State Water Report 2005/06

A statement of Victorian water resources

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Data presented in this report has been compiled from a number of sources and varies in reliability. However, where possible checks on the accuracy of the data have been undertaken and the data compilation process is auditable.

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Data compilation: PricewaterhouseCoopers

Editor: Ann White

Cover photo

Lake Bellfield, Grampians

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Introduction

The State Water Report 2005/2006 continues the Victorian Government's 2004 Our Water Our Future commitment to accounting for and reporting on the state's water availability and use on an annual basis.

In addition to documenting the key water resource management issues for Victoria in 2005/06, it offers an overview of the government's key policy directions and provides a model for bulk level water accounting and reporting at both the state and national level.

The State Water Report 2005/06 examines the entire state's water allocation and use for the 2005/06 year at bulk supply level. It is a consolidation of information from all Victorian water authorities, catchment management authorities, the Department of Sustainability and Environment, the Essential Services Commission and the Murray Darling Basin Commission.

There are three parts to the State Water Report 2005/06:

Part 1 provides the statewide overview. It reports on the quantity of water available in 2005/2006; the amount that was taken for consumption; and defines water set aside for the environment under the newly established Environmental Water Reserve. In addition, it identifies the water restrictions that were put in place in response to water scarcity during the period.

Part 2 forms the largest section of the report, comprising a water account for each of Victoria's 29 river basins. To assist in the interpretation of this section, an introductory chapter describes the approach taken to compile the basin accounts, as well as the key assumptions and any limitations of the data that have been identified.

Part 3 outlines the key policy direction and challenges for water resource planning. In particular, it explains Victoria's planning framework of Regional Sustainable Water Strategies, urban water supply initiatives, groundwater management challenges, the establishment of the Environmental Water Reserve, and water accounting and reporting directions.

Sustainable management of our water resources cannot be achieved without adequate monitoring, accounting and reporting. The State Water Report provides public accountability for water entitlements and use across Victoria. Importantly, our efforts in monitoring, reporting and accounting continue to be improved.

The report is also available in on the Department of Sustainability and Environment's website at www.dse.vic.gov.au/SWR.

Part 1
Overview of Victorian water resources 2005/06

Part 1 of the State Water Report provides a statewide overview of Victoria's water resources during 2005/06. It reports on:

- 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, quantity used and quantity recycled
- water restrictions and bans in 2005/2006 across the state
- water available to the environment.

1 Water availability

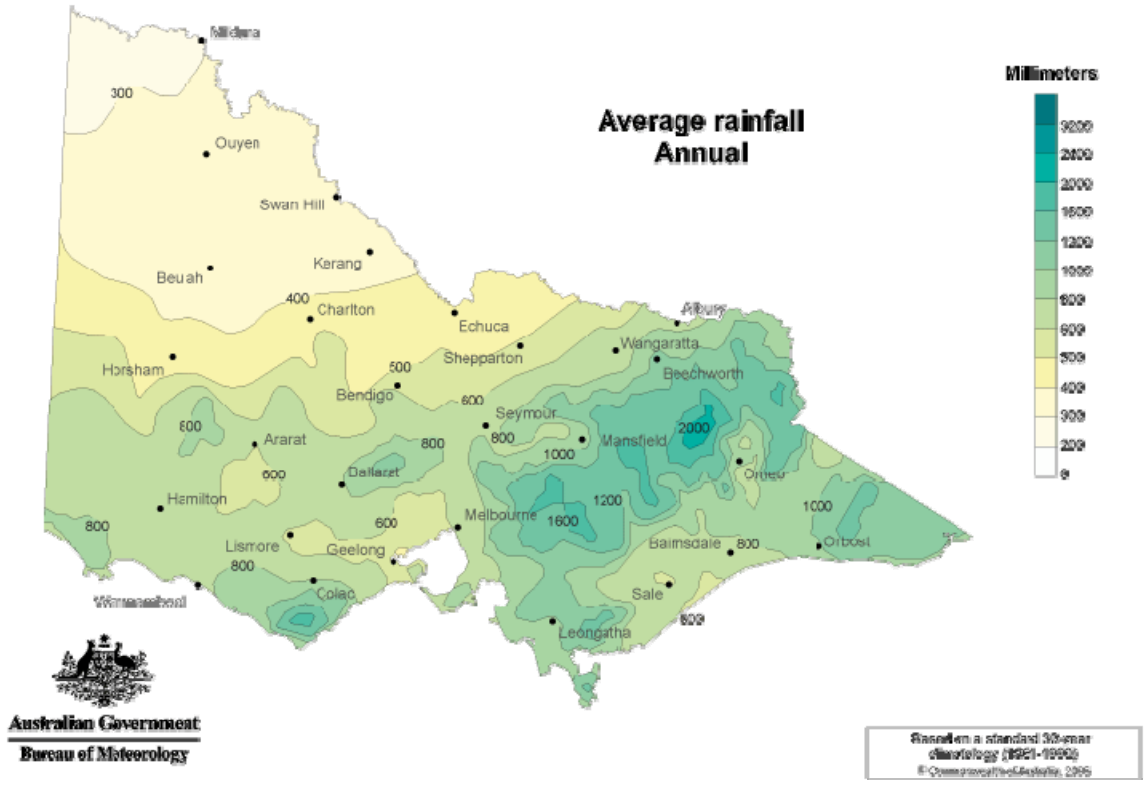
This chapter presents a description and analysis of surface water and groundwater in Victoria during 2005/06. It examines how much surface water was available in Victoria during 2005/06, and compares it with previous years. Rainfall, streamflow and reservoir levels are reported. The chapter also presents a high level synopsis of Victoria's groundwater resources as at 2005/06.

1.1 Rainfall

Much of the rainfall that occurs in Victoria is not available for diversion for consumptive uses. Of the rain and snow falling across the state, around 84% evaporates or is transpired by vegetation (evapotranspiration), around 15% runs off land as surface run-off and streamflow, and around 1% infiltrates the soil and is stored in groundwater aquifers.

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



Victoria's rainfall during 2005/06 is shown in Figure 1-2, and is compared to the average rainfall in Figure 1-3. Rainfall conditions were mostly below average across most of the state in 2005/06. Regions of slightly higher than average rainfall were observed in the far north west corner of the state and the far easterly region, as well as other small isolated areas.

Rainfall conditions across the rest of the state were only 60-100% of average and were particularly low in western Victoria.

Figure 1-2 Victorian rainfall in 2005/06 (mm)

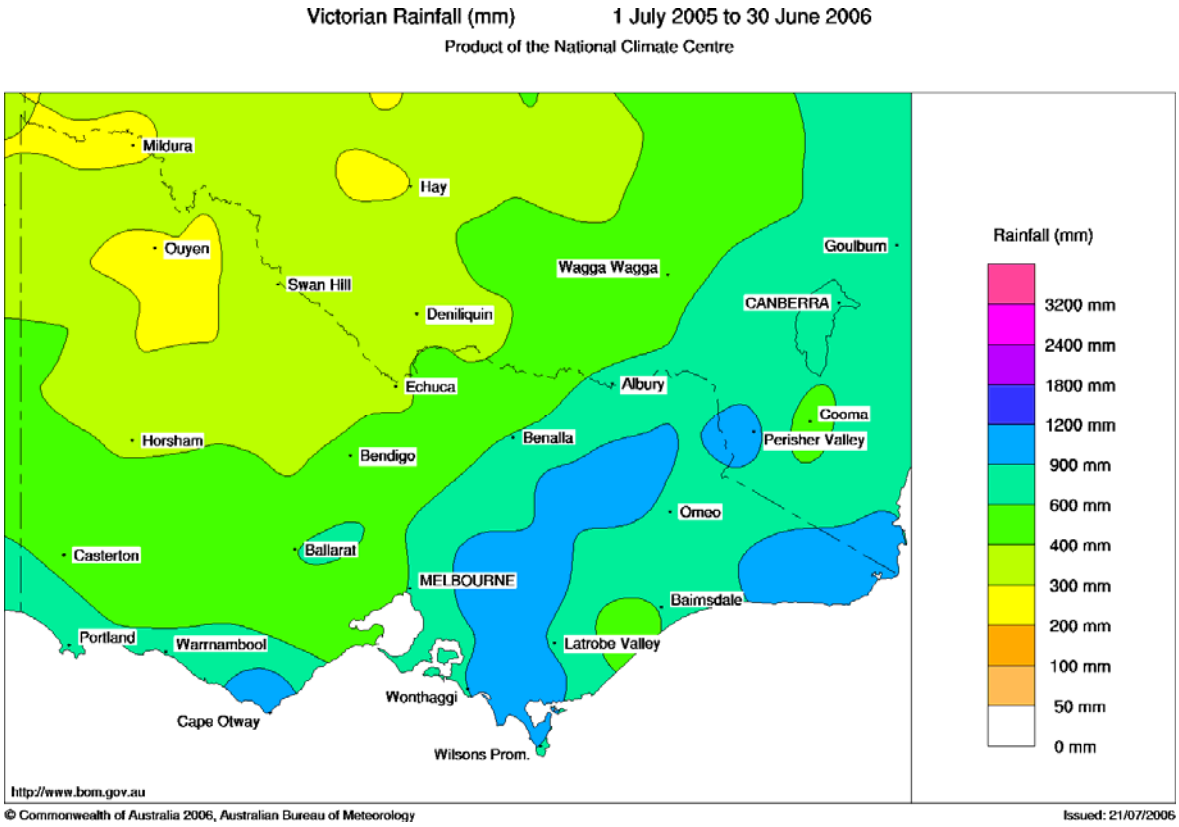
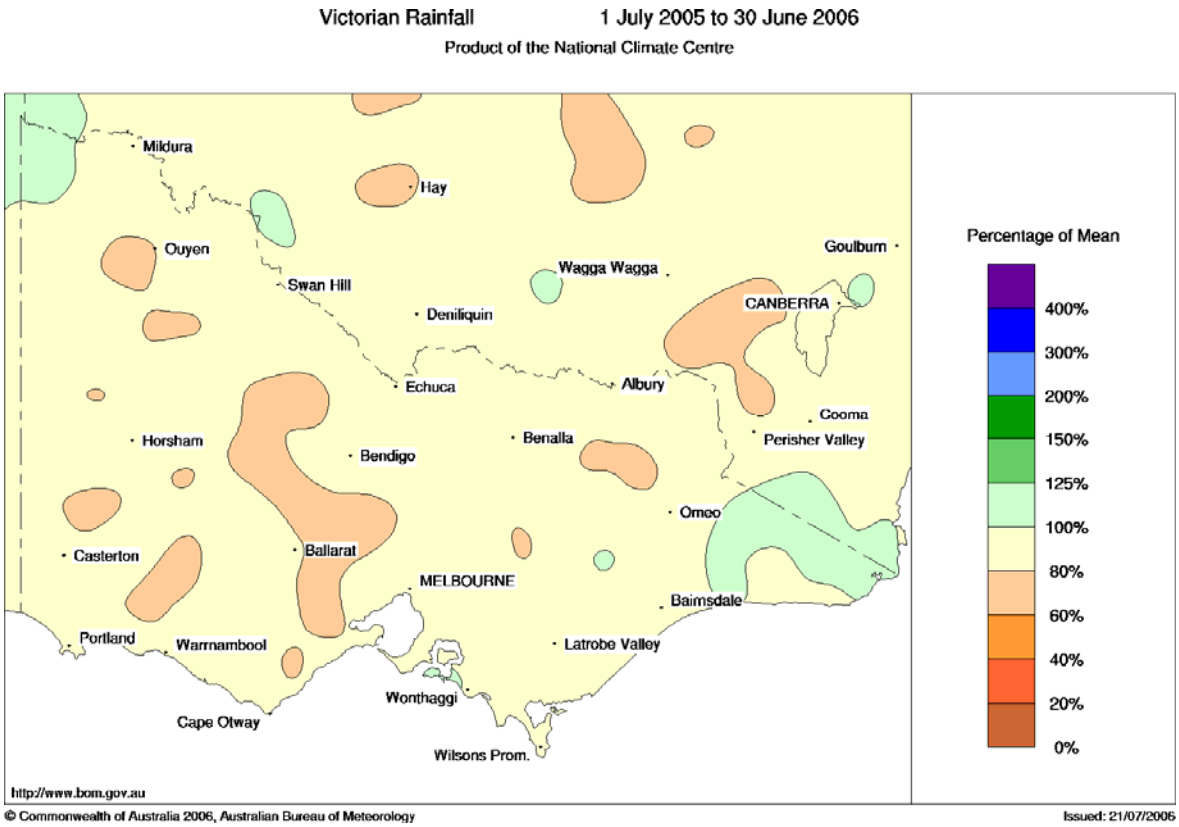


Figure 1-3 Victorian rainfall in 2005/06 relative to average rainfall



The pattern of mostly below average rainfall in many parts of Victoria for 2005/06 is consistent with that experienced in the entire region of south-eastern Australia over the period. In most of New South Wales rainfall patterns were similar to Victoria, although rainfall deficiencies in northern New South Wales and southern Queensland were even more severe.

In contrast, with the exception of Western Australia's coastline, most of western and northern Australia experienced rainfall well above long term averages.

Figure 1-4 Australian rainfall, percentage of mean, 1 July 2005 to 30 June 2006

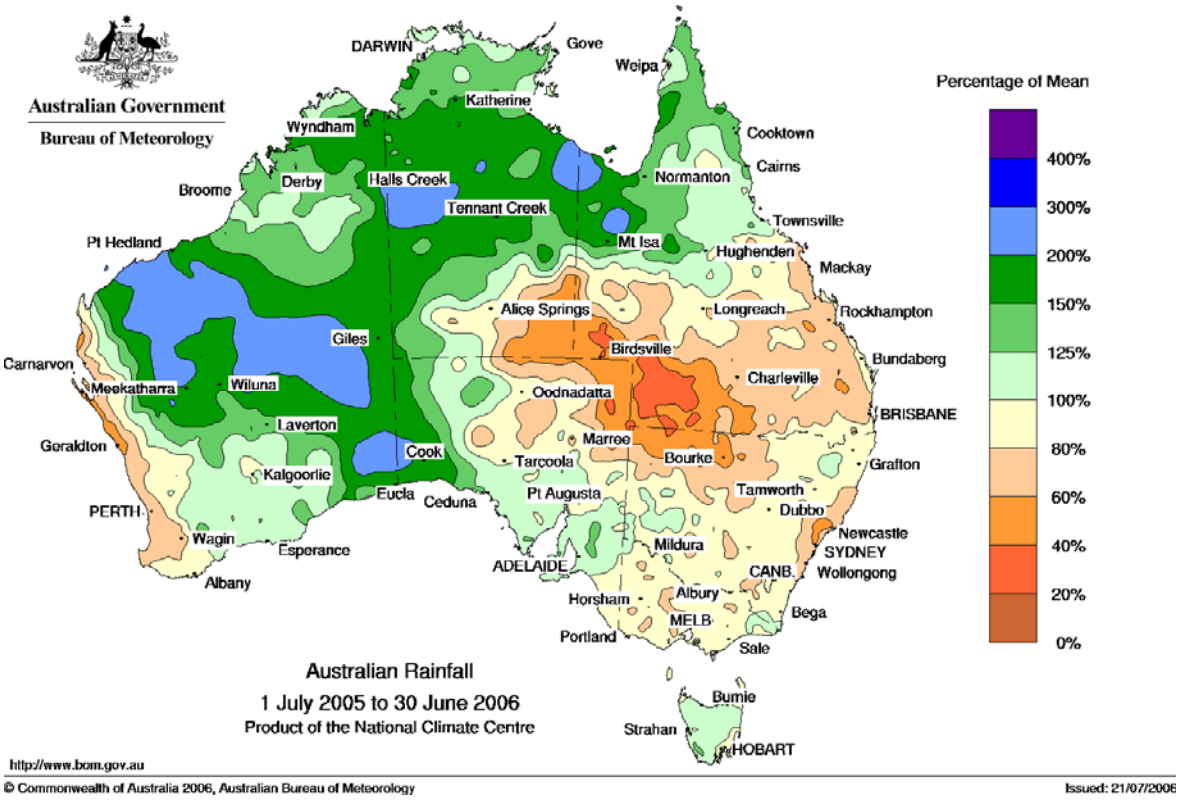
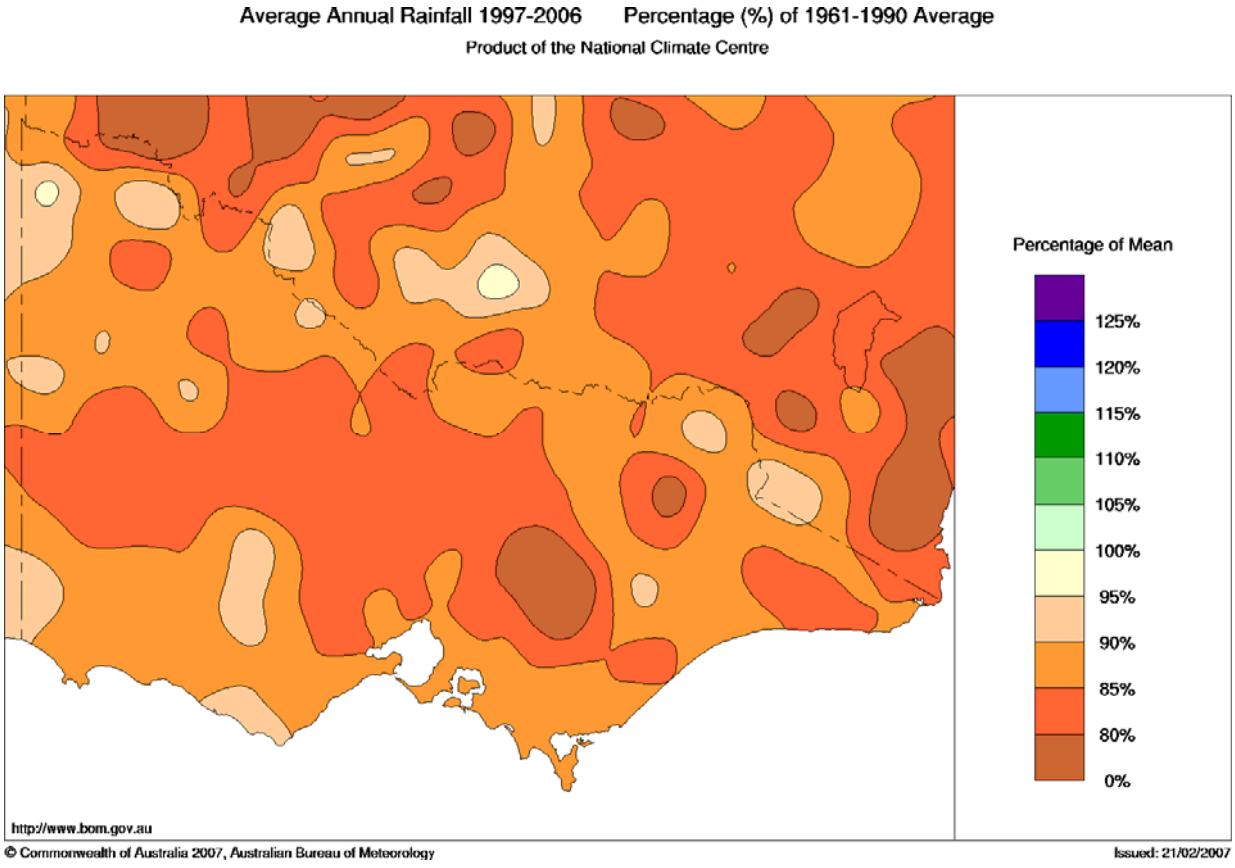


Figure 1-5 depicts the average annual rainfall percentage in Victoria over the past 10 years. It shows that, on average, rainfall in most parts of the state has been 80 to 90% of the long term average. In a small area of central Victoria, including some of Melbourne's key catchment areas, average rainfall has been less than 80% of the long term average.

