,974** | **79.0** |
| **Dilwyn Aquifer** | | | | | | | | | | | | | |
| Portland | | | 677 | 697 | 1 | | - | 305 | | | | | |
| Heywood | | | 88 | 28 | 2 | | - | 26 | | | | | |
| Dartmoor | | | 11 | 1 | - | | - | 5 | | | | | |
| Port Fairy | | | 233 | 338 | - | | 14 | 81 | | | | | |
| Port Campbell | | | 23 | 34 | - | | - | 6 | | | | | |
| Peterborough | | | 18 | 15 | 4 | | | 2 | | | | | |
| Timboon | | | 49 | 30 | 75 | | | 29 | | | | | |
| **Total** | **26** | **2,806** | **1,099** | **1,143** | **82** | | **14** | **454** | **-** | **2,792** | **14** | **26** | **83.2** |
| **Grampians (excl. Balmoral)** | | | | | | | | | | | | | |
| Cavendish | | | 7 | 1 | 3 | | | 1 | | | | | |
| Hamilton pipeline | | | - | - | 13 | | | - | | | | | |
| Hamilton | | | 600 | 197 | 32 | | 112 | 207 | | | | | |
| Dunkeld | | | 28 | 12 | 7 | | | 4 | | | | | |
| Tarrington | | | 17 | 2 | 6 | | | 13 | | | | | |
| **Total** | **909** | **2,756** | **652** | **212** | **61** | | **112** | **225** | **-** | **1,262** | **247** | **2,156** | **73.3** |
| **Balmoral** | **-** | **33** | **12** | **5** | **9** | **-** | **-** | **7** | **-** | **33** | **-** | **-** | **78.8** |
| **Port Campbell limestone aquifer** | | | | | | | | | | | | | |
| Tullich pipeline | | 399 | - | - | 1 | | | | | | | | |
| Casterton | | | 89 | 36 | 7 | | 31 | 76 | | | | | |
| Coleraine | | | 51 | 14 | 7 | | | 24 | | | | | |
| Sandford | | | 6 | 2 | 6 | | | 4 | | | | | |
| Merino | | | 13 | 4 | 11 | | | 5 | | | | | |
| Warrnambool | | 459 | | | | | | | 459 | | | | |
| **Total** | **-** | **858** | **159** | **56** | **32** | **-** | **31** | **109** | **459** | **846** | **12** | **-** | **83.5** |
| **Newer volcanic aquifer** | | | | | | | | | | | | | |
| Caramut | | 19 | 6 | 3 | 4 | | | 6 | | | | | |
| Penshurst | | 62 | 35 | 10 | 1 | | | 15 | | | | | |
| Macarthur | | 24 | 9 | 3 | 1 | | | 4 | | | | | |
| Mortlake | | 27 | | | | | | | 27 | | | | |
| Darlington | | 2 | 2 | | | | | - | | 2 | | | |
| **Total** | **-** | **134** | **52** | **16** | **6** | **-** | **-** | **25** | **27** | **126** | **8** | **-** | **80.2** |
| **Glenthompson** | **44** | **107** | **6** | **6** | **14** | **-** | **4** | **11** | **-** | **41** | **-** | **110** | **63.4** |
| **Konongwootong** | **536** | **934** | | | **32** | **364** | **-** | **13** | **-** | **409** | **-** | **1,061** | **96.8** |

Notes:

(1) Reticulation system losses are generally back-calculated for individual towns, so balancing items represent distribution losses in supplying water to the towns.

## 39.2 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 39-3 summarises GWMWater’s combined distribution systems.

## Table 39-3 Grampians Wimmera-Mallee Water combined distribution systems

| Area | System / towns supplied | Source of supply | Treatment plant location |
|---|---|---|---|
| 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 | WTPs 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 | WTPs 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 | WTPs 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 | WTPs 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 | River Murray 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 | River Murray at Wemen, Piangil, Nyah and Swan Hill | WTPs 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 39-4.

## Table 39-4 Grampians Wimmera-Mallee Water urban distribution systems

| Area | System / towns supplied | Source of supply | Treatment plant location |
|---|---|---|---|
| Ararat system | Ararat and surrounds | Mount Cole Reservoir and Lake Fyans | WTP at Ararat |
| Stawell system | Stawell, Great Western | Fyans Creek and Lake Fyans | WTPs at Stawell and Great Western |
| Halls Gap system | Halls Gap and Pomonal | Lake Bellfield | WTP at Halls Gap |
| Horsham system | City of Horsham and surrounds, including Haven and Natimuk | Lake Wartook and Laharum bores | WTP at Mount Zero |
| Willaura system | Willaura, Lake Bolac, Moyston and Wickliffe | Mt William, Stony and Masons creeks; groundwater bores (unincorporated area) | WTP at 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 | WTP 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 39-5 shows GWMWater's combined distribution systems' water balances.

### Table 39-5 Grampians Wimmera Mallee Water combined distribution systems' water balances

| Area / system | Start volume in store (ML) | Total inflows (ML) | Outflows (ML) | | | | | | | | Balancing item (ML) | End volume in store (ML) | Distribution system efficiency (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Deliveries | | | | Losses | | ... passed to other systems | Total outflows | | | |
| | | | ... to urban residential | ... to urban other | ... to rural customers | ... to env. / other | ... from treatment plants | ... from dist'n systems | | | | | |
| Wimmera Mallee Pipeline Supply Systems 1 and 7 | 0 | 1,207 | 186 | 79 | 882 | - | - | 60 | - | 1,207 | 0 | 0 | 95.0 |
| Wimmera Mallee Pipeline Supply System 2 | 0 | 702 | 357 | 94 | 216 | - | - | 35 | - | 702 | 0 | 0 | 95.0 |
| Wimmera Mallee Pipeline Supply System 3 | 0 | 202 | 123 | 34 | 35 | - | - | 10 | - | 202 | 0 | 0 | 95.0 |
| Wimmera Mallee Pipeline Supply System 4 | 0 | 1,271 | 399 | 238 | 570 | - | - | 64 | - | 1,271 | 0 | 0 | 95.0 |
| Wimmera Mallee Pipeline Supply System 5 | 0 | 1,659 | 37 | 118 | 1,421 | - | - | 83 | - | 1,659 | 0 | 0 | 95.0 |
| Wimmera Mallee Pipeline Supply System 6 | 0 | 224 | 0 | 0 | 48 | - | - | 3 | 51 | 102 | 122 | 0 | 97.1 |
| Northern Mallee Pipeline | 246 | 1,493 | 219 | 104 | 1,095 | - | - | 75 | - | 1,493 | 36 | 210 | 95.0 |

Table 39-6 shows GWMWater's urban distribution systems' water balances.