Figure 1-5 Average annual rainfall percentage 10 years ending September 2006

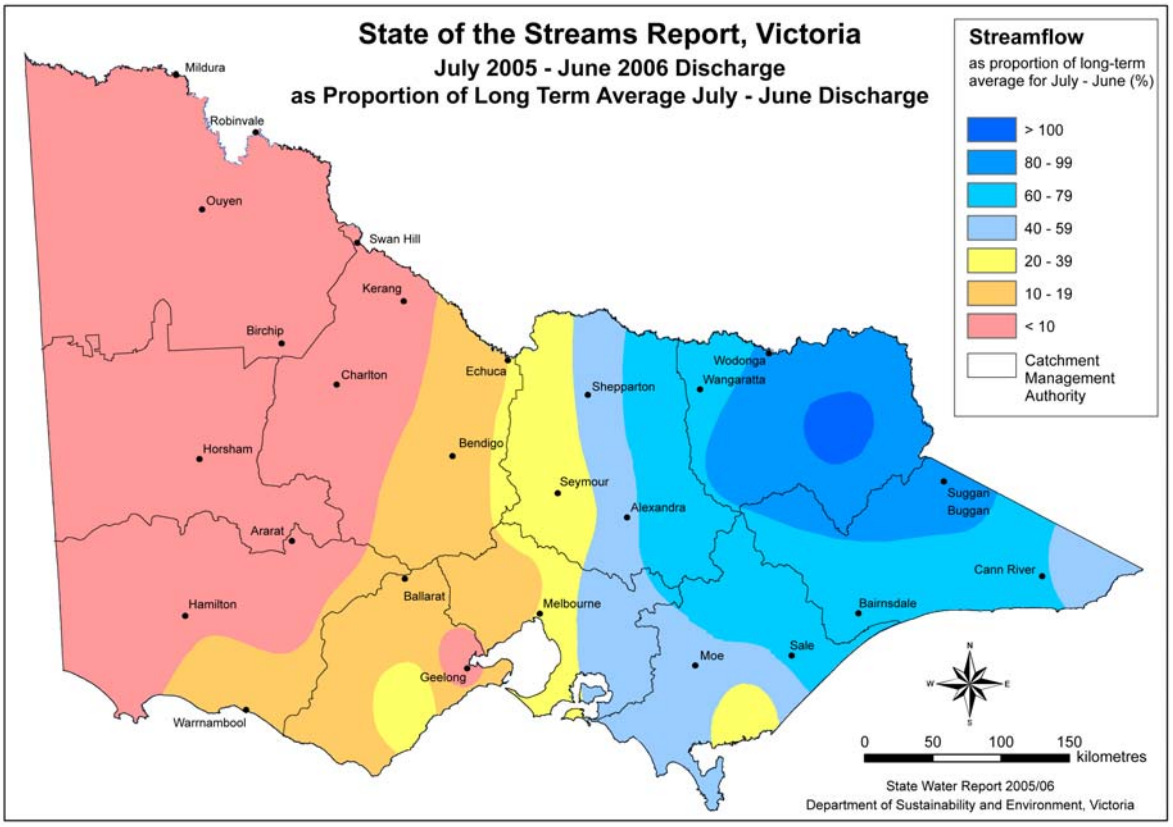


1.2 Streamflow

Local factors influence how much rainfall ends up as streamflow, and these factors vary from river basin to river basin. Local influences include soil moisture levels, the pattern of individual rainfall events and the impact of regenerating forests after the 2003 (and 2006) bushfires. The streamflow data for each basin presented in Table 1-1 is taken from the water balance for each basin in the Part 2 of this report. The table includes a comparison with the streamflow in 2004/05 and the average streamflow over the long term.

As can be seen in Table 1-1, and despite rainfall across the state being between 60% and 100% of the long term average, streamflows fell to around 56% of the long term average in 2005/06. This generally reflects dry soil conditions following several years of below average rainfall, and represents a reduction from 62% in 2004/05. Basins to experience significant reductions in streamflow included the Latrobe (89% to 58%), South Gippsland (97% to 55%), Yarra (96% to 56%), Moorabool (111% to 49%), Corangamite (83% to 22%), Otway Coast (111% to 53%) and Portland Coast (168% to 19%). In contrast, a number of basins experienced increased streamflows, including the Murray, Broken, East Gippsland, Wimmera, Snowy and Bunyip basins.

Figure 1-6 Streamflow in 2005/06 expressed as a percentage of long term average flow(1)



Note:

(1) Figure 1-6 shows 2005/06 streamflow as a percentage of long term average streamflow, based on data from 28 selected streamflow gauges evenly distributed across Victoria. Some of these gauges are located downstream of major storages where water is extracted and therefore are not directly comparable to the river basin flows listed in Table 1-1.

Table 1-1 Streamflow in 2005/06 compared with long term average

Basin	Average annual streamflow (ML) [1]	2005/06 streamflow		2004/05 streamflow	
		(ML) [2]	(% of average) [2]	(ML) [2]	(% of average) [2]
Murray[3]	7,000,000	4,394,300	63%	3,569,900	51%
Kiewa[3]	339,500	657,500	194%	648,600	191%
Ovens	1,692,000	1,423,800	84%	1,506,900	89%
Broken	326,000	257,200	79%	220,400	68%
Goulburn	3,366,000	1,955,900	58%	2,300,400	68%
Campaspe	305,000	83,400	27%	113,400	37%
Loddon	415,000	116,000	28%	155,100	37%
Avoca	136,200	24,500	18%	25,200	19%
Mallee	0	0	not applicable	0	not applicable
Wimmera [4]	316,400	109,600	35%	73,900	23%
East Gippsland	1,122,000	508,600	45%	159,300	14%
Snowy [5]	1,447,280	1,078,300	75%	530,200	37%
Tambo	570,000	167,500	29%	97,400	17%
Mitchell	1,355,000	675,700	50%	614,300	45%
Thomson	1,414,000	498,700	35%	688,800	49%
Latrobe [6]	875,000	507,800	58%	780,500	89%
South Gippsland	1,157,000	633,200	55%	1,120,100	97%
Bunyip	541,000	485,600	90%	463,200	86%
Yarra [6]	1,054,000	589,800	56%	1,008,700	96%
Maribyrnong [6]	113,000	30,400	27%	37,000	33%
Werribee [6]	102,000	21,600	21%	83,600	82%
Moorabool [6]	97,000	47,900	49%	108,000	111%
Barwon [6]	360,000	142,000	39%	189,200	53%
Corangamite	316,000	71,000	22%	263,000	83%
Otway Coast	884,000	467,300	53%	981,420	111%
Hopkins	635,000	154,900	24%	395,100	62%
Portland Coast	361,000	69,600	19%	607,200	168%
Glenelg [4]	964,000	140,700	15%	177,200	18%
Millicent Coast [7]	0	0	not applicable	200	not applicable
Total	**27,263,400**	**15,312,200**	**56%**	**16,918,200**	**62%**

Notes:

(1) Data is mean annual basin outflow under current level of development. Average annual streamflow in the basins within the Murray-Darling catchment is based on estimates provided in the National Land and Water Resources Audit (2001), except for the Murray Basin, which is from a long term resource allocation model. The average for all other catchments is based on the mean annual flow calculations of the Sustainable Diversion Limits project (Department of Natural Resources and Environment, 2002) and the Central Region Sustainable Water Strategy (Department of Sustainability and Environment, 2006).

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

(3) As discussed in Chapter 5, the methodology for calculation of streamflows in the Murray and Kiewa basins has changed compared to the 2004/05 State Water Report. Table 1-1 restates the 2004/05 figures based on the new methodology.

(4) Data for 2004/05 is for the period 1 November 2004 to 31 October 2005. Data for 2005/06 is for 1 July 2005 to 30 June 2006.

(5) Volumes shown for Snowy basin exclude catchment inflows from NSW (i.e. above Burnt Hut Crossing).

(6) Average annual streamflow volumes obtained from the Central Region Sustainable Water Strategy (Department of Sustainability and Environment, 2006). Note that average annual streamflows have been revised from those set out in the draft Central Region Sustainable Water Strategy. As a result, the percentages of average streamflows shown for 2004/05 have been revised from last year's State Water Report.

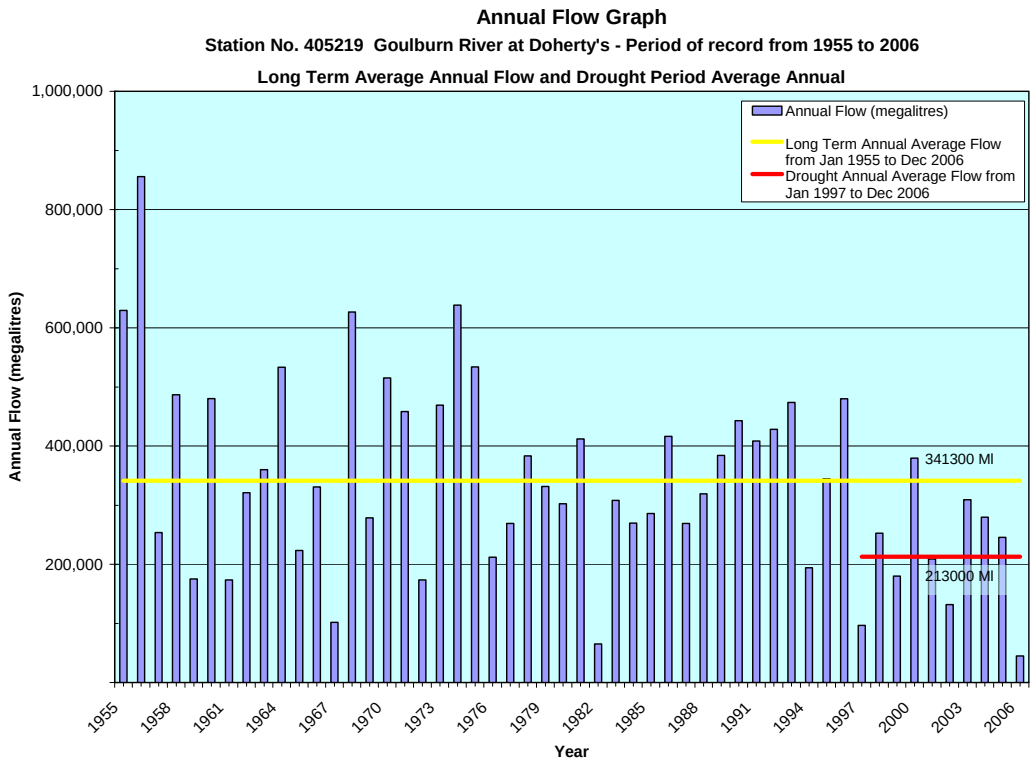
(7) Estimated streamflow is assumed to equal the estimated volume of water diverted.

1.2.1 Long term streamflow trends

Average inflows into reservoirs over the last ten years have generally been 30-60% below the previous long term average.

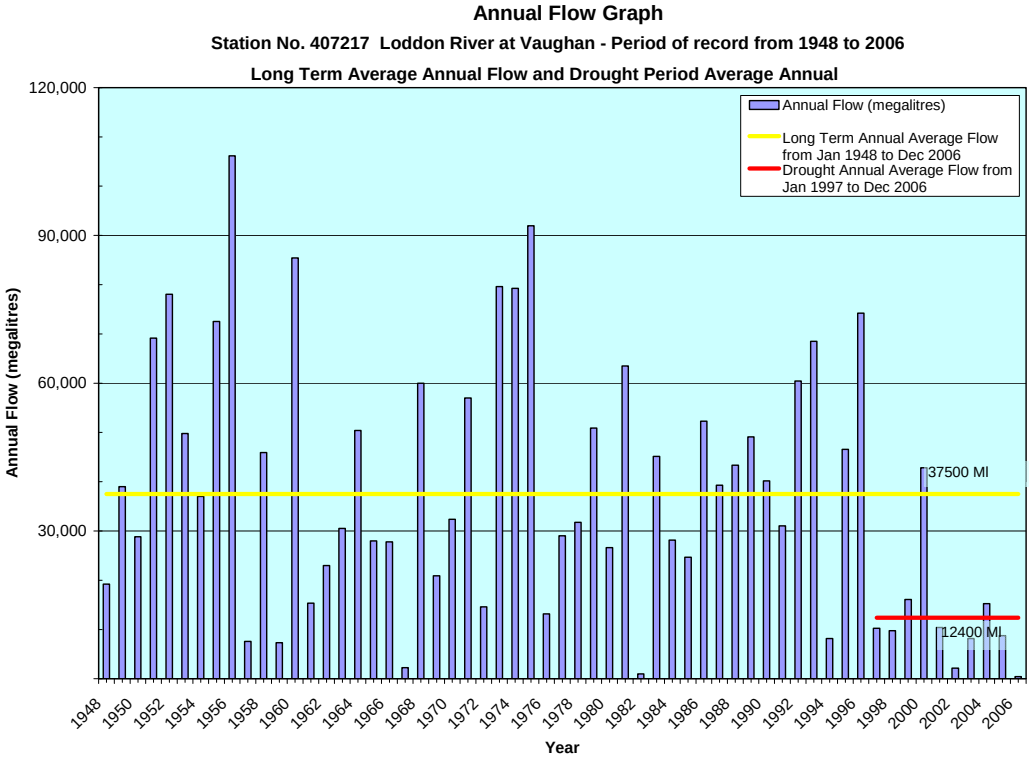
The following graphs provide flow data for a selection of waterways up to the end of 2006. They show the 2006 flows are significantly lower than the average of the last 10 years. They also show that the average flows since 1997 is significantly lower than the long term average flows. The impact of these limited flows has been felt by both rural and urban communities and the environment. Note that 2005/06 streamflows in Table 1.1 are for the period from 1 July 2005 to 30 June 2006, whereas the volumes shown on the graphs are for a calendar year.

Figure 1-7 Annual streamflow at Goulburn River



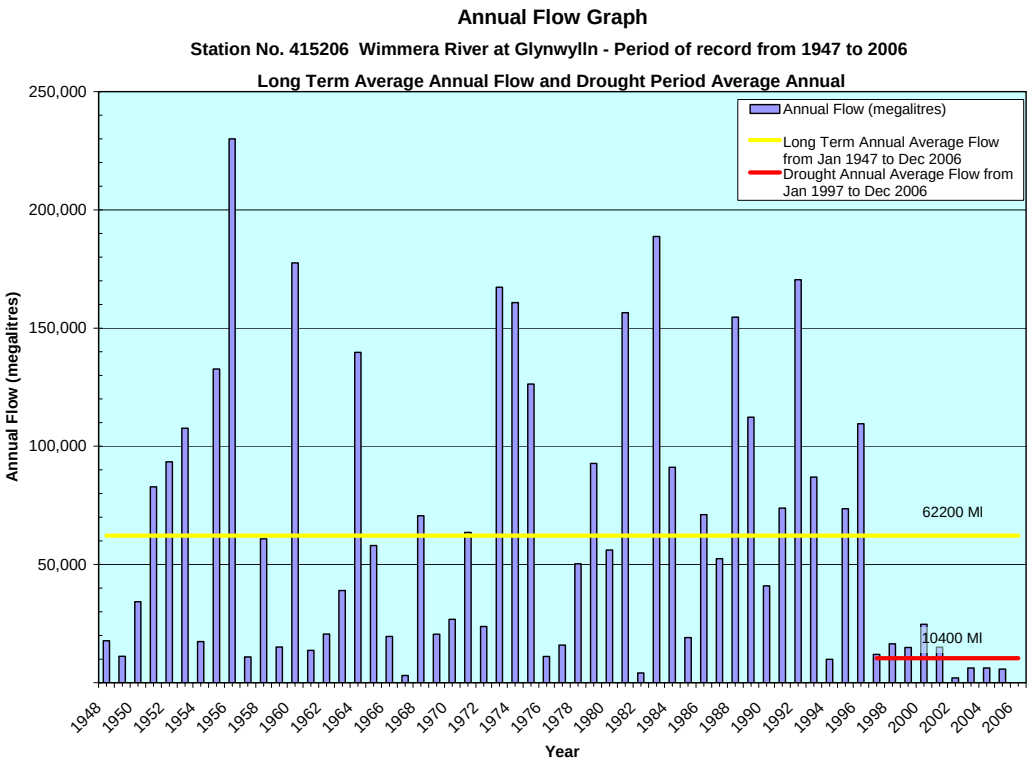
Annual flows in the Goulburn River over the past ten years have been 62% of the long term average flow. The 2006 flow was substantially lower than the past ten years' average, although irrigators still received 100% allocation of water entitlements and low level restrictions in some areas of the region were implemented.

Figure 1-8 Annual streamflow at Loddon River



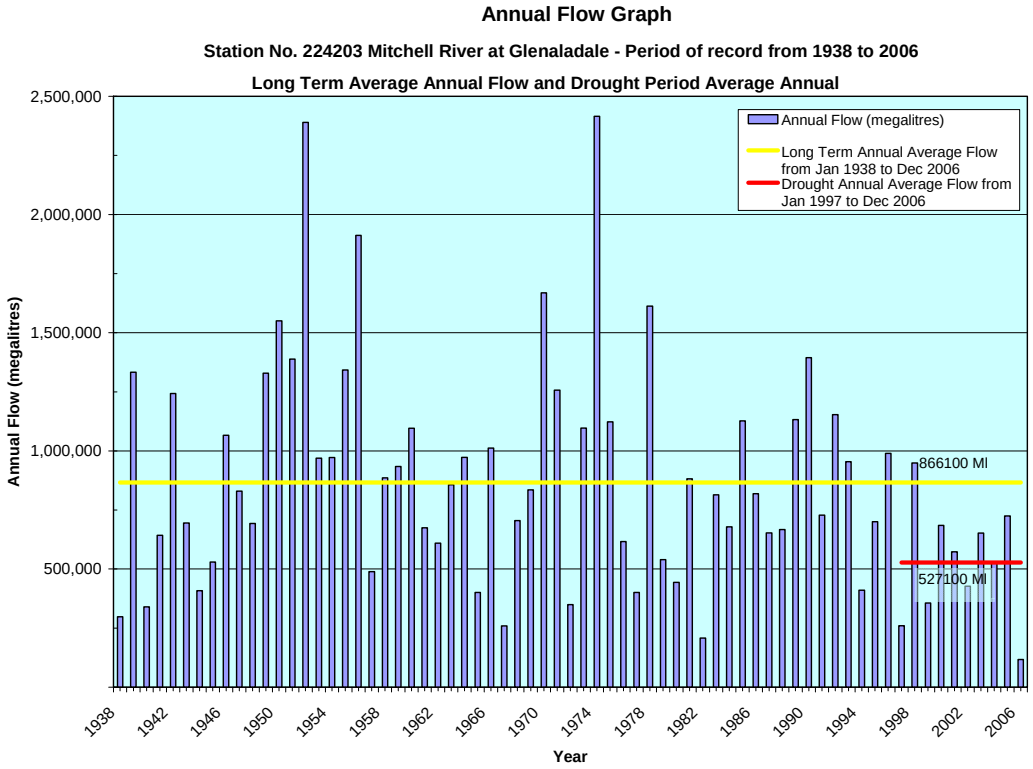
Over the past ten years, annual flows in the Loddon River have been 33% of the long term average, with 2006 another low year. In 2005/2006 inflows to storages were significantly reduced and storage levels were 9% of capacity by year end.