## Table 39-6 Grampians Wimmera Mallee Water urban distribution systems' water balances

| Area / system | Start volume in store (ML) | Total inflows (ML) | Outflows (ML) | | | | | | Balancing item (ML) | End volume in store (ML) | Distribution system efficiency (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Deliveries | | Losses | | ... passed to other systems | Total outflows | | | |
| | | | ... to urban residential | ... to urban other | ... from treatment plants | ... from dist'n systems | | | | | |
| **Surface water systems** | | | | | | | | | | | |
| Ararat system | 280 | 1,067 | 849 | - | - | 342 | - | 1,191 | - 136 | 292 | 71.3 |
| Stawell system | 247 | 1,274 | 1,139 | - | - | 6 | - | 1,145 | 31 | 345 | 99.5 |
| Horsham system | 183 | 4,724 | 1,204 | 354 | - | 154 | - | 1,712 | 3,018 | 177 | 91.0 |
| East Grampians system (Willuara) | 116 | 124 | 79 | 59 | - | - | - | 139 | - 2 | 103 | 100.0 |
| Quambatook | 89 | 65 | 20 | 11 | | 34 | | 65 | - 13 | 102 | 47.8 |
| Elmhurst | 16 | 51 | 10 | 2 | | | | 12 | 24 | 31 | 100.0 |
| Buangor(1) | 17 | 16 | 10 | 1 | | | | 11 | 0 | 22 | 100.0 |
| **Groundwater systems** | | | | | | | | | | | |
| Apsley | 0.2 | 11.0 | 14.2 | 5.2 | - | - 8.4 | - | 11.0 | 0.0 | 0.2 | 176.4 |
| Cowangie | 0.2 | 8.3 | 1.6 | 0.8 | - | 5.9 | - | 8.3 | - 0.0 | 0.2 | 28.9 |
| Goroke | 0.1 | 37.5 | 22.5 | 6.5 | - | 8.5 | - | 37.5 | - 0.0 | 0.1 | 77.3 |
| Edenhope | 7.6 | 113.3 | 53.7 | 20.7 | - | 38.9 | - | 113.3 | 1.4 | 6.2 | 65.7 |
| Harrow | - | 28.3 | 11.7 | 2.2 | - | 14.4 | - | 28.3 | - | - | 49.1 |
| Kaniva | 0.0 | 87.4 | 87.5 | 43.2 | - | - 43.3 | - | 87.4 | - 0.0 | 0.0 | 149.5 |
| Kiata | - | 8.7 | 1.8 | 0.5 | - | 6.4 | - | 8.7 | - | - | 26.3 |
| Lillimur | 0.0 | 6.7 | 5.6 | - | - | 1.1 | - | 6.7 | 0.0 | 0.0 | 83.6 |
| Miram | 0.0 | 1.3 | 1.2 | - | - | 0.1 | - | 1.3 | - 0.0 | 0.0 | 92.3 |
| Murrayville | 0.1 | 88.7 | 51.9 | 29.4 | - | 7.4 | - | 88.7 | - 0.0 | 0.1 | 91.7 |
| Nhill | - | 266.7 | 203.9 | 186.7 | - | - 123.9 | - | 266.7 | - | - | 146.5 |
| Serviceton | 0.0 | 6.3 | 3.9 | 1.2 | - | 1.2 | - | 6.3 | 0.0 | 0.0 | 81.0 |
| Streatham & Westmere | - | 10.4 | 4.1 | 2.2 | - | 4.1 | - | 10.4 | - | - | 60.6 |

Note:
(1) The balancing item in the Buangor water balance is total inflows.