Figure 1-9 Annual streamflow at Wimmera River



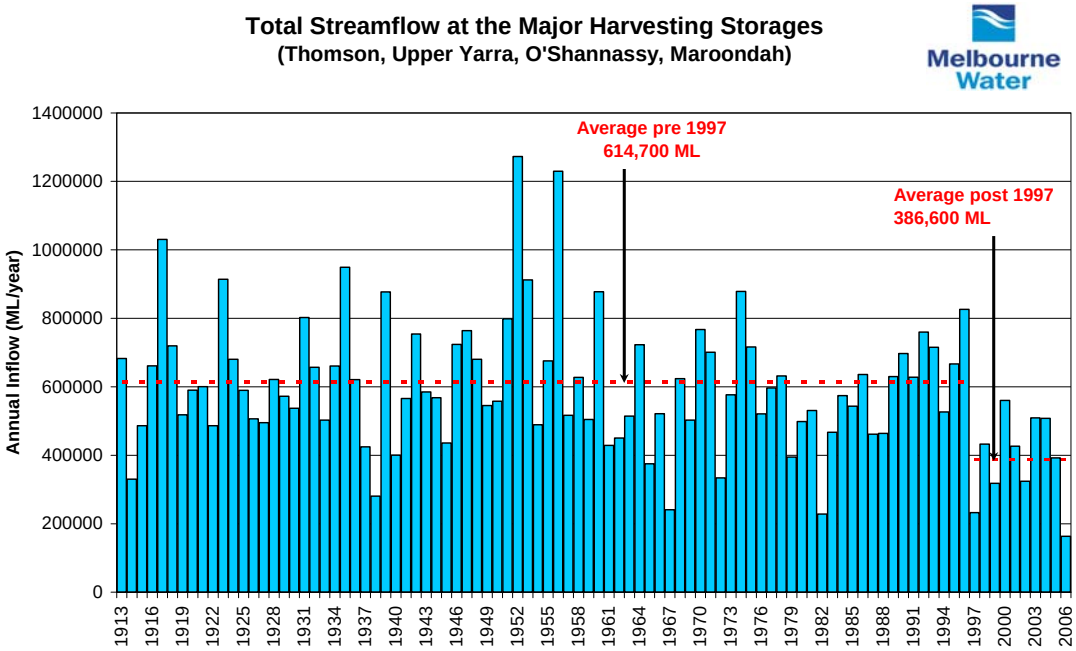
The Wimmera River has experienced a severe decrease in annual flows over the past ten years. The ten year average annual flow to 2006 represents 17% of the long term average flow. Major storages in the Wimmera basin continued to remain at historically low levels, and fell from an average 12% to 10% during 2005/06. Several storages were empty. Irrigation customers received 5% of their full allocation late in the season but elected not to take it due to the seriousness of the regional water supply situation.

Figure 1-10 Annual streamflow at Mitchell River



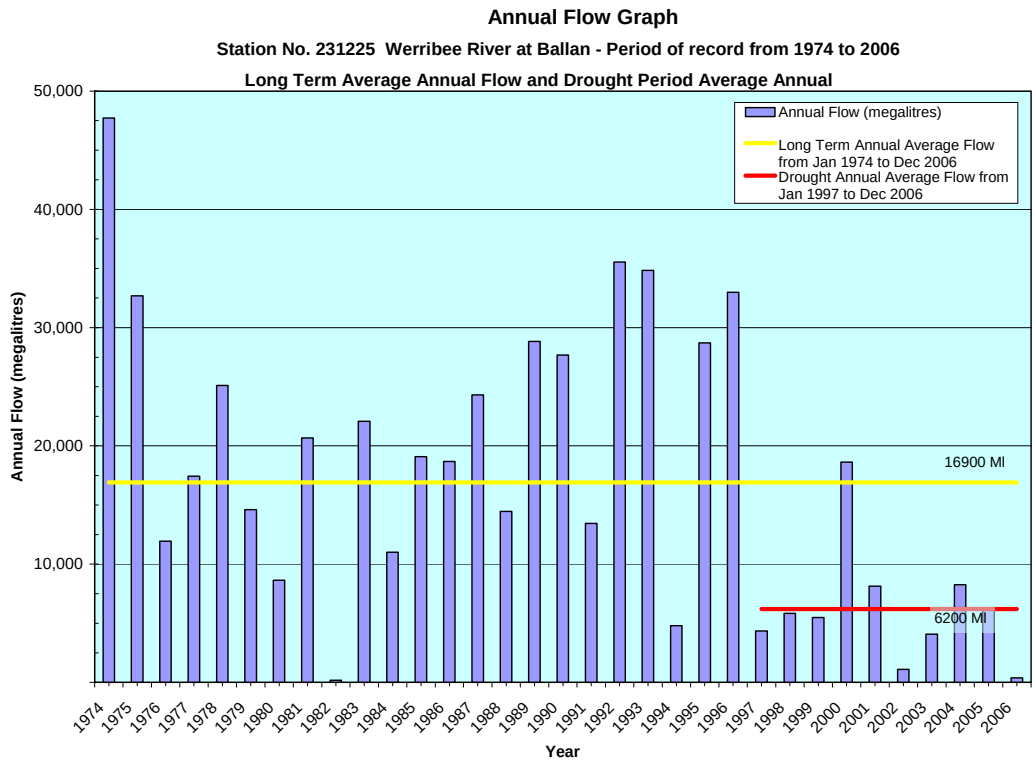
Over the past ten years, annual flows in the Mitchell River have been 60% of the long term average. Dry catchment conditions meant that inflows were 50% of the long term average, although these levels were sufficient to avoid the need for restrictions on diversions.

Figure 1-11 Annual streamflow at Melbourne's storages



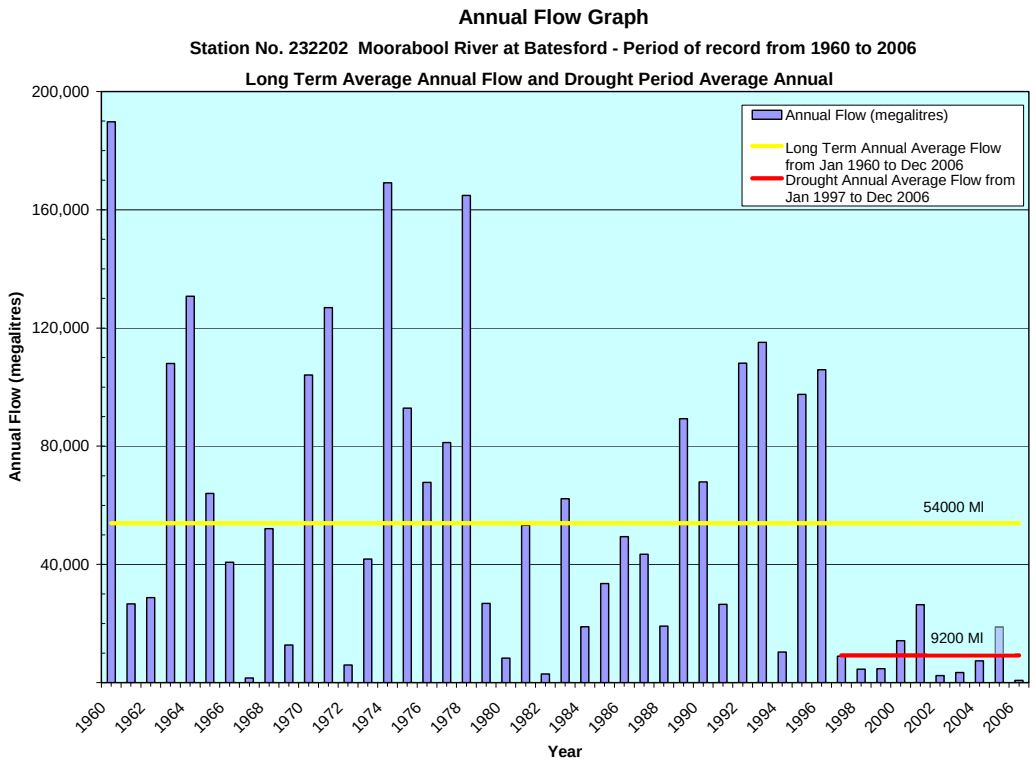
Since 1997, the average annual inflows to Melbourne's storages have been 63% of the long term average. Storages were close to full in 1997, and have experienced a gradual decline since then. Inflows to Melbourne's storages dropped sharply in 2005/06, but there was sufficient water in storages to maintain an unrestricted supply to Melbourne for the year (restrictions have been subsequently implemented). Licensed diverters on unregulated streams in the Yarra basin were subject to rosters and bans on their water use because they are not supplied from Melbourne's large storages.

Figure 1-12 Annual streamflow at Werribee River



The Werribee River's annual flow in the past ten years has been 37% of the long term average flow. Storage levels fell from an average 34% at the start of the year to 16% at the end of the year and irrigators in the Werribee and Bacchus Marsh districts experienced their third consecutive year of low water allocations.

Figure 1-13 Annual streamflow at Moorabool River



Annual flows in the Moorabool River have experienced a severe reduction over the past ten years during which time annual flows have been 17% of the long term average. Storages decreased from 30% at the start of the year to 20% by year end and increasingly stringent restrictions on licensed irrigation diversions from the unregulated Moorabool River were put in place during the year, culminating in an irrigation ban in January 2006.

Note: Unlike the other graphs, this graph shows readings taken downstream from water storages

1.3 Storages

The high year-to-year and within-year variability of rivers in most Victorian basins means that large reservoirs are necessary to even out the fluctuations in river flow and provide a continuous and reliable water supply to towns and farms.

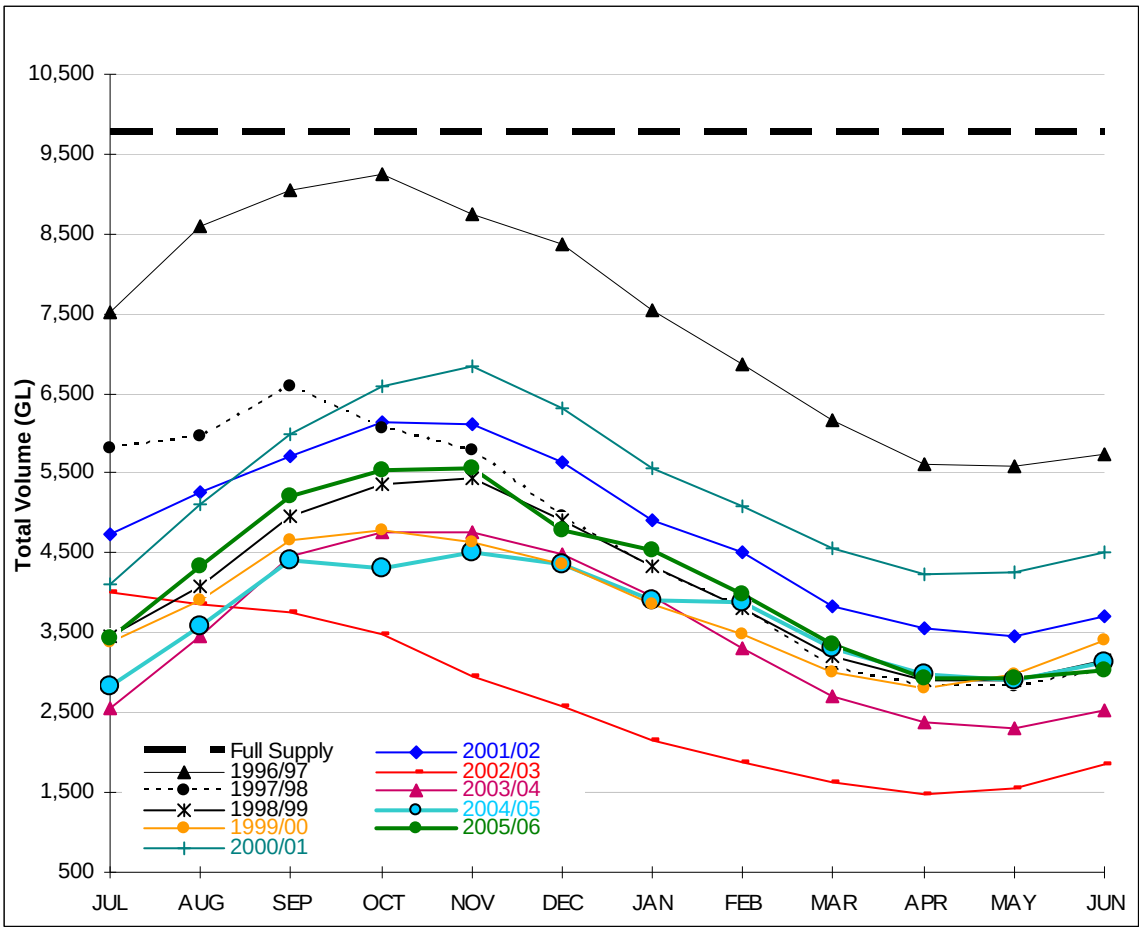
Victoria's major water storages are capable of holding around 11,540,000 ML when completely full. This includes 1,773,000 ML for Melbourne and 9,767,000 ML for rural and regional urban water supplies, and is well in excess of any one year's annual supply. For example, Melbourne's total water consumption in 2005/06 was around 438,000 ML, which is about 25% of its total storage capacity.

The total volume of water in major rural reservoirs typically increases over the winter/spring filling period and is at its maximum in October. Water levels then decrease over summer/autumn as water is released from the reservoirs, predominantly supplying irrigation demands (see Figure 1-14). This pattern was followed in 2005/06 and over the year storage levels fell from 3,434,000 ML (35% of capacity) at the start of July 2005 to 3,040,000 (31% of capacity) at the end of June 2006.

Storage levels vary greatly across the state. At the end of June 2006 storages in the Wimmera, Glenelg, Maribyrnong, Campaspe and Loddon Basins were all less than 10% full. In contrast, storages in the Latrobe basin were 80% full.

Information on storage levels in individual basins is set out in Appendix B.

Figure 1-14 Volume in major rural water authority storages during 2005/06 (plotted against previous years)



In the case of Melbourne's water storages, levels fell from 925,600 ML (52% of capacity) at the start of July 2005 to 850,800 ML (48% of capacity) at the end of June 2006.

Figure 1-15 Volume in Melbourne Water Corporation storages during 2005/06 (plotted against previous years)

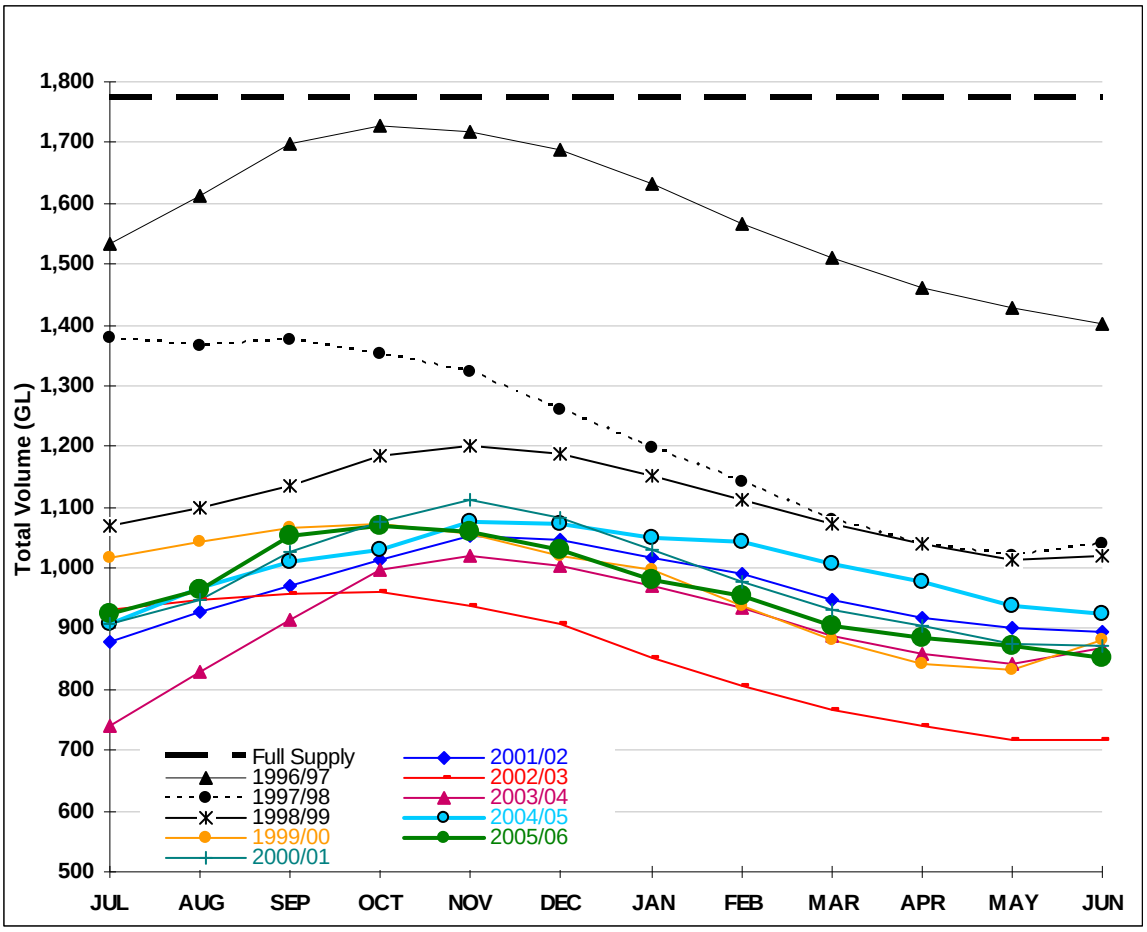
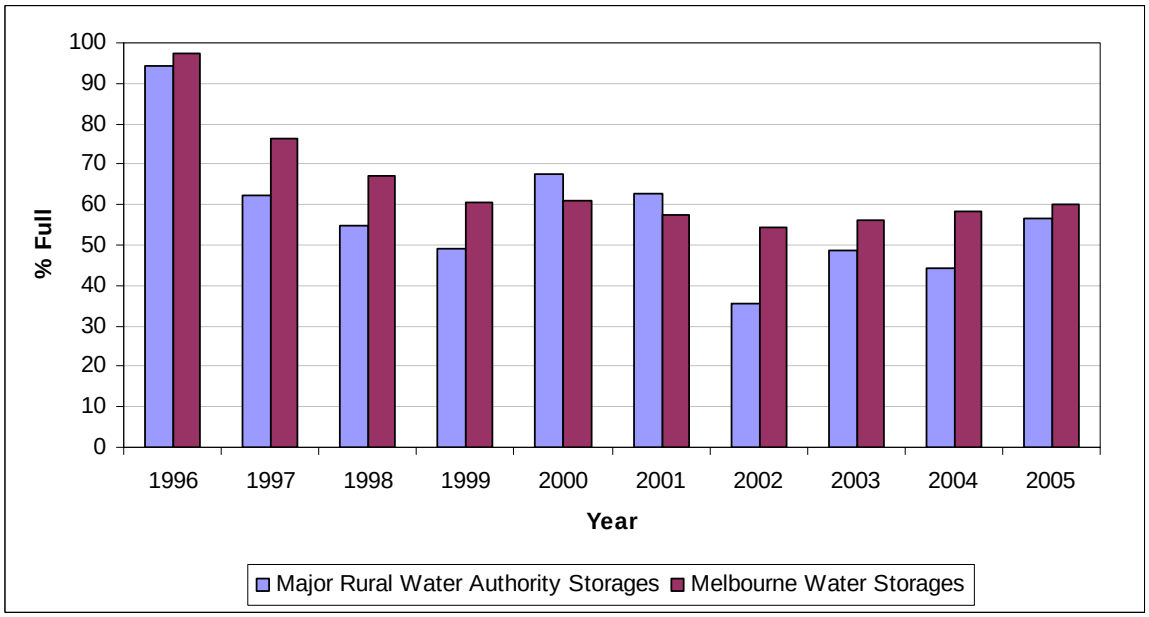


Figure 1-16 shows October storage levels from 1996 to 2005. October storage levels generally declined from 1996 to 2002 but started to recover between 2003 and 2005. Rural water authority storages experienced a significant increase in volumes between June and October 2005.