# Appendix A: Groundwater entitlement and use

| GMU[1] | PCV | Allocation limit as of 30/06/11 (ML) | Licensed volumes (as at 30/06/11) | | | | | | | Domestic and stock | | Total use (licensed + domestic and stock) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Licensed entitlements (ML) | No. of licenses | No. of metered bores | Metering program complete | Metered volume (ML) | Estimated non- metered use (ML)[2] | Method used to estimate non-metered use | No. of domestic and stock bores[3] | Estimated use (ML)[4] | |
| Goulburn-Murray Water | | | | | | | | | | | | |
| WSPA (approved plan) | | | | | | | | | | | | |
| Shepparton WSPA | - | 208,341 | 208,341 | 1,211 | 850 | Yes | 16,721 | 0 | | 1,728 | 3,456 | 20,177 |
| Katunga WSPA | 59,780 | 42,351 | 60,546 | 251 | 131 | Yes | 11,654 | 0 | | 696 | 1,392 | 13,046 |
| WSPA (draft plan) | | | | | | | | | | | | |
| Upper Ovens WSPA | 4,010 | 4,010 | 3,295 | 89 | 128 | Yes | 86 | 0 | | 302 | 604 | 690 |
| Loddon Highlands WSPA [7] | 20,521 | 19,244 | 20,048 | 190 | 249 | Yes | 1,704 | 0 | | 717 | 1,434 | 3,138 |
| Lower Campaspe Valley WSPA [8] | 56,381 | 34,627 | 56,627 | 150 | 217 | Yes | 8,523 | 0 | | 425 | 850 | 9,373 |
| GMA | | | | | | | | | | | | |
| Alexandra GMA | 1,937 | 1,937 | 1,714 | 10 | 21 | Yes | 138 | 0 | | 16 | 32 | 170 |
| Barnawartha GMA | 2,100 | 2,100 | 645 | 6 | 8 | Yes | 0 | 0 | | 27 | 54 | 54 |
| Kinglake GMA | 2,015 | 2,015 | 1,859 | 62 | 25 | Yes | 141 | 0 | | 268 | 536 | 677 |
| Mullindolingong GMA[10] | 6,980 | 6,980 | 1,732 | 45 | 86 | Yes | 13 | 0 | | 52 | 104 | 117 |
| Lower Ovens GMA | 25,200 | 25,200 | 17,959 | 262 | 246 | Yes | 1,344 | 0 | | 1,909 | 3,818 | 5,162 |
| Mid-Goulburn GMA | 14,900 | 14,900 | 12,356 | 66 | 57 | Yes | 895 | 0 | | 206 | 412 | 1,307 |
| Mid-Loddon GMA[9] | 37,200 | 37,200 | 34,036 | 103 | 100 | Yes | 2,738 | 0 | | 353 | 706 | 3,444 |
| Unincorporated areas | | | | | | | | | | | | |
| Goulburn-Murray Water | | 35,709 | 35,709 | 658 | 788 | Yes | 246 | 3,981 | 10% of entitlement | 4,959 | 9,918 | 14,145 |
| GWMWater | | | | | | | | | | | | |
| WSPA (approved plan) | | | | | | | | | | | | |
| Murrayville WSPA | 10,883 | 10,883 | 9,634 | 37 | 46 | Yes | 4,059 | 0 | | 167 | 334 | 4,393 |
| Neuarpur WSPA | 24,750 | 24,750 | 24,691 | 53 | 139 | Yes | 5,681 | 0 | | 25 | 50 | 5,731 |
| WSPA (draft plan) | | | | | | | | | | | | |
| Apsley WSPA | - | 5,591 | 5,591 | 32 | 24 | Yes | 759 | 0 | | 89 | 178 | 937 |
| Kaniva WSPA | - | 7,659 | 7,659 | 23 | 28 | Yes | 1,737 | 0 | | 74 | 148 | 1,885 |
| Telopea Downs WSPA | - | 10,682 | 10,682 | 14 | 15 | Yes | 814 | 0 | | 28 | 56 | 870 |
| GMA | | | | | | | | | | | | |
| Balrootan (Nhill) GMA | - | 1,522 | 1,522 | 13 | 13 | Yes | 462 | 0 | | 15 | 30 | 492 |
| Goroke GMA | 2,200 | 2,200 | 0 | 0 | 0 | Yes | 0 | 0 | | 1 | 2 | 2 |
| Kaniva TCSA GMA | 1,100 | 1,100 | 0 | 0 | 0 | Yes | 0 | 0 | | 0 | 0 | 0 |
| Little Desert GMA | 1,100 | 1,100 | 0 | 0 | 0 | Yes | 0 | 0 | | 1 | 2 | 2 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nhill GMA | 1,200 | 1,200 | 0 | 0 | 0 | Yes | 0 | 0 | | 1 | 2 | 2 |
| Unincorporated areas | | | | | | | | | | | | |
| GWMWater | - | 14,376 | 14,376 | 82 | | No | | 1,722 | 12% of entitlement | 710 | 1,420 | 3,142 |
| Southern Rural Water | | | | | | | | | | | | |
| WSPA (approved plan) | | | | | | | | | | | | |
| Koo-Wee-Rup WSPA | 12,915 | 12,915 | 12,018 | 371 | 250 | Yes | 1,939 | 0 | | 1,299 | 1,949 | 3,888 |
| Nullawarre WSPA | 21,280 | 21,280 | 21,276 | 207 | 164 | Yes | 4,060 | 0 | | 959 | 1,439 | 5,498 |
| Warrion WSPA | 13,836 | 13,836 | 13,835 | 131 | 125 | Yes | 992 | 0 | | 357 | 536 | 1,527 |
| Yangery WSPA | 14,103 | 14,103 | 14,100 | 158 | 179 | Yes | 1,943 | 0 | | 888 | 1,332 | 3,275 |
| Yarram WSPA | 25,317 | 25,317 | 25,317 | 83 | 82 | Yes | 6,882 | 0 | | 324 | 486 | 7,368 |
| WSPA (draft plan) | | | | | | | | | | | | |
| Bungaree WSPA | 5,321 | 5,321 | 5,321 | 105 | 143 | Yes | 732 | 0 | | 252 | 378 | 1,110 |
| Condah WSPA | 7,437 | 7,437 | 7,436 | 40 | 41 | Yes | 1,115 | 0 | | 48 | 72 | 1,187 |
| Denison WSPA | 17,743 | 17,743 | 17,741 | 121 | 100 | Yes | 3,010 | 685 | Estimated extraction salinity control | 225 | 338 | 4,032 |
| Deutgam WSPA | 5,100 | 3,823 | 5,097 | 149 | 195 | Yes | 244 | 0 | | 180 | 18 | 262 |
| Glenelg WSPA | 32,660 | 32,660 | 32,660 | 83 | 96 | Yes | 3,360 | 0 | | 1,183 | 1,775 | 5,134 |
| Wandin Yallock WSPA | 2,924 | 2,924 | 2,933 | 187 | 209 | Yes | 198 | 0 | | 82 | 123 | 321 |
| Wy Yung WSPA | 7,463 | 7,463 | 7,462 | 60 | 71 | Yes | 309 | 0 | | 32 | 48 | 357 |
| Sale WSPA | 21,212 | 21,212 | 21,104 | 109 | 114 | Yes | 7,164 | 0 | | 383 | 575 | 7,738 |
| GMA | | | | | | | | | | | | |
| Colongulac GMA | 4,695 | 4,695 | 4,026 | 66 | 21 | Yes | 285 | 0 | | 125 | 188 | 472 |
| Cardigan GMA | 3,967 | 3,967 | 3,887 | 25 | 24 | Yes | 713 | 0 | | 92 | 138 | 851 |
| Corinella GMA | 2,550 | 2,550 | 662 | 14 | 9 | Yes | 68 | 0 | | 88 | 132 | 200 |
| Cut Paw Paw GMA | 3,650 | 3,650 | 515 | 6 | 4 | Yes | 30 | 0 | | 0 | 0 | 30 |
| Frankston GMA | 3,200 | 3,200 | 1,069 | 30 | 25 | Yes | 72 | 0 | | 138 | 207 | 279 |
| Gellibrand GMA | 0 | 0 | 0 | 0 | 0 | Yes | 0 | 0 | | 2 | 3 | 3 |
| Gerangamete GMA(5) | 20,000 | 20,000 | 20,000 | 1 | 6 | Yes | 1,144 | 0 | | 2 | 3 | 1,147 |
| Giffard GMA | 5,670 | 5,670 | 5,670 | 15 | 17 | Yes | 865 | 0 | | 70 | 105 | 970 |
| Glenormiston GMA | 2,565 | 2,565 | 2,566 | 34 | 11 | Yes | 458 | 0 | | 85 | 128 | 586 |
| Hawkesdale GMA | 16,161 | 16,161 | 12,314 | 115 | 61 | Yes | 2,689 | 0 | | 1,186 | 1,779 | 4,468 |
| Heywood GMA | 8,500 | 8,500 | 6,937 | 96 | 50 | Yes | 912 | 0 | | 1,275 | 1,913 | 2,824 |
| Jan Juc GMA(6) | 39,250 | 39,250 | 14,250 | 2 | 7 | Yes | 5,717 | 0 | | 5 | 8 | 5,724 |
| Lancefield GMA | 1,485 | 1,485 | 1,390 | 15 | 20 | Yes | 51 | 0 | | 76 | 114 | 165 |
| Leongatha GMA | 6,500 | 6,500 | 1,833 | 32 | 13 | Yes | 31 | 0 | | 92 | 138 | 169 |
| Merrimu GMA | 451 | 451 | 440 | 14 | 17 | Yes | 177 | 0 | | 14 | 21 | 198 |
| Moe GMA | 8,200 | 8,200 | 3,937 | 89 | 28 | Yes | 191 | 0 | | 134 | 201 | 392 |
| Moorabbin GMA | 2,700 | 2,700 | 2,614 | 56 | 69 | Yes | 545 | 0 | | 370 | 555 | 1,100 |
| Nepean GMA | 6,013 | 6,013 | 6,115 | 72 | 76 | Yes | 1,798 | 0 | | 2,155 | 2,155 | 3,953 |
| Newlingrook GMA | 1,977 | 1,977 | 1,958 | 6 | 5 | Yes | 8 | 0 | | 4 | 6 | 14 |
| Orbost GMA | 1,201 | 1,201 | 1,201 | 4 | 4 | Yes | 95 | 0 | | 7 | 11 | 105 |
| Paaratte GMA | 4,606 | 4,606 | 3,202 | 5 | 1 | Yes | 294 | 0 | | 4 | 6 | 300 |
| Portland GMA | 7,795 | 7,795 | 7,794 | 8 | 7 | Yes | 2,466 | 0 | | 5 | 8 | 2,474 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rosedale GMA | 22,313 | 22,313 | 22,267 | 60 | 50 | Yes | 3,117 | 4,426 | Estimated extraction Latrobe Valley mines | 178 | 267 | 7,810 |
| Stratford GMA | 27,645 | 27,645 | 27,645 | 7 | 6 | Yes | 5 | 24,899 | | 3 | 5 | 24,908 |
| Tarwin GMA | 1,300 | 1,300 | 38 | 3 | 1 | Yes | 9 | 0 | | 700 | 1,050 | 1,059 |
| Wa De Lock GMA | 30,172 | 30,172 | 28,602 | 243 | 139 | Yes | 3,744 | 1,088 | Estimated extraction salinity control | 408 | 612 | 5,444 |
| Unincorporated areas | | | | | | | | | | | | |
| Southern Rural Water(8) | - | 71,385 | 71,385 | 1,533 | | Yes | | 10,708 | 15% of entitlement | 9,394 | 14,091 | 24,799 |
| Total | 692,134 | 1,005,661 | 967,634 | 7,712 | 5,611 | No | 115,143 | 47,509 | | 35,593 | 58,445 | 221,096 |