Figure 1-16 Water stored in reservoirs at the end of October, 1996-2005 (shown as a percentage of total storage capacity)



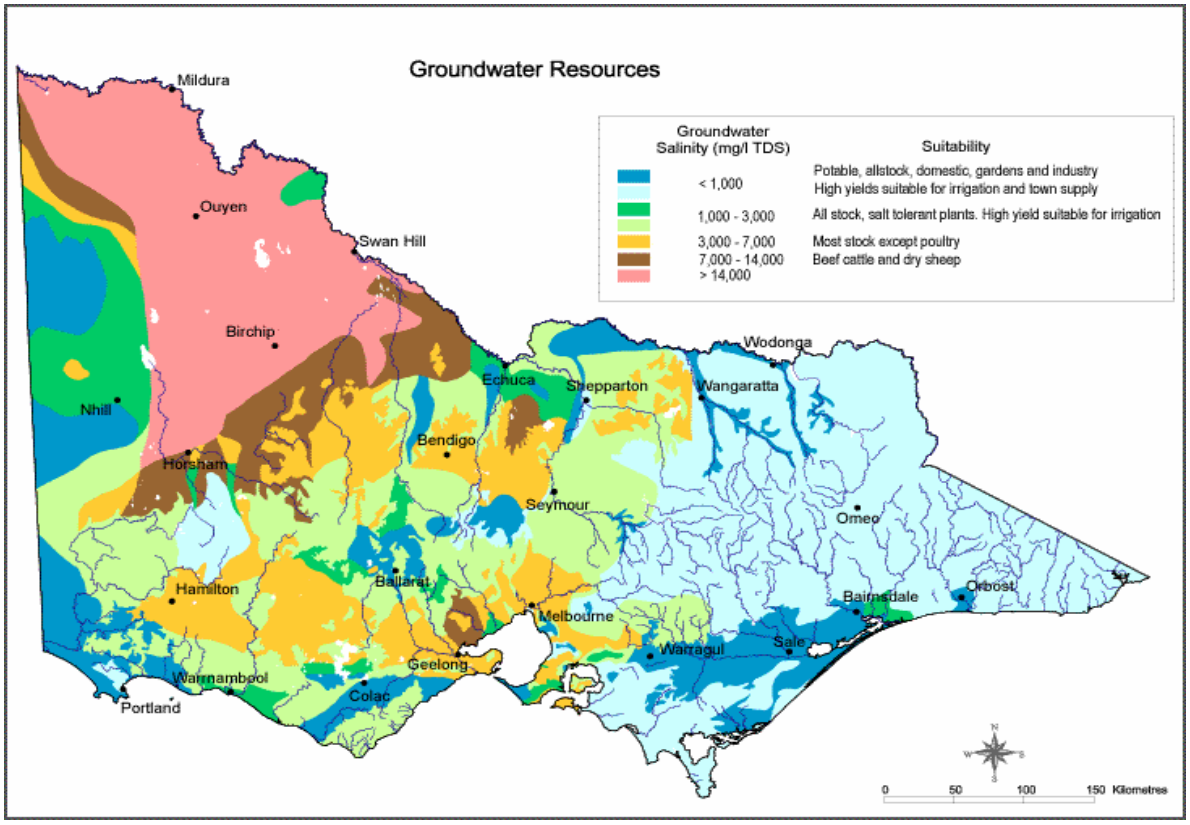
1.4 Groundwater

Victoria's useable groundwater resource is relatively small and equals about 10% of surface water resources. Aquifers do not align with surface water catchments, and some aquifers are interconnected to surface water resources across several basins.

The quality of groundwater is also highly variable, with groundwater use being determined largely by the level of salinity. Figure 1-17 identifies the location and salinity levels of Victoria's groundwater resources.

The antecedent soil moisture conditions are a dominant factor in determining the volume and rate of groundwater recharge. Dry soils enable greater volumes of water to be stored in the soil layers above the water table where it can be subsequently lost to evaporation and transpiration. Soils need to be sufficiently saturated to enable water to pass below the root zone, and the soil's water-holding capacity has to be exceeded to enable the groundwater system to recharge. Groundwater recharge is diminished during extended dry periods such as those observed in some Victorian groundwater management areas since 1993.

Figure 1-17 Location and quality of Victoria's groundwater resources



Water levels in aquifers across Victoria generally fell throughout 2005/06 during the ongoing dry conditions. This is attributable to aquifers receiving lower surface water infiltration whilst the demand for groundwater continued.

1.5 Conclusion

In 2005/06 Victoria experienced below average rainfall – the tenth successive year that this has occurred. As a result, total streamflow for the state was 56% of average and down from 62% in 2004/05.

Low streamflows led to a decline in storage volumes from an average 35% to 31% of capacity throughout 2005/06, although restrictions on urban and rural usage (discussed further in Chapter 3) slowed the decline to some extent.

Storage levels in some basins were extremely low at the end of 2005/06. These included the Wimmera, Glenelg, Maribyrnong, Campaspe and Loddon basins.

Groundwater levels in aquifers also generally declined in response to low rainfalls and streamflows.

2 Water for consumptive use

2.1 Victoria's water allocation framework

Water for consumptive use in Victoria is taken from reservoirs, streams and aquifers under entitlements issued by government and authorised under the *Water Act 1989*. These entitlements are formally issued through a number of different mechanisms.

- **Bulk entitlements**. A bulk entitlement is a right to water granted to urban and rural water authorities and other selected bodies (e.g. electricity companies) to use and supply water. Rural water authorities then distribute the water to their customers. These customers include irrigators who receive a regulated supply under their own entitlements in the form of water rights or licences, urban authorities that receive a bulk supply under their own bulk entitlement and rural properties that receive a domestic and stock supply. Bulk entitlements held by the Minister for the Environment are used for environmental purposes.

  In urban areas, customers receive reticulated metered water supplies from an urban water authority. The authority holds the entitlement to water, not the customer.

- **Water rights**. A water right is a right granted to a person to use water in an irrigation district as declared under the Water Act and set out in the district register. Water right holders are entitled to sales water when sufficient water is available.

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

In addition to the entitlements that are formally issued, the Water Act 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 the Act and are not formally issued.

As well as the above consumptive uses, the Water Act provides an extensive definition of water for the environment under the Environmental Water Reserve. It should be noted that water may be extracted for environmental purposes – see Chapter 4 for details.

Table 2-1 Water allocated for consumptive use in Victoria, 2005/06

Entitlement	Volume 2005/06 (ML)[1]
Surface water	
Bulk entitlements[2]	5,413,590
Licences[3]	279,550
Small catchment dams[4]	523,200
Groundwater	
Licences	879,900
Total water entitlements	7,096,240

Notes:

(1) An improvement in the data collection methodology for the 2005/06 State Water Report makes any comparison of the total volume under entitlements and licenses in prior years invalid.

(2) An estimate of the total volume of bulk entitlement granted as at 30 June 2006. Estimate is for an average year and is not adjusted for trade or long term rolling averages.

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

(4) Estimate of water taken by small catchment dams in 2005/06 includes mainly domestic and stock dams and also small catchment dams for commercial and irrigation use. The latter are required (by an amendment of the *Water Act 1989* in 2001) to be licensed (or registered), a process that is currently underway. The 2005/06 estimate reflects estimates of prior years and therefore it is likely that some water has been double counted. This is because some water previously classified as from a small catchment dam will now also be counted as a licensed volume.

2.2 Water availability and use

The volume and use of Victoria's water resources for 2005/06 is summarised in Table 2-2.

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

Table 2-2 Victoria's water availability and water taken for consumptive use in 2005/06

	Surface water [1] (ML)	Groundwater (ML)	Recycled water (ML)
Total resource	15,312,200	not applicable	440,000
Entitlement/allocation	6,216,340	879,900	not available
Water used	4,921,360	366,300	95,740

Notes:

(1) Catchment inflow as shown in each basin water balance in the 2005/06 state water accounts, excluding inter-basin transfers, irrigation return flows and recycled water.

Table 2-3 and Figure 2-1 show the amount of water used by various classes of consumers in 2005/06. Some 76% of water used is for irrigation purposes and is supplied by, or taken under licences issued by, Victoria's rural water authorities. Another 4% is taken for domestic and stock use.

Around 11% of water diverted in the state is for use in Melbourne, with approximately two thirds of this for residential customers. Large non-residential customer use in Melbourne (i.e. use by the largest 200 customers), continues to decline and since 2000/01 it has fallen from 45,930 ML to 39,640 ML, a decline of 13.7%.

Aggregate regional urban use (excluding major users in the Latrobe Valley) accounts for around 5% of water diverted in the state, two thirds of which is residential and one-third is non-residential. Major industrial customers (including power stations) in the Latrobe Valley use a similar amount of water to total non-residential use in Melbourne.

Table 2-3 Water consumption by consumer class 2005/06

	Residential (ML)	Non-residential (ML)	Total (ML)	Percentage of state use
Irrigation[1]		3,043,010	3,043,010	76.2
Domestic and stock[2]		176,130	176,130	4.4
Melbourne[3]	306,290	131,660	437,950	11.0
Regional[4]	142,540	75,320	217,860	5.4
Latrobe Valley major users[5]		120,460	120,460	3.0
Total[6]	**448,830**	**3,546,580**	**3,995,410**	

Notes:

(1) Total deliveries as reported in the *Victorian Water Review*, less domestic and stock use.

(2) As calculated in Part 2 of this State Water Report.

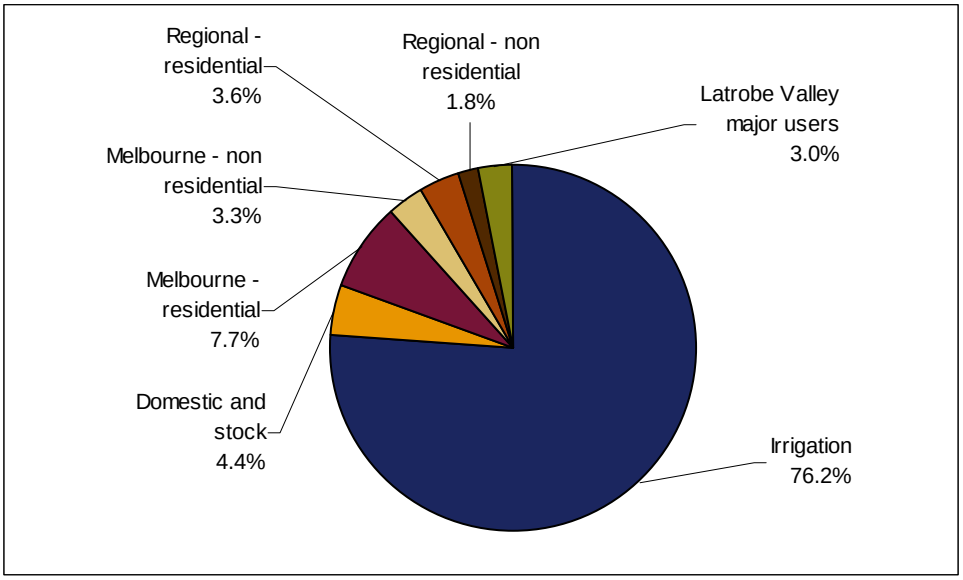
(3) As reported in *National Performance Report 2005-06* (WSAA and the National Water Commission). Non-revenue water (for example non-metered water, leaks, bursts, water used in flushing, metering error, etc.) has been allocated proportionately across the residential and non-residential categories.

(4) Sourced from the *National Performance Report 2005-06* (WSAA and the National Water Commission) and annual reports. Where relevant, non-revenue water has been allocated proportionately across the residential and non-residential categories.

(5) Gross usage (i.e. diversions/water supplied including that subsequently returned to relevant waterways).

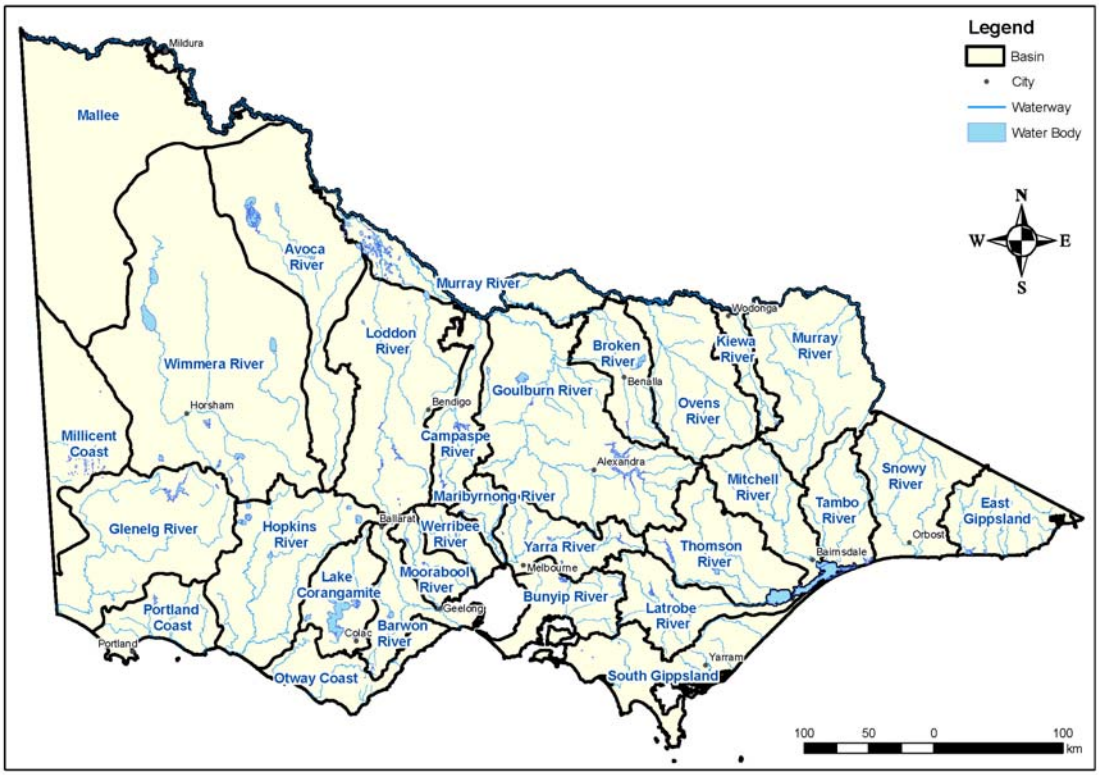
(6) The figures in Table 2-3 include in-system losses but exclude losses, evaporation, etc. before water enters delivery systems, hence the reported total is less than in Table 2-2.

Figure 2-1 Consumptive uses of water in Victoria, 2005/06



2.3 Surface water entitlement and use

Figure 2-2 River basins in Victoria for the state water accounts



The following information on the 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 River 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 2-2. Refer to the state water accounts in Part 2 of this report for details of water availability and use in each river basin.

Water authorities have an obligation to report on water use against their entitlements in their annual reports. These annual reports can be found on each water authority's web-site.

The state water accounts in Part 2 of this report show water use against each entitlement and an assessment of compliance with the entitlement volume. If an entitlement volume is averaged over more than one year, the outcome of the compliance calculation is reported in the relevant basin chapter.

The information on water use against water authority entitlements in Part 2, the state water accounts, is as reported in water authority annual reports except where water authorities have provided updated information.

River basins in northern Victoria are subject to the Murray-Darling basin cap on diversions. Each year, the target cap volume is adjusted to take account of the climatic conditions in that year and the volume of water traded between river basins and states. Compliance is assessed by the Murray-Darling Basin Commission's Independent Audit Group, which prepares an annual review of cap compliance containing preliminary findings, followed by a Water Audit Monitoring Report, which contains the detailed accounting under the cap. The Independent Audit Group's report was not available when this report was prepared.

Table 2-4 shows the volume of water allocated under bulk entitlements, licences and private rights (small catchment dams) in each basin and the volume diverted from waterways in 2005/06. In each basin the volume diverted is within the entitlement volume. Some bulk entitlements have an upper limit described as a five-year or 10-year rolling average. In this case, compliance would be assessed at the end of the full term of the bulk entitlement.

The total volume of bulk entitlements reported in Table 2-4 includes new bulk entitlements created during 2005/06, however it does not include bulk entitlements for the major water supply systems located in the Yarra and Bunyip basins. The Yarra bulk entitlement was finalised in October 2006 and the Bunyip bulk entitlements are yet to be completed.

Due to the drought, the volume of water taken under bulk entitlements in 2005/06 was around half to two-thirds of the entitlement volume. Water taken from basins such as the Campaspe, Loddon, Wimmera, Werribee and Maribyrnong was well below average because water availability was severely limited by the drought.