Notes:

(1) Areas with zones have been totalled.

(2) In non-metered areas, the water authorities' estimates have been adopted. Use in unincorporated areas has been estimated based on 15% of entitlement for Southern Rural Water, 10% of entitlement for G-MW and 12% for GWMWater.

(3) 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.

(4) 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), the Nepean GMA, where 1 ML per bore is a more accurate estimate, and Deutgam WSPA, where 0.1 ML per bore is used.

(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.

(7) Loddon Highlands WSPA replaced Upper Loddon WSPA and Spring Hill WSPA in 2010–11 and the new WSPA encompasses a slightly different geographic area.

(8) Lower Campaspe Valley WSPA replaced Campaspe Deep Lead WSPA and Southern Campaspe Plains GMA in 2010–11. The new WSPA encompasses a slightly different geographic area.

(9) Mid-Loddon WSPA became a GMA in 2010–11 and is now known as Mid-Loddon GMA.

(10) Mullindolingong Zone 1 GMA and Mullindolingong Zone 2 GMA are combined and reported under Mullindolingong GMA in 2010–11.

# Appendix B: Storage levels

| Basin | Reservoir | On stream or off-stream? | Full storage capacity (ML) | % full at 1 July 2010 | % full at 30 June 2011 |
|---|---|---|---|---|---|
| East Gippsland | None | - | - | - | - |
| Snowy | None | - | - | - | - |
| Tambo | None | - | - | - | - |
| Mitchell | None | - | - | - | - |
| Thomson | Lake Glenmaggie | on-stream | 177,640 | 54% | 82% |
| | Thomson Reservoir | on-stream | 1,068,000 | 22% | 41% |
| Latrobe | Blue Rock | on-stream | 208,188 | 80% | 99% |
| | Lake Narracan | on-stream | 7,230 | 82% | 76% |
| | Moondarra Reservoir | on-stream | 30,300 | 85% | 100% |
| South Gippsland | Lance Creek Reservoir | on-stream | 4,200 | 85% | 102% |
| | Hyland Reservoir | on-stream | 671 | 76% | 100% |
| | Western Reservoir | on-stream | 1,137 | 73% | 100% |
| | Candowie Reservoir | on-stream | 2,263 | 75% | 100% |
| Bunyip | Tarago Reservoir | on-stream | 37,580 | 58% | 64% |
| Yarra | Upper Yarra Reservoir | on-stream | 200,579 | 57% | 69% |
| | O'Shannassy Reservoir | on-stream | 3,123 | 101% | 104% |
| | Maroondah Reservoir | on-stream | 22,179 | 49% | 101% |
| | Yan Yean Reservoir | on-stream | 30,266 | 37% | 90% |
| | Cardinia Reservoir | off-stream | 286,911 | 35% | 71% |
| | Greenvale Reservoir | off-stream | 26,839 | 63% | 77% |
| | Silvan Reservoir | off-stream | 40,445 | 89% | 85% |
| | Sugarloaf Reservoir | off-stream | 96,253 | 61% | 99% |
| Maribyrnong | Rosslynne Reservoir | on-stream | 25,368 | 5% | 66% |
| Werribee | Melton Reservoir | on-stream | 14,364 | 20% | 95% |
| | Merrimu Reservoir | on-stream | 32,516 | 9% | 85% |
| | Pykes Creek Reservoir | on-stream | 22,119 | 5% | 100% |
| | Djerriwarrh Reservoir | on-stream | 983 | 40% | 94% |
| Moorabool | Korweinguboora Reservoir | on-stream | 2,100 | 24% | 73% |
| | Bostock Reservoir | on-stream | 7,480 | 23% | 99% |
| | Lal Lal Reservoir | on-stream | 59,549 | 7% | 92% |
| | Wilsons Reservoir | on-stream | 1,010 | 50% | 37% |
| | Moorabool Reservoir | on-stream | 6,738 | 13% | 91% |
| | Upper Stony Creek Reservoir | off-stream | 9,494 | 10% | 83% |
| Barwon | West Barwon Dam | on-stream | 21,504 | 20% | 57% |
| | White Swan Reservoir | on-stream | 14,107 | 75% | 95% |
| | Gong Gong Reservoir | on-stream | 1,902 | 6% | 2% |
| | Wurdee Boluc Reservoir | off-stream | 40431 | 54% | 69% |
| Corangamite | None | - | - | - | - |
| Otway Coast | West Gellibrand Reservoir | on-stream | 1,856 | 100% | 100% |
| Hopkins | None | - | - | - | - |
| Portland Coast | None | - | - | - | - |
| Glenelg | Rocklands Reservoir | on-stream | 348,310 | 2% | 38% |
| | Moora Moora Reservoir | on-stream | 6,290 | 48% | 88% |
| | Konongwootong Reservoir | on-stream | 1,920 | 28% | 54% |
| | Hamilton system reservoirs | on-stream | 2,716 | 31% | 88% |
| Millicent Coast | None | - | - | - | - |
| Murray | Lake Victoria (Victoria's share only) | on-stream | 338,500 | 36% | 71% |
| | Menindee Lakes (Victoria's share only)(1) | on-stream | 785,000 | 76% | 94% |
| | Lake Hume (Victoria's share only) | on-stream | 1,518,250 | 27% | 92% |
| | Lake Dartmouth (Victoria's share only) | on-stream | 1,953,795 | 33% | 68% |
| | Lake Cullulleraine | on-stream | 5,270 | 83% | 83% |
| Kiewa | Rocky Valley | on-stream | 28,294 | 51% | 64% |
| | Lake Guy | on-stream | 1,416 | 43% | 65% |
| | Clover Pondage | off-stream | 255 | 86% | 85% |
| | Pretty Valley Basin | off-stream | 500 | 100% | 100% |

| Basin | Reservoir | On stream or off-stream? | Full storage capacity (ML) | % full at 1 July 2010 | % full at 30 June 2011 |
|---|---|---|---|---|---|
| Ovens | Lake William Hovell | on-stream | 13,710 | 101% | 101% |
| | Lake Buffalo | on-stream | 23,900 | 61% | 58% |
| Broken(2) | Lake Nillahcootie | on-stream | 40,400 | 28% | 101% |
| | Loombah-McCall Say | on-stream | 1,747 | 100% | 100% |
| Goulburn | Lake Eildon | on-stream | 3,334,158 | 27% | 87% |
| | Goulburn Weir | on-stream | 25,500 | 98% | 98% |
| | Sunday Creek Reservoir | on-stream | 1,700 | 97% | 97% |
| | Greens' Lake | off-stream | 32,440 | 51% | 70% |
| | Waranga Basin | off-stream | 432,362 | 46% | 81% |
| Campaspe | Upper Coliban Reservoir | on-stream | 37,770 | 1% | 100% |
| | Lauriston Reservoir | on-stream | 19,790 | 77% | 100% |
| | Malmsbury Reservoir | on-stream | 12,034 | 4% | 84% |
| | Lake Eppalock | on-stream | 304,651 | 9% | 97% |
| | Campaspe Weir | off-stream | 2,624 | 86% | 102% |
| Loddon | Newlyn Reservoir | on-stream | 3,012 | 17% | 101% |
| | Tullaroop Reservoir | on-stream | 72,950 | 6% | 96% |
| | Cairn Curran Reservoir | on-stream | 147,130 | 4% | 89% |
| | Laanecoorie Reservoir | on-stream | 7,940 | 21% | 77% |
| | Hepburn Lagoon | on-stream | 2,457 | 4% | 97% |
| | Evansford Reservoir | off-stream | 1,351 | 40% | 99% |
| | Sandhurst Reservoir | off-stream | 2,590 | 81% | 82% |
| | Spring Gully Reservoir | off-stream | 1,680 | 40% | 59% |
| Avoca | None | - | - | - | - |
| Mallee | None | - | - | - | - |
| Wimmera | Taylors Lake | on-stream | 27,060 | 85% | 82% |
| | Lake Lonsdale | on-stream | 65,000 | 4% | 74% |
| | Wartook Reservoir | on-stream | 29,360 | 56% | 74% |
| | Lake Bellfield | on-stream | 78,550 | 28% | 78% |
| | Fyans Lake | on-stream | 18,460 | 31% | 72% |
| | Batyo Lake | on-stream | 2,250 | 0% | 82% |
| | Dock Lake | on-stream | 4,420 | 0% | 0% |
| | Green Lake | on-stream | 5,350 | 0% | 83% |
| | Pine Lake | on-stream | 62,000 | 0% | 17% |
| | Toolondo Reservoir | on-stream | 92,430 | 0% | 0% |

Notes:

(1) Victoria held a share of Menindee Lakes for the whole of 2010–11.

(2) Previously, Lake Mokoan was included as a storage within the Broken basin. As it was decommissioned in February 2010 and no water was supplied from it after January 2010, it is no longer reported.