Table 2-4 Volume allocated and taken under surface water entitlements in 2005/06

Basin	Bulk entitlements[1]			Unregulated river licensed private 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	2,159,580	1,595,510	71%	21,480	14,000	65%	6,500
Kiewa	1,150	660	57%	14,480	9,400	65%	3,900
Ovens	35,040	20,410	58%	20,460	13,300	65%	15,900
Broken	66,210	23,790	36%	5,670	3,700	65%	15,800
Goulburn	1,958,630	1,468,870	75%	28,890	18,800	65%	47,500
Campaspe	64,740	35,600	55%	4,710	3,100	66%	28,800
Loddon	49,890	22,110	-	23,420	15,200	65%	50,000
Avoca	280	50	18%	3,620	1,400	39%	12,700
Mallee	0	0	n/a	0	0	n/a	0
Wimmera	206,790	69,100	33%	2,490	1,700	68%	14,400
East Gippsland	620	300	48%	750	200	27%	1,100
Snowy	2,200	900	41%	3,860	1,100	28%	3,400
Tambo	3,650	60	2%	3,790	1,400	37%	3,900
Mitchell	5,900	4,380	74%	15,650	8,700	56%	4,500
Thomson	458,940	307,300	67%	13,830	11,600	84%	7,000
Latrobe	216,840	144,720	67%	18,400	13,000	71%	20,500
South Gippsland	14,020	8,440	60%	11,960	5,900	49%	24,300
Bunyip[5]	0	5,730	-	10,180	6,400	63%	15,500
Yarra[5]	0	444,370	n/a	45,380	30,200	67%	15,900
Maribyrnong	9,680	1,410	15%	2,060	1,400	68%	7,800
Werribee	36,190	7,860	22%	920	400	43%	9,300
Moorabool	43,100	14,920	35%	3,610	1,600	44%	22,200
Barwon	55,730	28,530	51%	4,200	3,800	90%	30,900
Corangamite	0	0	n/a	960	500	52%	12,300
Otway Coast	19,230	16,100	84%	6,300	3,300	52%	12,800
Hopkins	630	470	75%	9,930	3,500	35%	64,600
Portland Coast	0	0	n/a	1,224	400	33%	16,200
Glenelg[6]	4,550	1,410	31%	1,220	1,200	98%	55,500
Millicent Coast	0	0	n/a	100	0	0%	0
Total	**5,413,590**	**4,223,000**		**279,540**	**175,200**	**63%**	**523,200**

Notes:

(1) Bulk entitlement volume and use rounded to nearest 10 ML.

(2) Estimate of the total volume of bulk entitlement granted as at 30 June 2006. Estimate is for an average year and is not adjusted for trade, caps that are climatically adjusted, or caps that are long term rolling averages.

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

(4) Refers to the total volume harvested by the small catchment dams, including water estimated as lost to evaporation.

(5) Some or all of the bulk entitlements in this basin are yet to be finalised, therefore the percentage of entitlement taken in 2005/06 has not been calculated.

(6) Water taken under the Wimmera and Glenelg Rivers bulk entitlement cannot be split into each river and is therefore included only under the Wimmera basin for reporting purposes in this table.

n/a: not applicable

2.3.1 Water entitlement transfers

The water market is the main mechanism by which irrigators and, to a lesser extent, urban water authorities, can manage their water supplies. Given the large number of irrigators and entitlement volumes in the Murray and Goulburn basins, the number of trades in these two basins account for approximately 90% of the transactions in the market. Other irrigation districts such as Macalister, Werribee and Bacchus Marsh comprise the majority of the balance.

Trade is more active in dry conditions and when allocations are low – this is when the 'scarcity' value of water increases.

In total, approximately 40,000 ML of permanent water entitlements were traded in 2005/06, with 3,555 ML transferred interstate. The temporary market is always more active than the permanent market, and approximately 380,000 ML was temporarily exchanged via more than 27,000 transactions.

The volume of surface water entitlements transferred on a permanent or temporary basis is shown in Table 2-5.

Table 2-5 Permanent and temporary trades, 2005/06

Basin	Permanent entitlement transfers			Temporary entitlement transfers		
	Bought (ML)	Sold (ML)	Net transfer to basin	Bought (ML)	Sold (ML)	Net transfer to basin
Murray	33,931	18,706	15,225	141,852	154,753	-12,901
Kiewa	0	0	0	640	640	0
Ovens	0	0	0	1,952	1,862	90
Broken	0	0	0	1,130	1,130	0
Goulburn	1,235	15,512	-14,277	165,328	137,752	27,576
Campaspe	617	1,188	-571	3,684	2,515	1,169
Loddon	75	4,368	-4,293	50,462	34,047	16,415
Avoca	0	0	0	0	0	0
Mallee	0	0	0	0	0	0
Wimmera	0	0	0	0	0	0
East Gippsland	0	0	0	0	0	0
Snowy	0	0	0	0	0	0
Tambo	0	0	0	0	0	0
Mitchell	0	0	0	0	0	0
Thomson	603	603	0	13,733	13,733	0
Latrobe	0	0	0	2,716	2,716	0
South Gippsland	0	0	0	0	0	0
Bunyip	0	0	0	0	0	0
Yarra	0	0	0	0	0	0
Maribyrnong	10	10	0	86	86	0
Werribee	0	0	0	1,657	1,657	0
Moorabool	0	0	0	0	0	0
Barwon	0	0	0	0	0	0
Corangamite	0	0	0	0	0	0
Otway Coast	0	0	0	0	0	0
Hopkins	0	0	0	0	0	0
Portland Coast	0	0	0	0	0	0
Glenelg	0	0	0	0	0	0
Millicent Coast	0	0	0	0	0	0
Total	**36,471**	**40,387**	**-3,916**	**383,240**	**350,891**	**32,349**
Interstate	0	3,555	-3,555	49,592	21,998	27,594
Unaccounted difference	n/a	n/a	-361	n/a	n/a	4,756

n/a: Not applicable.

The unaccounted difference in Table 2-5 can be attributed to a number of factors such as inconsistencies in transaction dates for interstate trades or differing data management practices between the water authorities. The Victorian Water Register, which will commence operation on 1 July 2007 for the northern part of Victoria, should substantially reduce or eliminate unaccounted differences in the future.

Urban water authorities that participated in the water market in 2005/06 were Coliban Water, Goulburn Valley Water and North East Water. Goulburn Valley Water was the most active and made temporary trades to irrigators from a number of its bulk entitlements. Details of trades are reported in the state water accounts for each of the bulk entitlements held by water authorities.

The volume of permanent water traded across the state decreased by around 10% from 2004/05, however similar volumes of water were temporarily traded in both years. Trading substantially increased in the Thomson basin (temporary trades increased from 1,951 ML to 13,733 ML) but fell in the lower Campaspe basin lowerbecause of the very low allocations in 2005/06.

Trade in groundwater entitlements has increased every year since entitlements were first traded in 2002/03. In 2005/06 there was a contrast in trading patterns between the northern and southern regions of the state. Groundwater entitlement trading in Southern Rural Water's area decreased from 733 ML of permanent entitlement and 4,052 ML in temporary entitlement in 2004/05 to 340 ML and 2,861 ML respectively in 2005/06. Temporary entitlement transfers in Goulburn-Murray Water's region increased from 836 ML in 2004/05 to 3,039 ML in 2005/06, whilst GWMWater customers permanently transferred 500 ML of entitlement in 2005/06 after no trade occurred in the previous year.

2.4 Groundwater management and use

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

- **groundwater management area** (GMA): the geographical area from which water is extracted from an aquifer and defined for the purposes of its ongoing management
- **water supply protection area** (WSPA): an area declared under the Water Act to protect the area's groundwater or surface water resources through a management plan
- **unincorporated area** (UA): an area where no significant development of the groundwater resource has occurred.

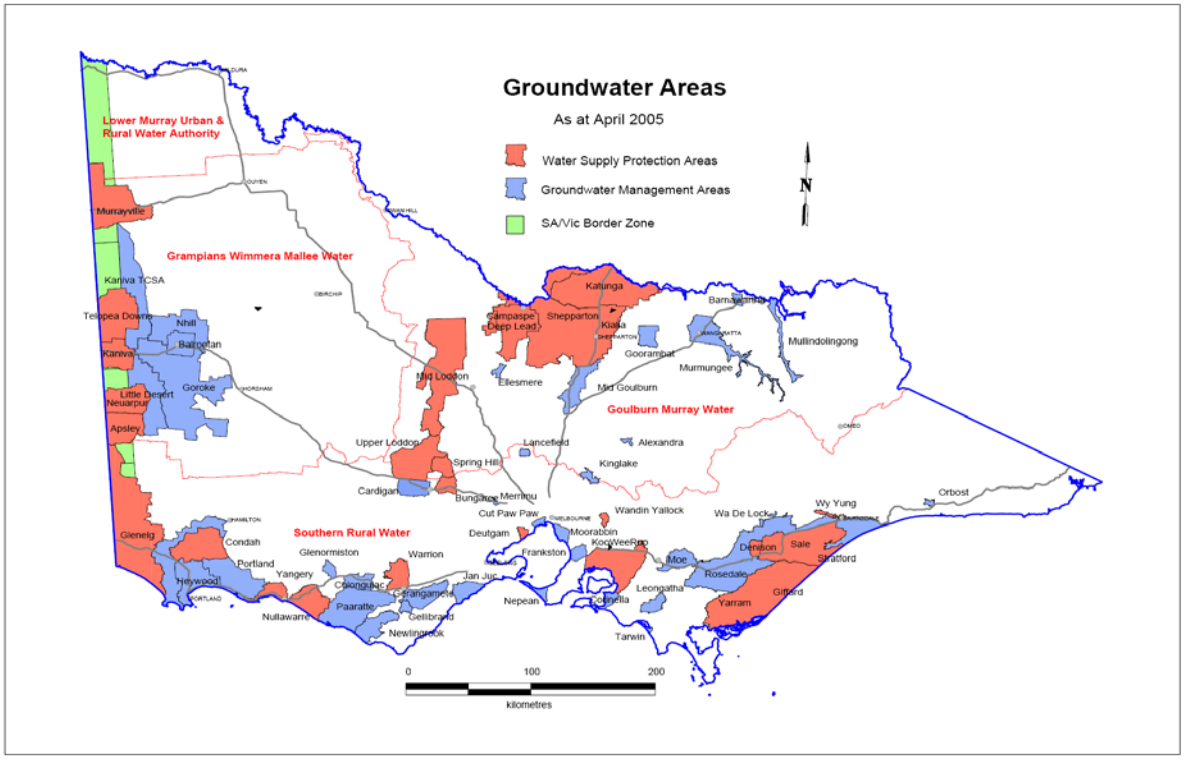
Estimates of sustainable yields for groundwater inform decisions about granting new groundwater licences and assist in determining the permissible annual volume (PAV) or permissable consumptive volume (PCV)[1] that may be allocated to groundwater users in a particular GMA. WSPAs have historically not had PAVs because the allocation limits are reported as the sum of the existing licensed volumes.

Figure 2-3 shows the location of GMAs and WSPAs in Victoria.

More detailed information about the origin, uses and management of Victoria's groundwater is included in Appendix A.

[1] PAVs are no longer used and have been replaced by permissible consumptive volumes (PCVs) the first of which came into effect in mid-2006.

Figure 2-3 Groundwater management units in Victoria



Under Victoria's management framework, groundwater management plans are required to be prepared for all WSPAs to ensure the long term sustainability of the resource and protect important environmental assets.

Table 2-6 shows the progress made during 2005/06. Currently nine WSPAs have completed management plans, and the plans of 14 WSPAs are at draft stage.

Table 2-6 Status of water supply protection areas during 2005/06

Water supply protection area	Status at end 2005/06
Campaspe Deep Lead	Approved
Katunga	Approved
Koo-Wee-Rup	Approved
Murrayville	Approved
Neuarpur	Approved
Nullawarre	Approved
Shepparton	Approved
Spring Hill	Approved
Yangery	Approved
Deutgam	Prepared and under consideration
Sale	Prepared and under consideration
Warrion	Prepared and under consideration
Wy Yung	Prepared and under consideration
Apsley	Preparatory work
Bungaree	Preparatory work
Condah	Preparatory work
Denison	Preparatory work
Glenelg	Preparatory work
Kaniva	Preparatory work
Telopea Downs	Preparatory work
Upper Loddon	Preparatory work
Wandin Yallock	Preparatory work
Yarram	Preparatory work

2.5 Statewide overview of groundwater use for 2005/06

Continued dry conditions in the state and the associated depletion of soil moisture resulted in deteriorating water levels in many of Victoria's aquifers. Recovery of Victoria's aquifers is expected to require several consecutive years of above-average rainfalls to restore soil moisture and revive streamflows and aquifer recharge.

Full details of water allocated and extracted from each GMA and WSPA during 2005/06 is presented in Appendix A. In summary:

- The total of groundwater entitlement was 879,900 ML.
- The total estimated groundwater use across the state, including domestic and stock use, was about 366,300 ML. This represents around 42% of groundwater entitlement in Victoria in 2005/06.
- Domestic and stock use accounts for around 11% of the state's total estimated groundwater use.
- Groundwater entitlement in the unincorporated areas is 112,000 ML (13% of the total allocated volume).
- Estimated groundwater use in unincorporated areas is 42,900 ML (12% of the total estimated groundwater usage).
- Urban water authorities using groundwater for the supply of towns accounted for 46,500 ML of allocated groundwater (5% of the total allocated volume) and 12,200 ML of metered groundwater use (5% of the total metered use). This is an increase of 3,000 ML over 2004/05 and reflects greater use of groundwater as surface water supplies become more constrained.

Groundwater entitlements increased by approximately 27,000 ML (3% of total entitlement) over the course of 2005/06. The majority of this rise is explained by the volume of entitlements in the Shepparton WSPA, which increased from 203,600 ML at the end of 2004/05 to 224,200 ML at the end of 2005/06.

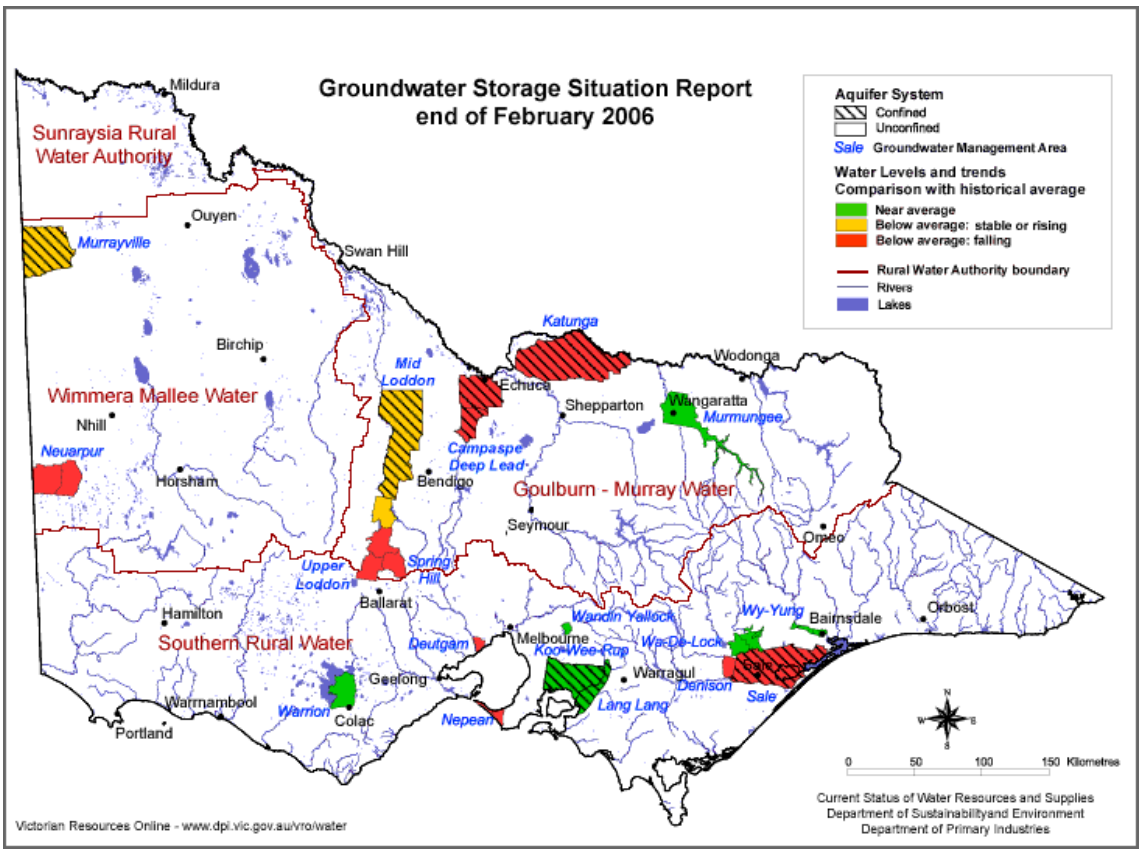
In contrast to the volume of entitlements, the volume of metered groundwater use decreased by 5% (13,000 ML) for the second consecutive year. When the estimated use from unmetered bores has been included, total groundwater usage fell by approximately 9% (35,000 ML) compared with 2004/05. The most notable decreases were in the Shepparton WSPA (15,100 ML) and Glenelg WSPA (12,400 ML). The decreases may reflect a number of factors, such as fewer crops being grown, or higher localised summer rainfall.

As already indicated, despite this lower use groundwater levels across the state continued to show a general decline. As the drought continues, groundwater will continue to be closely monitored to ensure that long term extraction remains at sustainable levels.

2.6 Trends in water and pressure levels

Trends in water and pressure levels in key groundwater systems are monitored around the state on a quarterly basis. Trends at the end of the 2005/06 summer period are shown in Figure 2-4 and reflect the seasonal effects of pumping.

Figure 2-4 Groundwater storage situation at end of February 2006



Groundwater levels in these systems either fell over the course of the 12 months between February 2005 and February 2006 or remained at similar levels. Around half of the systems were below historical average levels and falling and will require continued active monitoring and management. Table 2-7 presents a comparison of the noted change in groundwater levels between 2005 and 2006.

Table 2-7 Change in groundwater levels between February 2005 and February 2006

Groundwater system	Water level February 2006(1)	Water level February 2005(1)
Deutgam	Below average and falling	Near average
Neuarpur	Below average and falling	Near average
Campaspe Deep Lead	Below average and falling	Below average and stable or rising
Denison	Below average and falling	Below average and stable or rising
Katunga	Below average and falling	Below average and stable or rising
Spring Hill	Below average and falling	Below average and stable or rising
Upper Loddon	Below average and falling	Below average and stable or rising
Nepean	Below average and falling	Below average and falling
Sale	Below average and falling	Below average and falling
Murrayville	Below average and stable or rising	Near average
Mid Loddon	Below average and stable or rising	Below average and stable or rising
KooWeeRup	Near average	Near average
Lang Lang	Near average	Near average
Murmungee	Near average	Near average
Wa De Lock	Near average	Near average
Wandin Yallock	Near average	Near average
Warrion	Near average	Near average
Wy Yung	Near average	Near average

Note:

(1) As compared with historical average.

2.7 Recycled water

As shown in Table 2-8, in 2005/06 a total of 79,906 ML of wastewater was recycled for use, external to treatment plants, across Victoria. This represented 18% of the total volume available for reuse at the end of the wastewater treatment process. The proportion was higher than in both 2004/05 and 2003/04, when recycled water accounted for 12% and 14% respectively of treated wastewater. In addition, 15,833 ML of wastewater was recycled 'within process' or on-site, bringing the total of recycled wastewater to 22%. Note, however, the volumes and percentages used in the following paragraphs only refer to recycled water supplied for use external to the treatment plants.

The increase in 2005/06 can predominantly be attributed to the two treatment plants operated by Melbourne Water in the Bunyip and Werribee basins. The Eastern Treatment Plant in the Bunyip basin recycled approximately 5,000 ML more than the previous year, mostly as a result of the Eastern Irrigation Scheme where wastewater is treated and supplied to irrigators in the Cranbourne/Five Ways district.

The Western Treatment Plant recycled approximately 17,700 ML more wastewater than the previous year, 15,065 ML of which was used for habitat management of Ramsar-listed wetlands. An additional 1,279 ML of recycled water was supplied to Werribee irrigators. In total, the two Melbourne metropolitan treatment plants recycled 44,758 ML of wastewater, or 15% of the total wastewater available to them. Including the treatment plants operated by the Melbourne metropolitan retailers, Melbourne as a whole recycled 14% of available wastewater.

The percentage of recycled water is higher outside Melbourne where weather conditions, the availability of land and access to potential purchasers (i.e. agricultural producers) are more favourable. Excluding the wastewater recycled in Melbourne, the remainder of the state recycled 29%, or 33,105 ML, of the wastewater available to them for reuse.

Recycled water from regional water authorities is used for a number of purposes, including vineyards, vegetable farms, tree plantations, pasture, parks and recreational facilities.

Table 2-8 Volume of wastewater recycled in 2005/06

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	11,021	5,698	52%	0	52%
Kiewa	235	140	60%	0	60%
Ovens	2,863	865	30%	0	30%
Broken	632	325	51%	0	51%
Goulburn	9,386	6,661	71%	0	71%
Campaspe	1,305	577	44%	0	44%
Loddon	8,716	2,419	28%	0	28%
Avoca	254	245	96%	0	96%
Mallee	n/a	n/a	n/a	n/a	n/a
Wimmera	2,041	1,952	96%	77	99%
East Gippsland	65	65	100%	0	100%
Snowy	276	276	100%	0	100%
Tambo	778	778	100%	0	100%
Mitchell	1,486	1,486	100%	0	100%
Thomson	378	345	91%	0	91%
Latrobe	19,982	41	0%	0	0%
South Gippsland	5,011	326	7%	15	7%
Bunyip	159,550	8,511	5%	14,712	15%
Yarra	9,013	404	4%	0	4%
Maribyrnong	2,900	1,333	46%	87	49%
Werribee	162,413	42,464	26%	0	26%
Moorabool	n/a	n/a	n/a	n/a	n/a
Barwon	28,955	1,796	6%	834	9%
Corangamite	2,141	282	13%	27	14%
Otway Coast	1,360	309	23%	54	27%
Hopkins	5,763	1,016	18%	27	18%
Portland Coast	2,132	256	12%	0	12%
Glenelg	1,282	1,274	99%	0	99%
Millicent Coast	62	62	100%	0	100%
Total 2005/06	**440,001**	**79,906**	**18%**	**15,833**	**22%**
Total 2004/05	**468,830**	**57,867**	**12%**	**15,123**	**16%**

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.

3 Management of scarce water resources

3.1 Prolonged dry conditions

As noted in Chapter 1, Victoria experienced its tenth consecutive year of below average rainfall, with 2005/06 rainfall 60-100% of the long term average. This low rainfall, when combined with dry soil and hence decreased streamflows and aquifer recharge, continued to put pressure on both urban and rural water use.

Limitations on urban and rural use typically take the form of restrictions in urban areas and reduced allocations in rural areas. These are described further below. However, in addition to these measures, under exceptionally dry conditions such as those experienced in Victoria in the past few years, some of the water sharing arrangements specified in bulk entitlements can be temporarily adjusted in order to maintain a basic supply for essential needs. In these cases, the Minister for Water can use powers under the *Water Act 1989* to qualify rights. In 2005/06 rights were qualified in a number of cases in northern Victoria to ensure that towns received a water supply while irrigators had a zero allocation.

3.2 Urban restrictions

At the end of June 2006, 192 towns were on a form of water restrictions, almost equal to the number of towns on restrictions at the start of 2005/06. The majority of towns on restrictions were located in the western half of the state and were either on the same level of restriction or higher than at the start of the year.

All customers of the Melbourne metropolitan retailers, Goulburn Valley Water and Western Water were subject to permanent water savings measures for the entire year. By the end of the year, customers of Barwon Water, Central Highlands Water, East Gippsland Water, Gippsland Water, South Gippsland Water, Wannon Water and Westernport Water also had permanent water savings measures in place. Lower Murray Water imposed permanent water savings measures on 1 July 2006.

March 2006 figures showed that record amounts of water had been saved since the introduction of the Permanent Water Saving Rules in 2005. In Melbourne, water consumption was 22 per cent lower than the city's water usage in the 1990s with less water used per person in 2005 than in any other year since the metropolitan water authorities started keeping detailed records in 1995.

Figure 3-1 summarises the number of towns on some form of restrictions during 2005/06, and the level of those restrictions.

Figure 3-1 Number of Victorian towns on restrictions, 2004/05 to 2005/06

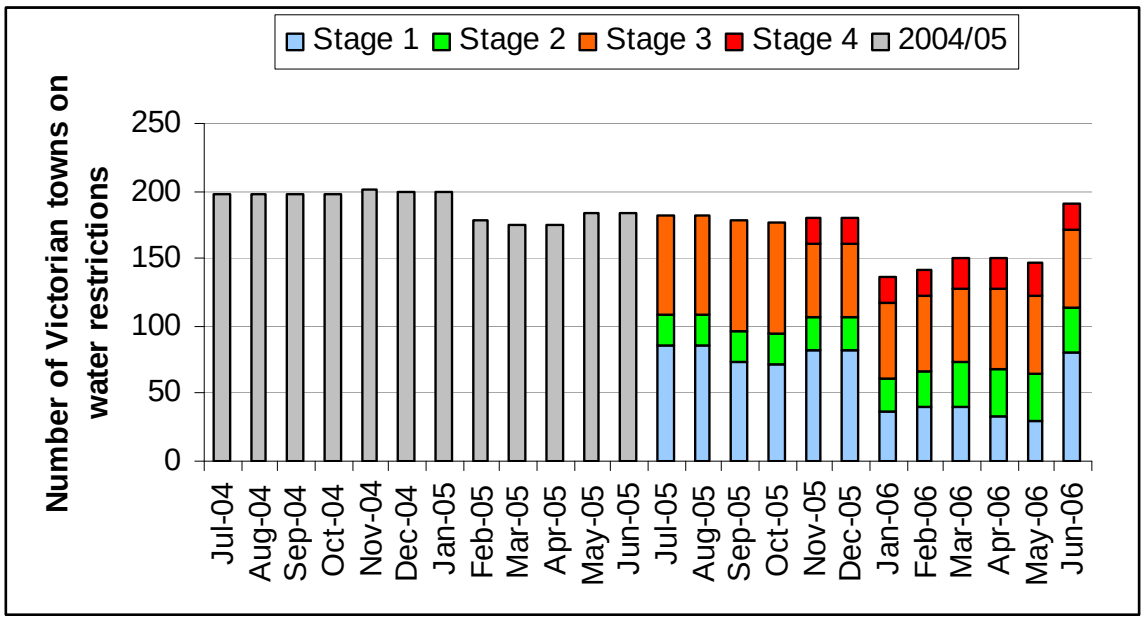
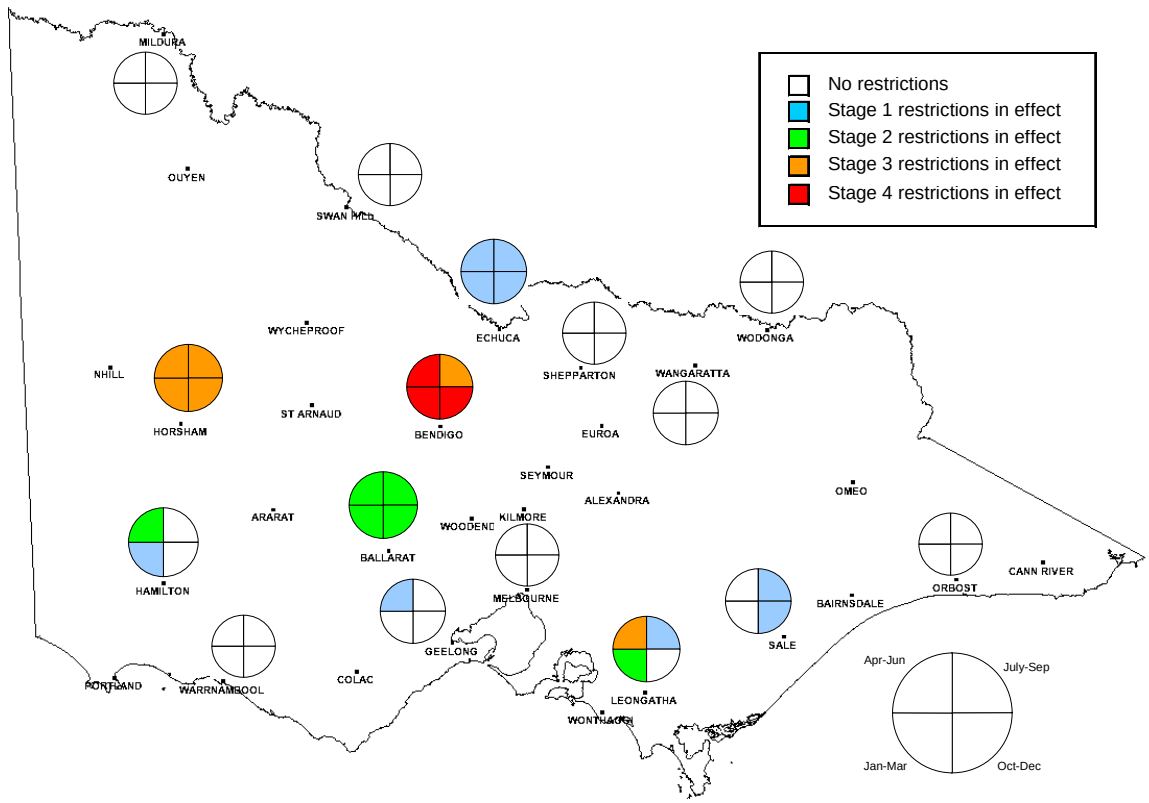


Figure 3-2 shows the level of restrictions for the major population centres, and the manner in which they changed over 2005/06. Restriction levels generally tightened in most centres, although some remained unchanged and in some cases restrictions were lifted (to be replaced by permanent water savings measures).

Figure 3-2 Changes in restrictions levels for major towns, 2005/06



Note:

Each quadrant in the circles represents a quarter of the 2005/06 year. The level of restrictions in July to September is in the top right quadrant and the next three quarters follow in a clockwise direction.

3.3 Seasonal allocation of water in irrigation districts

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.

Seasonal allocations are expressed as a percentage of entitlement (water right or licence volume) and, should sales water be available, seasonal allocations are allowed to be greater than 100% of entitlement. They 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 water authorities 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.

The 2005/06 seasonal allocations for Victoria's irrigation districts are shown in Table 3-1. The continued drought meant that almost all districts received less water in February 2006 than the long term average allocation.

Allocations in Goulburn-Murray Water's districts were broadly in line with allocations in 2004/05 and higher in districts supplied by the Murray. However Southern Rural Water's Macalister, Werribee and Bacchus Marsh districts were approximately 20% below the 2004/05 allocations.

Most irrigators ultimately received allocations at or above 100% of their water right, however there were a few notable exceptions. Irrigators in the Campaspe district received 31% of their water right (compared to the long term median allocation of 200%) and irrigators in the Wimmera received a 5% allocation late in the season but elected not to take it. Regulated diverters on Jacksons Creek in the Maribyrnong basin received just 15% of licence volume.

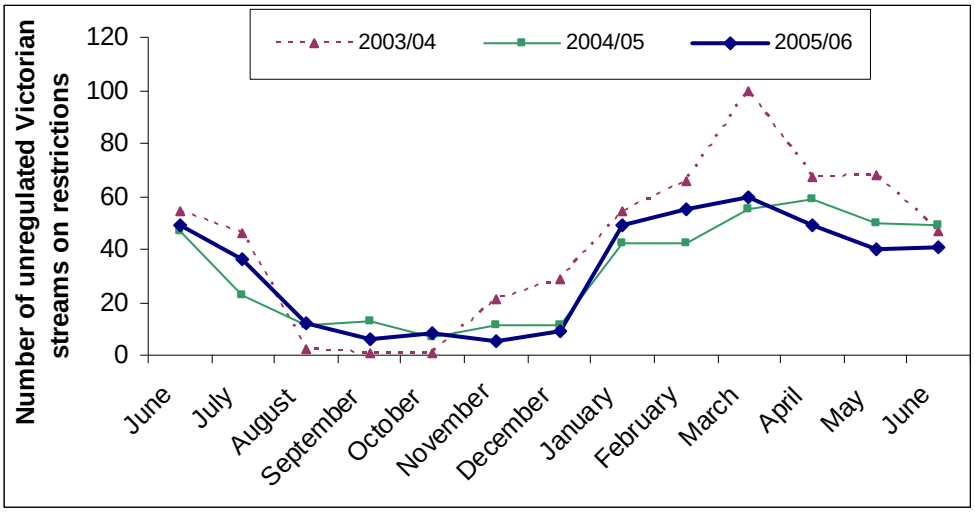
Table 3-1 Seasonal irrigation water allocations

Irrigation system	Initial allocation August 2005 (% of entitlement)	Mid season allocation February 2006 (% of entitlement)	Final allocation May 2006 (% of entitlement)	2004/05 final allocation (% of entitlement)
Murray – gravity	82	141	144	100
Murray – pumped	82	111	114	100
Goulburn	7	100	100	100
Broken	78	170	170	170
Campaspe	0	31	31	39
Loddon	1	98	100	100
Bullarook Creek	100	190	190	190
Wimmera	0	0	5	7
Thomson - Macalister	80	110	115	140
Werribee and Bacchus Marsh	55	80	80	100
Maribyrnong (SRW)	0	15	15	25

3.4 Restrictions on diversions from unregulated streams

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 likely to be lifted over the winter and spring seasons. Restrictions in 2005/06 again followed this pattern, with restrictions or bans applying to 41 streams at 30 June 2006. The number of streams with restrictions in 2005/06 was similar to that in 2004/05 (Figure 3-3).

Figure 3-3 Number of Victorian unregulated streams on restrictions



3.5 Restrictions on groundwater use

The only restriction recorded on groundwater use in 2005/06 was for the Deutgam WSPA in the Werribee basin, managed by Southern Rural Water. Extractions were limited to 60% of licensed volume for most of the year, before increasing to 100% in May 2006. In June 2006 the allocation for the 2006/07 season was reduced to 25% to protect the WSPA from seawater intrusion.

4 Water for the environment

4.1 The environment's share of water

A major advance in the allocation of water for the environment was realised in 2005/06 with the introduction of the *Water (Resource Management) Act 2005*. By amending the *Water Act 1989*, the new Act created the legal foundation for water to be set aside to maintain environmental values of rivers and streams. This water is defined as the Environmental Water Reserve (EWR). For the first time, the 2005/06 State Water Report is able to report on the components of water that make up the EWR in each river basin.

Rivers have naturally variable flow regimes, reflecting the rainfall and run-off within their catchments. It should be noted that total annual streamflow volumes are not, in themselves, indicators of river health; seasonal flow regimes are critical. Furthermore, the total volume of water leaving a basin is inadequate as an indicator of river health or other environmental benefits.

Further details and explanation of the EWR is available in Part 3.

4.2 Reporting on the EWR

The 2005/06 basin accounts in Part 2 define the EWR for each basin. This can include any of the following elements:

- Entitlements for the environment are usually defined as amounts of water held in storage and are specified under separate legal entitlements. Prior to the Water (Resource Management) Act, a number of bulk entitlements for the environment were established. Following the Water (Resource Management) Act, environmental entitlements were able to be established. A number of environmental entitlements were under development during 2005/06 and will be reported for the first time in the 2006/07 State Water Report.
- Passing flow requirements are the flows that a water authority must pass at its weirs or reservoirs before it can take any water for consumptive use. These flows are specified as obligations, and water authorities must allow these flows to pass as a consequence of their right to take water from the stream. Water authorities must also report on their compliance with these requirements.
- Streamflow management plans (SFMPs) formally provide for a minimum environmental flow within the relevant system. Streamflow management plans determine how river water will be shared between consumptive use and the environment in unregulated systems. SFMPs create rules for the sharing of water including capping the volume of water permitted to be allocated for consumptive use. Two SFMPs were in place in the Yarra basin in 2005/06, and a number of other SFMPs were being prepared across the state.
- Water leaving the basin includes traded water, water not used under consumptive entitlements and above cap water. In some instances, water above cap is part of the EWR and can provide a significant EWR contribution. Water above cap is any water in the basin in excess of water authorities' and other entitlement holders' water entitlements, and any other defined elements of the EWR as outlined above.

As 2005/06 is the first year of implementation of some parts of the Water (Resource Management) Act, the level of reporting of the different aspects of the EWR varies across each

basin. The 2005/06 state water accounts do not report on the groundwater EWR, however reporting will be progressively introduced in future years.

4.3 Entitlements for the environment

Table 4-1 lists the entitlements for the environment in place in 2005/06. The use of this water in each basin is described more fully in the separate basin chapters in Part 2. New environmental bulk entitlements came into effect in 2005/06 for the Thomson and Loddon rivers. Two existing environmental bulk entitlements were also amended to provide additional water: the Goulburn System - Snowy Environmental Reserve; and the Wimmera and Glenelg Rivers – Flora and Fauna Bulk Entitlement. Environmental entitlements for the Yarra River, and Silver and Wallaby creeks were prepared during 2005/06 and came into effect during 2006/07. Details for these will be reported in the 2006/07 State Water Report.

Table 4-1 Entitlements for the environment in place in 2005/2006 (ML)

Entitlement	Entitlement at 30 June 2006 A	2005/06 allocation B	Allocation carried over from 2004/05 C	Total water available in 2005/06 B+C	Water used in 2005/06 D	Carried over to 2006/07 B+C-D
River Murray – Flora and Fauna	27,600	27,600	0	27,600	27,600	0(1)
River Murray – Barmah/Millewa Forest	75,000	75,000	175,000	250,000	256,000	-6,000
Wimmera and **Glenelg** Rivers	41,240	3,404.	4,433	8,689	5,115	3,574
Snowy River – Victorian components: • 14,812 ML from the Goulburn System - Snowy Environmental Reserve • 6,988 ML from the River Murray – Snowy Environmental Reserve • 990 ML from the Broken System - Snowy Environmental Reserve	22,790	22,490	26,600	49,090	26,600	22,490
Thomson River	10,000	10,000	422	10,422	9,539	883
Loddon River	2,000	0	0	0	0	0

Note:

(1) Unused water cannot be carried over as part of the conditions of this entitlement.