# Appendix C: Groundwater trades

| GMU | Permanent trade | | Temporary trade | |
|---|---|---|---|---|
| | No. trades | Total volume (ML) | No. trades | Total volume (ML) |
| **Goulburn Murray Water** | | | | |
| Shepparton WSPA | 0 | 0 | 0 | 0 |
| Katunga WSPA | 5 | 587 | 2 | 206.5 |
| Loddon Highlands WSPA (1) | 0 | 0 | 10 | 1376 |
| Lower Campaspe Valley WSPA (2) | 1 | 10 | 4 | 565 |
| Alexandra GMA | 0 | 0 | 0 | 0 |
| Barnawartha GMA | 0 | 0 | 0 | 0 |
| Kinglake GMA | 2 | 26 | 2 | 30 |
| Lower Ovens GMA | 1 | 40 | 6 | 104 |
| Mid-Goulburn GMA | 1 | 10 | 3 | 134 |
| Mid-Loddon GMA (3) | 1 | 104 | 1 | 10 |
| Mullindolingong GMA (4) | 0 | 0 | 0 | 0 |
| Upper Ovens GMA | 0 | 0 | 1 | 34 |
| **Southern Rural Water** | | | | |
| Nullawarre WSPA | 4 | 223.5 | 1 | 94 |
| Yangery WSPA | 2 | 76 | 3 | 70.3 |
| Bungaree WSPA | 0 | 0 | 4 | 31 |
| Condah WSPA | 0 | 0 | 2 | 111 |
| Denison WSPA | 0 | 0 | 0 | 0 |
| Deutgam WSPA | 0 | 0 | 0 | 0 |
| Koo-Wee-Rup WSPA | 0 | 0 | 1 | 9 |
| Glenelg WSPA | 0 | 0 | 4 | 426 |
| Sale WSPA | 1 | 20 | 4 | 259.5 |
| Wandin Yallock WSPA | 2 | 11.5 | 0 | 0 |
| Warrion WSPA | 1 | 150 | 0 | 0 |
| Wy Yung WSPA | 0 | 0 | 0 | 0 |
| Yarram WSPA | 1 | 34.2 | 4 | 295 |
| Cardigan GMA | 0 | 0 | 0 | 0 |
| Colongulac GMA | 0 | 0 | 0 | 0 |
| Corinella GMA | 0 | 0 | 0 | 0 |
| Cut Paw Paw GMA | 0 | 0 | 0 | 0 |
| Frankston GMA | 0 | 0 | 0 | 0 |
| Gellibrand GMA | 0 | 0 | 0 | 0 |
| Gerangamete GMA | 0 | 0 | 0 | 0 |
| Giffard GMA | 0 | 0 | 1 | 50 |
| Glenormiston GMA | 0 | 0 | 0 | 0 |
| Hawkesdale GMA | 4 | 352.5 | 2 | 190 |
| Heywood GMA | 0 | 0 | 0 | 0 |
| Jan Juc GMA | 0 | 0 | 0 | 0 |
| Lancefield GMA | 0 | 0 | 0 | 0 |
| Leongatha GMA | 0 | 0 | 0 | 0 |
| Merrimu GMA | 0 | 0 | 0 | 0 |
| Moe GMA | 0 | 0 | 1 | 10 |
| Moorabbin GMA | 0 | 0 | 1 | 0.3 |

| GMU | Permanent trade | | Temporary trade | |
|---|---|---|---|---|
| | No. trades | Total volume (ML) | No. trades | Total volume (ML) |
| Nepean GMA | 2 | 87 | 3 | 17 |
| Newlingrook GMA | 0 | 0 | 0 | 0 |
| Orbost GMA | 0 | 0 | 0 | 0 |
| Paaratte GMA | 0 | 0 | 0 | 0 |
| Portland GMA | 0 | 0 | 0 | 0 |
| Rosedale GMA | 3 | 905 | 1 | 40 |
| Stratford GMA | 0 | 0 | 0 | 0 |
| Tarwin GMA | 0 | 0 | 0 | 0 |
| Wa De Lock GMA | 1 | 50 | 0 | 0 |
| **GWMWater** | | | | |
| Murrayville WSPA | 0 | 0 | 3 | 1100 |
| Neuarpur WSPA | 1 | 360 | 5 | 760 |
| Apsley WSPA | 0 | 0 | 0 | 0 |
| Kaniva WSPA | 0 | 0 | 0 | 0 |
| Telopea Downs WSPA | 0 | 0 | 0 | 0 |
| Balrootan (Nhill) GMA | 0 | 0 | 0 | 0 |
| Goroke GMA | 0 | 0 | 0 | 0 |
| Kaniva TCSA GMA | 0 | 0 | 0 | 0 |
| Little Desert GMA | 0 | 0 | 0 | 0 |
| Nhill GMA | 0 | 0 | 0 | 0 |
| **Total** | **33** | **3,047** | **69** | **5,923** |

Notes:

(1) Loddon Highlands WSPA replaced Upper Loddon WSPA and Spring Hill WSPA in 2010–11. The new WSPA encompasses a slightly different geographic area.

(2) Lower Campaspe Valley WSPA replaced Campaspe Deep Lead WSPA and Southern Campaspe Plains GMA in 2010–11. The new WSPA encompasses a slightly different geographic area.

(3) Mid-Loddon WSPA became a GMA in 2010–11 and is now known as Mid-Loddon GMA.

(4) Mullindolingong Zone 1 GMA and Mullindolingong Zone 2 GMA are combined and reported under Mullindolingong GMA in 2010–11.

# Appendix D: Evapotranspiration estimates

This section summarises statewide estimates of evapotranspiration (ET). Chapter 5 explains the method of calculating, and the limitations of, these estimates.

For the purpose of allowing ET to be reported at a basin scale, Figure D-1 and D-2 divide the state into four geographical areas. The basin areas used to report ET results are slightly different from those used for reporting in the Victorian Water Accounts. In the Victorian Water Accounts, the Murray basin captures information about River Murray irrigation districts in the Mallee, Avoca, Loddon, Campaspe, Goulburn and Broken basins. For ET reporting, these irrigation districts are in their host river basin (for example, the Mildura Irrigation District is in the Mallee Basin).

Figure D-1 shows modelled ET expressed on a unit area basis (mm), because it is easier to relate to rainfall, and because it makes it easier to compare catchments of different sizes. For example, the Wimmera Avon Basin had the largest ET volume due to its large area rather than to high rates of ET (which can be seen by comparing the basin's results in the two figures).

Figure D-2 shows the modelled ET for the total catchment. In 2010–11, average ET for Victoria was estimated as 663 mm, which was 21 % above the long-term (1961–1990) average of 546 mm. The above-average ET was caused by high rainfall across northern Victoria and parts of southern Victoria. In 2010–11, a lower proportion of rainfall became ET than on average in all basins except East Gippsland. Due to the above-average rainfall, and a lower proportion of rainfall becoming ET, more water remained for streamflow and groundwater recharge in 2010–11 than on average.

Figure D-3 shows the contribution of key land uses to ET at a basin scale in the Kiewa and Glenelg basins. Information such as this will allow the effect of large scale land use changes on catchment ET to be tracked over time.

**North-east Victoria (Goulburn to Upper Murray basins)**

In 2010–11, ET varied from 610 mm in the Ovens Basin to 856 mm in the Upper Murray Basin. ET in the north-east was above the long-term average by 10 % (Kiewa and Upper Murray Basin) to 20 % (Broken Basin).