Key points to note about the entitlements listed in Table 4-1 are:

- **Wimmera and Glenelg rivers**. The *Bulk Entitlement (Wimmera and Glenelg Rivers – Flora and Fauna) Conversion Order 2004* was amended in October 2005 with an additional 9,000 ML being provided from the Speed-Patchewollock and Cannie Ridge Pipeline water savings project, bringing the full entitlement up to 40,563 ML a year. By the end of June 2006 the 2005/06 allocation under this entitlement was 8,689 ML. This volume is considerably less than the full entitlement because of the low seasonal allocations to all Wimmera-Mallee system entitlement holders resulting from the extremely low reservoir levels. The Glenelg River also received 50 ML in compensation flow. This volume was used in conjunction with the bulk entitlement towards meeting environmental objectives in the Glenelg River.

  Water availability and the use of this entitlement during 2005/06 are described in the Wimmera and Glenelg basin accounts in Part 2 of this report.

- **Snowy River** (Victorian component). The use of this entitlement is assigned two-thirds to the Snowy River and one third to the Murray River and came from a number of water savings projects within the Murray and Goulburn water supply systems. The *Bulk Entitlement* (*Goulburn System - Snowy Environmental Reserve) Order 2004* was amended in 2005, with an additional allocation of 150 ML resulting from water savings. The savings were achieved through the implementation of the Improved Measurement of Small Volumes Supplies to Irrigation Districts project in the Campaspe system, and brought the entitlement up to a total of 14,812 ML.
- **Barmah-Millewa Forest Environmental Water Allocation**. This is not strictly an environmental entitlement, but is included in Table 4-1 because it is a significant operational rule embedded in consumptive entitlements, and it effectively forms part of the water for the environment. Under arrangements approved by the Murray-Darling Basin Ministerial Council, Victoria and New South Wales contribute environmental water for the long term sustainability of the forest and wetland.

  Formal support was received from the New South Wales and Victorian Governments in October 2005 to release approximately 510 gigalitres of the accumulated Barmah-Millewa Forest EWA, which watered approximately 30,000 hectares (~55%) of the Barmah-Millewa floodplain. The water was used to top-up natural high flows coming from upstream tributaries, resulting in two and half months of floodplain inundation and three flood pulse events. Victoria granted approval in December 2005 for overdraw of the EWA by up to 50 gigalitres. This was considered necessary for successful completion of significant bird breeding and other ecological processes that had been triggered by the released water.
- **Thomson River**. The *Bulk Entitlement (Thomson River – Environment) Order 2005* was gazetted in August 2005, with the Minister for the Environment receiving: an entitlement for a 10,000 ML share of storage capacity in Thomson Reservoir; carry-over in-storage space in the reservoir not being used by other entitlement holders; and passing flows between Thomson Reservoir and Cowwar Weir on the Thomson River, which were previously specified as an obligation in Melbourne Water's bulk entitlement.
- **Loddon River**. The *Bulk Entitlement (Loddon River - Environmental Reserve) Order 2005* was gazetted in November 2005. Under this entitlement, the Minister for the Environment is entitled to: passing flows in the Loddon system, the delivery of which is specified for five sections of the system; 2,000 ML a year of water to enable the watering of the Boort District Wetlands; and temporary access of up to 300 ML a year from the wetland entitlement to provide water to Little Lake Boort until savings from the Wimmera-Mallee pipeline project are realised. The wetland entitlement includes a carry-over provision.

4.4 Compliance with passing flow requirements

Each water authority is required to report on whether they have complied with their obligations to pass flows at dams, weirs and other extraction points specified through bulk entitlements. Generally there was a high level of compliance during 2005/06, and details are in the basin accounts in Part 2 of this report.

A number of actions were reported by water authorities as underway in 2005/06 to help improve the level of compliance reporting, including:

- installation of infrastructure and instrumentation
- improved instrumentation and monitoring specifically for passing flow requirements.

4.5 The environment's share of total flow at the basin outlet

Table 4-2 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 uses. 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, it is important to note that the total volume of water leaving a basin is inadequate as an indicator of river health or other environmental benefits. While this water may have environmental benefits, it is not entirely comprised of water protected under the EWR as it also includes water not used under consumptive entitlements and in some cases water traded out of a system.

Across the state the proportion of total flow leaving the basins increased from 56% in 2004/05 to 61% in 2005/06. However, in volumetric terms the amount of water leaving the basins reduced by more than 10% from 10,322 GL to 9,231 GL, reflecting generally lower basin inflows in 2005/06.

In 2005/06 the basins that experienced the lowest proportions of water leaving the basin as a percentage of total flow were the Loddon (5%), Werribee (4%) and the Avoca (2%) due to continued drought conditions and extremely low streamflows and reservoir levels.

There were nine basins where the proportion of annual flow leaving the basin was greater than 90%. Seven were in the south of the state, and two – the Ovens and Kiewa basins – in the north. While the value for the Snowy basin indicates that only 1% of the Snowy River's flow in Victoria is for consumptive use, it does not account for the large volume of water extracted in New South Wales for the Snowy Scheme.

Table 4-2 Volume leaving the basin 2005/06

Basin	2005/06			2004/05
	Streamflow if no extractions (ML)	Total volume leaving the basin (ML)	Proportion of total flow leaving the basin in 2005/06 (%)	Proportion of total flow leaving the basin in 2004/05 (%)
Murray [1]	4,394,300	1,471,000	33%	27%
Kiewa[2]	657,500	637,800	97%	98%
Ovens	1,423,800	1,378,000	97%	96%
Broken	257,200	132,400	51%	51%
Goulburn	1,955,900	477,100	24%	20%
Campaspe	83,400	8,500	10%	9%
Loddon	116,000	6,200	5%	5%
Avoca[7]	24,500	500	2%	4%
Mallee[3]	not available	not available	not available	not available
Wimmera[4] [7]	109,600	10,600	10%	2%
East Gippsland	508,600	506,900	100%	99%
Snowy (Vic. only)[5]	1,078,300	1,072,200	99%	99%
Tambo	167,500	160,000	96%	91%
Mitchell	675,700	656,600	97%	97%
Thomson	498,700	267,800	54%	35%
Latrobe	507,800	400,800	79%	80%
South Gippsland	632,200	589,100	93%	96%
Bunyip	485,600	459,000	95%	94%
Yarra [6]	589,800	253,400	43%	60%
Maribyrnong	30,400	16,000	53%	45%
Werribee	21,600	900	4%	29%
Moorabool	47,900	3,300	7%	40%
Barwon	142,000	81,000	57%	66%
Corangamite	71,000	53,300	75%	93%
Otway Coast	467,300	432,400	93%	96%
Hopkins	154,600	56,200	36%	75%
Portland Coast	69,600	48,600	70%	96%
Glenelg[4]	140,700	51,400	37%	39%
Millicent Coast[3]	not available	not available	not available	not available
Total	**15,312,200**	**9,230,500**	**60%**	**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) There are no significant streams in this basin.

(4) Data for 2004/05 is shown over the period 1 November 2004 to 31 October 2005, in accordance with bulk entitlement specifications. Data for 2005/06 is for the period 1 July 2005 to 30 June 2006. Flow leaving the basin is taken as the flow entering the terminal lakes.

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

(6) Transfers of water into these basins are not included in the total flow.

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

4.6 Streamflow management plans

Streamflow management plans (SFMPs) determine how river water will be shared between consumptive uses and the environment in unregulated systems. There were two SFMPs in effect in the Yarra basin in 2005/06 however a number of SFMPs are currently being prepared across the state for unregulated rivers with the focus on those that are flow stressed. In the future, the implementation of each completed and approved SFMP will be reported annually to the Minister for Water and the relevant catchment management authority.

Table 4-3 lists each basin where SFMPs are under development, and reports the progress made towards the finalisation of SFMPs within them.

Table 4-3 Status of streamflow management plans

Basin	Work undertaken in 2005/06
Kiewa	Preparatory work
Ovens River above Myrtleford	Preparatory work The plan will be a combined surface water and groundwater management plan. Further investigation was carried out to confirm the scope of the plan.
Goulburn: King Parrot Creek Yea River Seven Creeks	 Preparatory work Preparatory work Preparatory work
Wimmera (upper)	Halted pending technical work
Thomson: Avon River	 Preparatory work/Advertising to declare WSPA
Latrobe (upper)	Preparatory work
South Gippsland: Tarra River	 Preparatory work
Yarra: Diamond Creek Hoddles Creek Plenty River Pauls/Steels/Dixons Creeks Olinda Creek Stringybark Creek Woori Yallock Creek Little Yarra/Dons Creeks	 Approved Approved Under development Under development Under development Under development Preparatory work/Advertising to declare WSPA Preparatory work/Advertising to declare WSPA
Maribyrnong (upper)	Preparatory work
Barwon: Main stem and tributaries to the south including Leigh River, but excluding Moorabool River	Preparatory work
Otway Coast: Gellibrand River	 Preparatory work
Hopkins: Merri River	 Preparatory work

Further detail on the progress of SFMPs is provided within the relevant Part 2 basin reports.

Part 2
Basin water accounts 2005/06

Part 2 presents an account of water in each of Victoria's 29 river basins during 2005/06.

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

Chapters 6 to 34 deal with the basins in turn. Each contains:

- a seasonal overview for 2005/06 including the main factors that have influenced water availability in the basin, significant events and a summary of 2005/06 in relation to the previous two years
- a map of the basin
- the current management arrangements for water resources within the basin
- a summary of total water resources in the basin in relation to:
    - surface water
    - groundwater
    - recycled water
    - water for the environment
- a water balance.

5 Overview of methodology

5.1 Introduction

This chapter outlines how the state water accounts are constructed. It presents a number of important assumptions and limitations of the data in the accounts that should be read in conjunction with the information in each basin summary.

The reporting unit of the state water accounts is the river basin and surface water data is reported according to river basin boundaries as designated by the Australian Water Resource Council. This unit was chosen because it is consistent with Victoria's surface water allocation framework which is predicated on achieving a sustainable balance between water that can be taken from the river for consumption and the water needs of the river itself for a healthy state acceptable to the community. Some data is not aligned with river basin boundaries and this data has been treated in various ways. For example, groundwater management units do not often fit neatly within river basins and require a different system of reporting. Where possible, groundwater is reported within a river basin to give an indication of total resource use.

These accounts present information on diversions and extractions rather than use. Diversions may include (where relevant) urban diversions, irrigation district diversions, regulated licensed diversions, unregulated 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 prior to water being 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 2005 to 30 June 2006. (Note that for 2004/05 the Glenelg and Wimmera basins were reported on the Wimmera Mallee system water year, 1 November to 31 October). The responsibilities for water management are reported in the state water accounts as they existed during the 2005/06 period. Any changes to responsibilities since June 2006 will be reflected in subsequent water accounts.

The accounts are generally reported in megalitres (ML): one megalitre equals one million litres. Volumes of surface water and groundwater entitlements, entitlement transfer and use from surface water entitlements have been reported to the nearest megalitre as required to assess compliance. Groundwater use and recycled water iis reported to the nearest 10 ML. 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 to reflect the uncertainty in these values. Gigalitres (GL) (one thousand megalitres) are only used where volumes are sufficient to express them in this way.

The State Water Report does not provide information on water quality or 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* (Department of Sustainability and Environment, 2005) (www.vicwaterdata.net).

5.2 Data sources

The state water accounts are compiled from information obtained from:

- responses to specific data requests from water authorities, the Department of Sustainability and Environment, major users and the Murray-Darling Basin Commission
- water consumption and recycled water data collected from water authorities by the Essential Services Commission (ESC)
- hydrologic information from selected streamflow monitoring sites
- climate information provided by the Australian Bureau of Meteorology and Victorian water authorities from selected rainfall and evaporation monitoring sites
- estimated relationships between water use and climate or hydrologic data, which is produced by water supply system modelling
- water authority annual reports and related documents.

5.3 Comparison with 2004/05

This is the third year that the water accounts have been compiled. Water balance information for each basin in 2005/06 is presented alongside the values reported in 2004/05 for comparative purposes.

Differences between 2005/06 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.

5.4 Methodology, key assumptions and limitations of data

A number of key assumptions and limitations of the data presented should be borne in mind when interpreting the accounts. Qualifications on 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 2005/06 values and those of the previous year/s.

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 in every case) 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 that allows it to divert water from Lake Eppalock, which is located in the Campaspe basin, and then transfers that water to Bendigo, which is located in the Loddon basin. For the purposes of the water accounts, the accounting for that water is undertaken at the point of diversion (i.e. 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 source of supply is included.

5.4.2 Groundwater resources

As noted in Chapter 2 the management of groundwater in Victoria is based on allocating resources within:

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

Groundwater is managed not only across areas, but also at different aquifer depths. In the Gippsland area, for instance, groundwater is drawn from different aquifers that lie at different depths. Each aquifer is reported individually in the water accounts.

The concentration of bores and groundwater use varies considerably across groundwater management units, which often fall across more than one river basin. As a result, where less than 90% of the area of a GMA or WSPA falls within a river basin, it is not always accurate to apportion groundwater allocations and use on the basis of area alone.

For the 2005/06 state water accounts, the total groundwater resource for the basin has been presented in the water accounts for each river basin only if the proportion of all GMAs or WSPAs within that river basin is greater than 90% by area. Where reported, this information will be located in Table x-3 of each basin chapter, for example, in Chapter 17 Snowy basin, the total groundwater resource is reported in Table 17-3.

Although the total groundwater resource is not reported in Table x-3 if the above condition is not met, each GMA and WSPA contained within each basin are reported in the 'Compliance with licensed groundwater volumes' table, if the GMA or WSPA has more than 5% of its area in the basin. For example, in the Portland Coast basin chapter, Table 32-6 includes the Heywood GMA, Portland GMA, Condah WSPA and Yangery WSPA because all of these groundwater management units have more than 5% of their area within the Portland Coast basin (100%, 72%, 53% and 40% respectively). The Glenelg WSPA, which has 4% of its area within the Portland Coast basin has not been included in Table 32-6, because it is lower than the 5% threshold.

As groundwater resources in unincorporated areas are largely undeveloped, currently resource information is not readily available in these areas.

The interaction between surface water and groundwater introduces the potential for double counting of these resources. In determining permissible annual volumes for groundwater extraction throughout the state, varying degrees of consideration have been applied to groundwater-surface water interaction.

The level of metering of groundwater resources is increasing as a result of initiatives in the *Our Water Our Future* action plan outlined in Part 3. Generally, metering within WSPAs is approaching 100% of the total number of licensed bores and this will enable more accurate reporting in the future.

In non-metered areas, an estimate of use is provided for the 2005/06 report based on estimates from the relevant rural water authority. In 2004/05 a statewide average figure was used.

5.4.3 Recycled water

The recycled water from towns with wastewater treatment plants has been assigned to river basins according to the point of discharge from the plant 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 its river basin.

Recycled water data was collected from each water authority by the ESC. This data includes separation into the following categories:

- volume of effluent produced, excluding evaporation
- volume recycled for urban and industrial uses
- volume recycled for agricultural uses
- volume recycled for beneficial allocations (e.g. 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 water authority in accordance with the ESC's Performance Reporting Framework (which includes an audit component). Although the ESC has high level definitions of the end use categories that water authorities must report on, in some cases it is possible that certain recycling activities may be classified by different authorities under different end-use categories.

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. The restrictions applied by water authorities at each stage are of different levels of severity.

For urban water authorities, water for basic household needs is met and restrictions target outdoor water use. Each water authority has developed restriction policies which are applied in accordance with the Drought Response Plans developed for each supply system. All authorities now have a four-stage restriction policy, with one exception (GWMWater) having more than four restriction stages. Progressively higher savings are achieved at each stage of restriction by limiting the hours and means available for watering and by banning specific external water uses at the higher stages of restriction. For example, the watering of grass is banned from Stage 2 onwards and all outdoor water use is effectively curtailed at Stage 4.

As set out in Chapter 3, many urban water authorities implemented permanent water saving measures in 2005/06. These measures are designed to ensure the efficient use of resources at all times. For example, most permanent water restrictions ban the hosing of paved areas, require cars to be washed with a flow shut-off device, and require gardens to be watered only with a watering can, bucket or hose with a trigger nozzle.

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.

Seasonal allocations are expressed as a percentage of entitlement (water right or licence volume), and should water be available, seasonal allocations are allowed to be greater than 100% of entitlement (sales water). They 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 water authorities 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.

Restrictions on licensed diversions from unregulated streams are typically as follows:

- rostering: restricts the time or day on which water can be diverted from rivers
- Stage 1, 2 and 3 restrictions: 25%, 50% and 75% reduction in diversion rate respectively
- Stage 4 or ban: no water can be diverted.

5.6 Surface water balance

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

- In most cases, only on-stream storages greater than 1,000 ML were included in the water balance. Off-stream storages are not reported because this would otherwise 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 generally insignificant relative to total storage at a river basin and statewide level.
- The unknown item in each water balance is generally the basin inflows. Inflows have been back-calculated as the sum of basin outflows plus diversions.
- The method of calculating in-stream 'losses', i.e. infiltration from streams to groundwater, flows to floodplains and evaporation, is based on the loss functions used in models such as REALM models.
- Unless otherwise reported by water authorities, 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. The volume associated with these rights is small.

For 2005/06 changes were made in the way the surface water balance was prepared for the Kiewa and Murray basins. In presenting the Kiewa basin, the 2004/05 report separately reported the Victorian and New South Wales share of inflows and combined the outflows. This year's report presents inflows as a consolidated volume and splits the outflows.

In presenting the Murray basin, the 2005/06 approach differed from that adopted in the 2004/05 in several respects. In 2005/06 inflows to Lake Victoria were not recorded as inflows to the Murray basin since those flows are actually transfers from elsewhere within the basin. Furthermore, a release to the Murray via the Snowy hydro-electric scheme was included as an inflow or transfer to the basin as it is consistent with the water balance protocols established in the methodology.

5.7 Small catchment dams

As in 2004/05, small catchment dam information was sourced from the Department of Sustainability and Environment's Sustainable Diversion Limit database and the Flow Stress Ranking project. Farm dams filled by domestic and stock channel runs, such as in the Wimmera region, have been excluded.

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*), but for which registration has not yet been completed. When registration is completed, registered dams will be included as part of the unregulated licences category in future water accounts.

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, 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.

5.8 Volume diverted

Water authorities have an obligation to report on water use against their entitlements in their annual reports. These annual reports can be found on each water authority's web-site. The state water accounts present:

- the volume of surface water diverted from rivers relative to the volume in each bulk entitlement conversion order. Licensed diversions on regulated streams are reported as part of bulk entitlements. Licensed diversions on unregulated streams are reported as a separate line item in each basin.

- the volume of groundwater extracted relative to licensed volume for a groundwater management area or water supply protection area. This is reported at the scale of each aquifer and not at the individual licence holder level, which is assessed separately by water authorities.