Of these basins, the Broken Basin had the highest proportion of rainfall that became ET (66 % in 2010–11, average is 80 %), and the Kiewa Basin the lowest (47 % of rainfall in 2010–11, average is 57 %). In 2010–11, the proportion of rainfall that became ET was 10–14 % lower than the average for these basins.

Because relatively less rainfall became ET in 2010–11 than for the long-term average, relatively more rainfall was available for streamflow and groundwater recharge. Of the north-east basins, the Kiewa Basin had the highest proportion of rainfall available for streamflow or groundwater recharge (53 % in 2010–11, average is 43 %) and the Broken Basin had the least (34 % in 2010–11, average is 20 %).

**South-east Victoria (East Gippsland to Yarra basins)**

In 2010–11, ET varied from 730 mm in the Tambo Basin to 843 mm in the Mitchell Basin. ET in the south-east varied from just below average in East Gippsland, to 10 % above average in the Bunyip and Yarra basins.

Of these basins, the Tambo Basin had the highest proportion of rainfall that became ET (83 % in 2010–11, average is 84 %), and the Yarra Basin the lowest (55 % of rainfall in 2010–11, average is 66 %). In 2010–11, the proportion of rainfall that became ET in south-east basins was between 1 % higher and 10% lower than average.

In 2010–11, relatively more rainfall was available for streamflow and groundwater recharge than the long-term average. Of the south-east basins, the Yarra Basin had the highest proportion of rainfall available for streamflow or groundwater recharge (45 % in 2010–11, average is 34 %) and the Tambo Basin had the lowest (17 % in 2010–11, average is 16 %).

**South-west Victoria (Maribyrnong to Millicent Coast Basins)**

In 2010–11, ET varied from 571 mm in the Millicent Coast Basin to 750 mm in the Werribee Basin. ET in south-west basins varied from 5 % above average in the Otway Coast to 30 % above average in the Werribee Basin.

Of these basins, the Millicent Coast Basin had the highest proportion of rainfall that became ET (78 % in 2010–11, average is 88 %) and the Maribyrnong Basin the lowest in 2010–11 (59 %). The Otway Coast basin has on average had the lowest proportion of rainfall that became ET (average is 69 %). In 2010–11, the proportion of rainfall that became ET was 4–21 % lower than the average for south-west basins.

In 2010–11, relatively more rainfall was available for streamflow and groundwater recharge than for the long-term average. Of the south-west basins, the Maribyrnong basin had the highest proportion of rainfall available for streamflow or groundwater recharge (41 % in 2010–11, average is 20 %) and the Millicent Coast basin the lowest (22 % in 2010–11, average is 12 %).

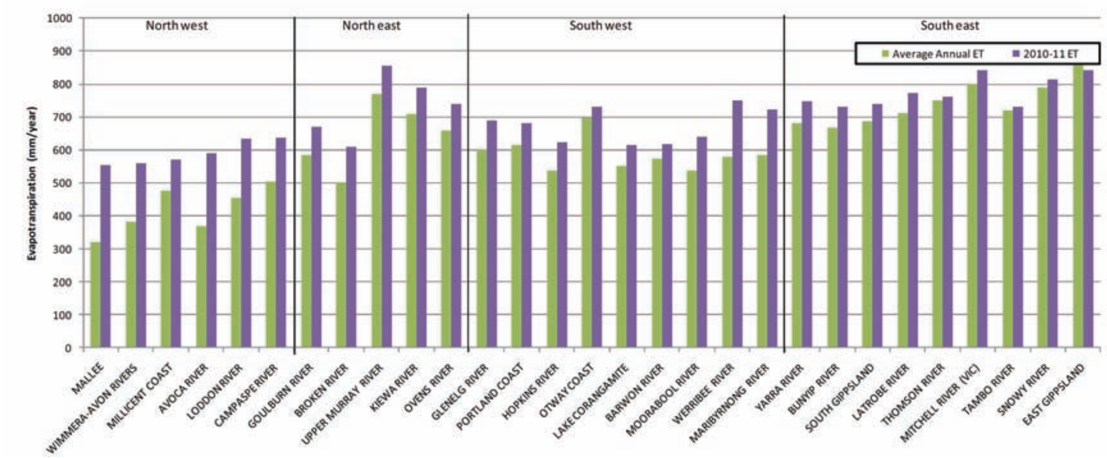
**North-west Victoria (Wimmera-Avon to Campaspe River basins)**

In 2010–11, ET varied from 555 mm in the Mallee basin to 638 mm in the Campaspe basin. ET in the north-west varied from 26 % above average in the Campaspe basin to 70 % above in the Mallee basin.

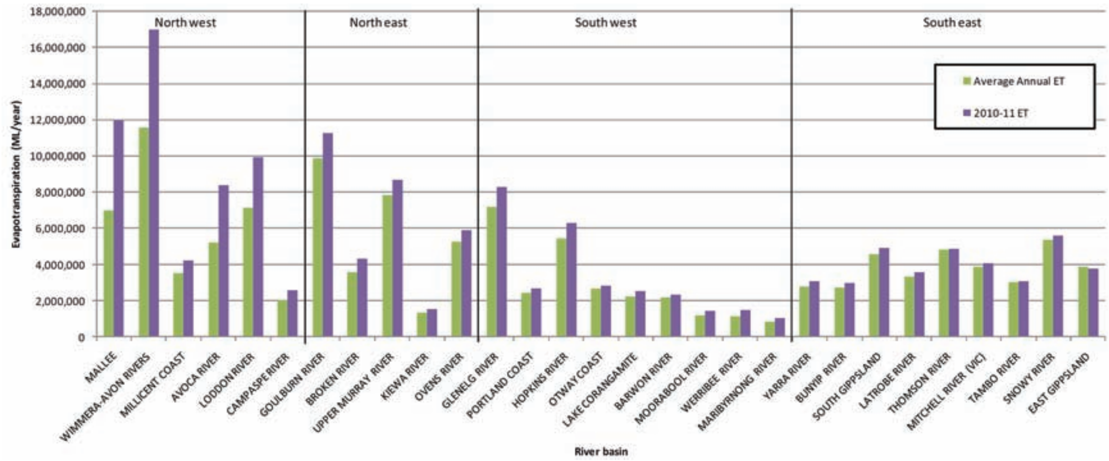
Of these basins, the Mallee basin had the highest proportion of rainfall that became ET (91 % in 2010–11, average is 102 %) and the Campaspe basin the lowest (61 % of rainfall in 2010–11, average is 77 %). In 2010–11, the proportion of rainfall that became ET was 7–19 % lower than the average for north-west basins.

In 2010–11, relatively more rainfall was available for streamflow and groundwater recharge than the long-term average. Of the north-west basins, the Campaspe basin had the highest proportion of rainfall available for streamflow or groundwater recharge (39 % in 2010–11, average is 23 %) and the Mallee basin the lowest (9 % in 2010–11, average ET slightly greater than rainfall).

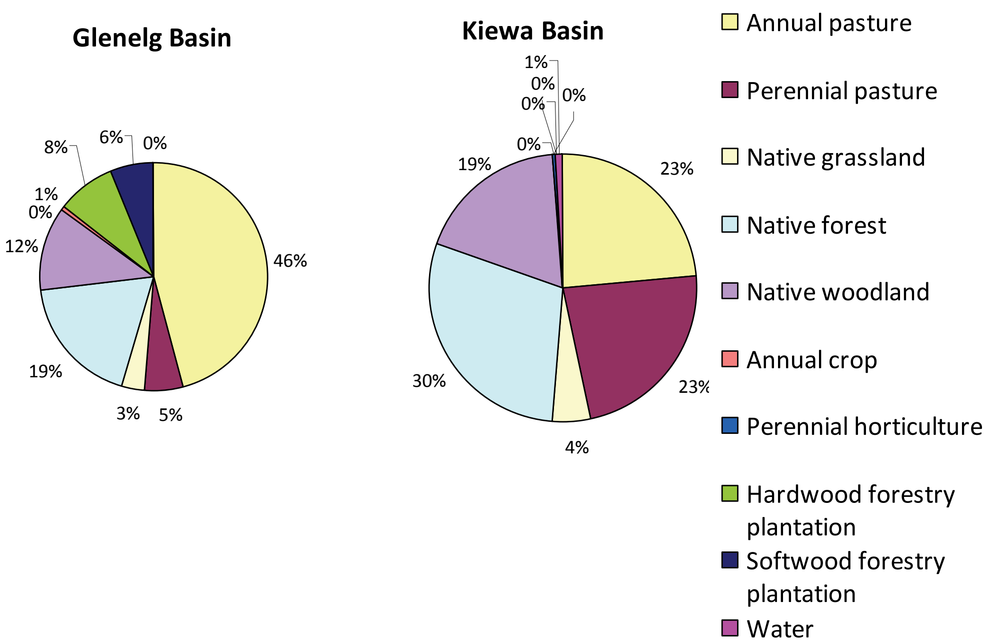
### Figure D-1 Modelled ET per unit area (mm)




### Figure D-2 Modelled ET for the total catchment (ML)



### Figure D-3 Contribution of key land uses to ET, 2010–11 rainfall



# Abbreviations

| | |
|---|---|
| AWRC | Australian Water Resources Council |
| BE | Bulk entitlement |
| BGA | Blue-green algae |
| BoM | Bureau of Meteorology |
| CEWH | Commonwealth Environmental Water Holder |
| CMA | Catchment management authority |
| DSE | Department of Sustainability and Environment |
| EC | Electrical conductivity |
| EPBC Act | *Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth) |
| ESC | Essential Services Commission |
| EWA | Environmental water allocation |
| EWR | Environmental Water Reserve |
| FFG Act | *Flora and Fauna Guarantee Act 1988* (Victoria) |
| GL | Gigalitre |
| GMA | Groundwater management area |
| GMU | Groundwater management unit |
| MDBA | Murray-Darling Basin Authority |
| ML | Megalitre |
| NVIRP | Northern Victoria Irrigation Renewal Program |
| PAV | Permissible annual volume |
| PCV | Permissible consumptive volume |
| REALM | Resource allocation model |
| SFMP | Streamflow management plan |
| SOBN | State Observation Bore Network |
| SWEP | Schools Water Efficiency Program |
| TCSA | Tertiary confined sand aquifer |
| UA | Unincorporated area |
| VEWH | Victorian Environmental Water Holder |
| WSPA | Water supply protection area |

# Glossary of terms

**Above-cap water:** Any water in a basin in excess of water corporations' and other entitlement holders' water entitlements, and any other defined elements of the EWR.

**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.

**Base flows:** The component of streamflow supplied by groundwater discharge.

**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'.

**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.

**Call (calling of water):** See 'order'.

**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.

**Compliance point:** The location where passing-flow requirements are established. Compliance points may include gauging stations, weirs, reservoirs or sections of a river.

**Dead storage:** Water in a storage that is below the elevation of the lowest constructed outlet.

**Drainage division:** An aggregation of river basins in an area (for example, the Murray-Darling Drainage Division, the South-East Coast Drainage Division). Australia has 12 drainage divisions.

**EC:** Electrical conductivity, which is a measure of water salinity.

**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 Project:** Undertaken by DSE, 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.

**Flush:** See 'fresh'.

**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.

**Irrigation return flows:** Water that is returned to a water course after being used in an irrigation area (for example, outflows from irrigation drainage systems).

**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 km.

**Living Murray Initiative:** 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.

**Nutrient:** Generally refers to nitrogen and phosphorous in water.

**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.

**Permissible consumptive volume (PCV):** The total amount of water that can be taken in a GMA under a ministerial declaration.

**Potable water:** Water that is suitable for drinking.

**Precautionary principle:** Erring on the side of caution in favour of a given entity. For example, where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

**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. All rights qualified in 2006–07 were of a temporary nature.

**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'.

**Run-off:** The volume of water that enters streams and lakes from rainfall.

**Salinity:** The total amount of water-soluble salts present in the soil or in a stream.

**Seasonal irrigation water 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'.

**Sedimentation:** The process whereby solid particles in water sink to the bottom, forming sediment.

**Sewage:** The waterborne wastes of a community.

**Sewerage system:** A physical arrangement of pipes and plant for the collection, removal, treatment and disposal of sewage, trade and liquid waste.

**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.

**Storm water:** Untreated rainfall run-off from urban areas.

**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.

**Statewide sustainable diversion limits:** Precautionary estimates of the sustainable diversion limit for 1,600 small Victorian catchments using a statewide methodology.

**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 shares:** A water entitlement held by a water corporation or person. From July 2007, water rights and licences can be converted into water shares. For more information, see the *Our Water Our Future* action plan.

**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.