Where a bulk entitlement was not finalised prior to 1 July 2006, compliance against that entitlement has not been assessed in the 2005/06 water accounts and will be presented in subsequent water accounts.

5.9 Water for the environment

Information set out in this report on water for the environment was obtained from a number of sources. These include:

- annual reports prepared by catchment management authorities and Melbourne Water
- discussion with representatives of catcment management authorities
- responses to questionnaires sent to water authorities with responsibilities for meeting passing flow requirements under their bulk entitlements
- streamflow management plan annual reports prepared by Melbourne Water
- information held by the Department of Sustainability and Environment's River Health division.

Information on whether water authorities had met passing flow requirements was not uniformly reported, and in some instances compliance could not be fully reported as necessary metering and instrumentation were not in place during 2005/06.

5.10 Comparison of the water accounts with other data sources

The state water accounts for 2005/06 have been prepared using readily available information. Water accounts for parts of Victoria are also published in the Murray-Darling Basin Commission Independent Audit Group's report on extraction cap compliance and other reports. Some of these documents were not finalised at the time of preparation of the water accounts and as a consequence 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 authorities present information individually in each of their annual reports. It is important to note when comparing the water accounts with these annual reports that the water authority only reports on its area of jurisdiction. For example, Goulburn-Murray Water and Lower Murray Water only report on water trading that they have each processed, and it is only by presenting the sum of trade processed by these two authorities 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 Department of Sustainability and Environment is not responsible for the results of any actions taken on the basis of information in this report, nor for any errors or omissions.

6 Murray basin (Victoria)

Table 6-1 Key features of the Murray basin (Victoria), 2005/06

- Rainfall was 80-100% of long term average, with inflows below long term average at 63%.
- Victoria' share of the basin's storages increased by 400,000 ML during the year.
- Irrigators were allocated 82% of their water entitlement at the beginning of the season, increasing to 144% (gravity irrigation) and 114% (pumped irrigation).
- No bans or restrictions on groundwater use were applied.
- 52% of the volume of wastewater in the basin was recycled.

6.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall in the Murray basin ranged between 80% and 100% of the long term average, as was the case in the previous two years. Inflows were 63% of the long term average (7,000,000 ML), an improvement on both 2004/05 (51%) and 2003/04 (58%).

6.2 Responsibilities for management of water resources

The Murray-Darling Basin Commission (MDBC) is responsible for managing the water resources of the Murray system on behalf of Victoria, New South Wales and South Australia under the Murray-Darling Basin Agreement. Under the agreement, Victoria shares the volume 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 Murray-Darling Basin 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 holders from Victoria's share of the water supply storages in the Murray basin.

6.3 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 6-3. 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, as well as outflows from other Victorian rivers (Ovens, Broken, Goulburn, Campaspe, Loddon) into the River Murray.

Victoria's share of the flow in the River Murray to South Australia, including from Lindsay River, was 1,471,000 ML in 2005/06.

Planning and design of the Robinvale high pressure system was undertaken by Lower Murray Water during 2005/06. The system will replace the current open channel irrigation infrastructure in the Robinvale Irrigation System with a high pressure pipeline. Lower Murray Water is anticipating the project to be completed by 2012 and provide estimated water savings of 1,500 ML per annum.

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

Table 6-2 shows the responsibilities of various authorities within the Murray basin (Victoria).

Table 6-2 Responsibilities for water resources management within the Murray basin (Victoria), 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Murray Darling Basin Commission				Jointly co-ordinates waterway management along the River Murray
River Murray Water				Operation of River Murray supply system
Department of Sustainability and Environment				Co-ordinate Victoria's input to resource management associated with the River Murray.
State Water New South Wales				Lake Hume, Euston Weir and the Menindee Lakes on behalf of River Murray Water
South Australian Water Corporation				Lake Victoria and several locks on behalf of River Murray Water
Goulburn-Murray Water	Murray Valley, Torrumbarry, Woorinen, Tresco and Nyah	Groundwater and surface water private diversions on the Victorian side of the River Murray basin to Nyah		Lake Dartmouth, Yarrawonga Weir (Lake Mulwala), Torrumbarry Weir and Mildura Weir on behalf of River Murray Water
Lower Murray Water	Red Cliffs, Robinvale and Merbein	Groundwater and surface water private diversions in Sunraysia region	Towns along the River Murray from Swan Hill to the South Australian border including Robinvale and Mildura	
First Mildura Irrigation Trust	FMIT district			
North East Water			Towns upstream of Lake Mulwala, including Yarrawonga	
Goulburn Valley Water			Towns in the Murray Valley Irrigation Area	
Coliban Water			Echuca and towns in the Torrumbarry Irrigation Area	
East Gippsland Water			Omeo and Dinner Plain	
GWMWater			Towns and farms for domestic and stock water in the Northern Mallee area	
North East Catchment Management Authority				Waterways within the North East CMA area
Mallee Catchment Management Authority				Waterways within the Mallee CMA area

6.4 Location of water resources

Figure 6-1 Map of the Murray basin (Victoria)

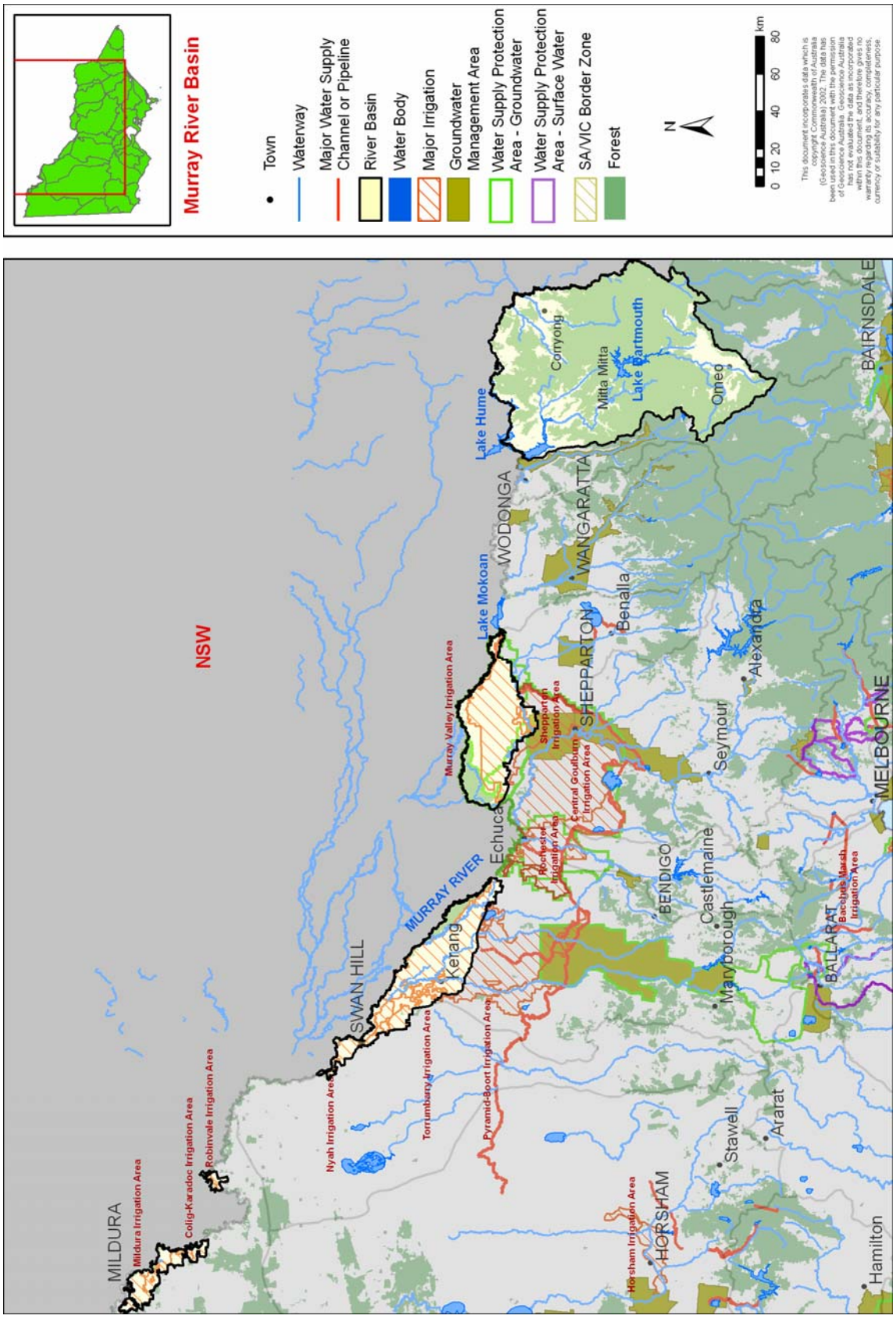


Table 6-3 Summary of total water resources and water use in the Murray basin (Victoria), 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	4,517,100	1,616,000
Groundwater[1]	Not available	Not available
Recycled water	11,020	5,700

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

6.5 Surface water resources

6.5.1 Water balance

A surface water balance for the Murray basin (Victoria) is shown in Table 6-4.

Only on-stream storages greater than 1,000 ML capacity have been included in the water balance. In the Murray basin, this includes Victoria's share of Lake Hume, Lake Dartmouth, Lake Cullulleraine, Lake Victoria and the Menindee Lakes. Changes in other storage volumes are incorporated into the in-stream loss term in the water balance.

Table 6-4 Balance of surface water in the Murray basin (Victoria)

Water account component	2005/06 (ML)[1]	2004/05 (ML)[1][2]
Major on-stream storage		
Volume in storage at start of year	1,976,100	1,776,300
Volume in storage at end of year	2,376,400	1,944,300
Change in storage	**400,300**	**168,000**
Inflows		
Catchment inflow[3]	4,394,300	3,569,900
Spills from NSW share of storage	0	0
Return flow from irrigation	117,500	151,100
Treated wastewater discharged back to river	5,320	6,470
Sub-total	**4,517,100**	**3,727,500**
Usage		
Urban diversions	40,940	41,630
Irrigation district diversions	1,241,900	1,201,200
Licensed private diversions from unregulated streams	14,000	5,000
Licensed private diversions from regulated streams	251,600	246,100
Environmental water diversions[4]	61,100	28,400
Small catchment dams	6,500	6,500
Sub-total	**1,616,000**	**1,528,800**
Losses		
Net evaporation losses from major storages[5]	151,200	256,000
Evaporation from small catchment dams	1,100	1,100
In-stream infiltration to groundwater, flows to floodplain and evaporation[6]	290,100	329,400
Sub-total	**442,400**	**586,500**
Water passed at outlet of basin		
River Murray flow to South Australia from Victoria's allocation	1,471,000	955,000
Spills to NSW share of storages	542,000	381,900
Ceding to NSW storages per Murray-Darling Basin Agreement	45,400	107,300

Notes:

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

(2) Some of the 2004/05 figures in this table differ from those published in the State Water Report 2004/05 because of changes in the methodology of water accounting in the Murray basin. See Chapter 5 for details.

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

(4) Includes donated water as well as environmental Water Reserve diversions. Does not include environmental diversions under surplus flow conditions.

(5) Evaporation reported in the 2004/05 State Water Report included was calculated using gross evaporation, rather than net evaporation. The 2004/05 evaporation volume has been amended in Table 6-4.

(6) Value estimated via back-calculation based on the difference between inflows and outflows. Includes environmental diversions under surplus flow conditions.

6.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available. The values provided in Table 6-5 are based on the estimated average annual impact.

Table 6-5 Small catchment dam information, 2005/06

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

6.5.3 Water entitlement transfers

Water entitlement transfers in the Murray basin include transfers within the basin, transfers to other basins within Victoria and interstate transfers.

A summary of interstate transfer of entitlement with New South Wales and South Australia is shown in Table 6-6, whilst a summary of the transfer of entitlements within the Murray basin (Victoria) is shown in Table 6-7.

Approximately 3,560 ML of water entitlement was permanently transferred from Victoria to interstate. Conversely, more than 27,500 ML of entitlements were transferred on a temporary basis into Victoria from interstate.

Trades within Victoria resulted in a net import of permanent water entitlements to the Murray basin totalling 15,225 ML and a net export of 12,901 ML of temporary entitlements to other basins.

Table 6-6 Interstate transfer of entitlements in the Murray basin (Victoria)

Entitlement	Net transfer to NSW (ML)	Net transfer to SA (ML)	Net transfer to interstate (ML)
Permanent transfer of water right and sales	970	2,590	3,560
Temporary transfer of water right and sales	-29,610	2,020	-27,590
Total transfers 2005/06	**-28,640**	**4,610**	**-24,030**
Total transfers 2004/05	**-1,940**	**15,540**	**13,600**

Table 6-7 Transfer of entitlements in the Murray basin (Victoria)

Entitlement	Permanent entitlement transfer				Temporary entitlement transfer			
	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)
Goulburn Valley Water								
River Murray	174	0	1	174	174	174	2	0
North East Water								
River Murray	260	0	5	260	0	557	3	-557
Grampians Wimmera Mallee Water								
River Murray	0	0	0	0	0	0	0	0
FMIT								
FMIT - Water right	87	87	0	0	2,063	6,605	n/a	-4,542
FMIT - Sales					0	0	0	0
Goulburn Murray Water								
Murray Valley - Water right	398	1,573	20	-1,175	26,011	19,743	1,036	6,268
Murray Valley – Sales					4,504	5,233		-729
Kerang-Cohuna - Water right	216	5,602	44	-5,386	49,495	18,290	1,334	31,205
Kerang-Cohuna - Sales					5,807	5,089		718
Swan Hill - Water right	115	1,328	18	-1,213	6,654	9,008	570	-2,354
Swan Hill – Sales					1,757	3,559		-1,802
Woorinen - Water right	0	349	5	-349	491	1,628	110	-1,137
Woorinen – Sales					73	721		-648
Nyah - Water right	30	107	11	-77	260	2,022	111	-1,762
Nyah - Sales					0	0		0
Tresco - Water right	0	156	6	-156	710	942	81	-232
Tresco - Sales					121	0		121
Mitta Mitta - Water right	100	190	3	-90	230	1,546	22	-1,316
Mitta Mitta - Sales					0	0		0
River Murray - Water right	22	968	15	-946	5,066	13,138	305	-8,072
River Murray - Sales					695	474		221
Lower Murray Water								
River Murray - Lower Murray Water	32	0	2	32	0	0	0	0
River Murray - Sunraysia Water	32,498	8,347	352	24,151	37,741	66,024	974	-28,283
Minister for the Environment								
River Murray - Flora & Fauna	0	0	0	0	0	0	0	0
Total 2005/06	**33,931**	**18,706**	**482**	**15,225**	**141,852**	**154,753**	**4,548**	**-12,901**
Total 2004/05	**38,156**	**25,229**	**n/a**	**12,927**	**188,823**	**178,532**	**n/a**	**10,291**

n/a: information not available

6.5.4 Volume diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 6-8.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Goulburn-Murray Water. Compliance with individual bulk entitlement volumes is deemed to occur in Table 6-8 if water use is not more than the maximum volume allowed to be diverted in 2005/06.

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 2005/06 (ML)	Volume diverted 2005/06 (ML)	Entitlement volume compliance?(1)
East Gippsland Water					
Omeo	n/a	n/a	0	61	n/a
Coliban Water					
River Murray	1	6,285	0	4,964	Yes
Goulburn Valley Water					
River Murray	1	5,043	0	4,797	Yes
North East Water					
River Murray	1	12,792	-557	9,930	Yes
GWMWater					
River Murray	1	3,242	0	3,121	Yes
FMIT					
River Murray	1	82,097	-4,542	50,985	Yes
Goulburn-Murray Water					
River Murray	1	1,585,000	20,481	1,144,264	Yes
Lower Murray Water					
River Murray - Lower Murray Water	1	30,433	0	21,186	Yes
River Murray - Sunraysia Water	1	392,726	-28,283	295,075	Yes
Minister for the Environment					
River Murray - Flora and Fauna(2)	1	27,600	0	61,130	No
River Murray – Snowy Environmental Reserve	1	14,362	0	0	Yes
Total annual volume of bulk entitlements 2005/06		**2,159,580**	**-12,901**	**1,595,514**	
Total annual volume of bulk entitlements 2004/05		**1,726,614**	**10,291**	**1,517,345**	
Licensed diversions from unregulated streams 2005/06(3)		*21,476*		*13,959*	
Licensed diversions from unregulated streams 2004/05		*12,542*		*5,000*	

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 MDBC's Water Audit Monitoring Report 2005/06.

(2) Water diverted exceeded the bulk entitlement volume as surplus water was made available to River Murray Water from surplus flow, Snowy Water savings, and donated water from the Sunraysia region.

(3) The difference in licensed diversions from unregulated streams in 2005/06 compared to 2004/05 is because of improved methodology.

n/a: information not available.

6.6 Groundwater resources

Licensed groundwater entitlements and use for the Kialla GMA and Katunga and Shepparton WSPAs are shown in Table 6-9.

In February 2006 the level of the Katunga WSPA was below average and falling.

Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 6-9 Compliance with licensed groundwater volumes, Murray basin (Victoria) 2005/06

Water supply protection area/Groundwater management area[1]	GMA/WSPA depth limits (m)[2]	Allocation limit (ML/year)[3]	Licensed entitlement allocated (ML/year)[4]	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Kialla GMA (8%)[5]	>25	4,770	2,332	0	1,062	1,062	816
Katunga WSPA (81%)	>25	59,770	42,487	21,610	0	21,610	26,220
Shepparton WSPA (32%)	≤25	244,226	224,226	62,750	0	62,750	79,820

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) The Kialla GMA has been reported on a consolidated basis, incorporating Kialla zones 1 and 2.

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, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Kialla GMA	23	46
Katunga WSPA	593	1,186
Shepparton WSPA[3]	1,373	2,746

Notes:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in Table 6-9.

(2) The number of domestic and stock bores represents bores registered in the state database records as being drilled since 1965.

(3) Number of bores has been revised by Goulburn-Murray Water from 2004/05.

Groundwater is used to provide urban water supply to a number of towns in the Murray basin. The licensed entitlements and metered use for these supplies is presented in Table 6-11.

Table 6-11 Urban groundwater usage

Town supplied	Licensed allocation (ML)	Metered use 2005/06	Metered use 2004/05
Barnawartha	293	98	83
Dinner Plain	60	61	61
Katunga	110	50	47
Strathmerton	730	13	130

6.7 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 6-12.

No bans or restrictions were imposed on groundwater extraction in the Murray basin during 2005/06.

Table 6-12 Seasonal allocations and restrictions on water use in Murray basin (Victoria), 2005/06

Type of restriction	Area	Nature of restriction
Urban	Murray system (Cohuna, Echuca, Gunbower, Leitchville)	Stage 1 from July 2005 to June 2006
Licensed diversions from unregulated streams	Sandy Creek, Lockharts Creek	Irrigation ban from February to June 2006
Irrigation	Murray system (gravity)	82% of water right and licence volume from July 2005, increasing to 144% in April 2006
	Murray System (pumped)	82% of water right and licence volume from July 2005, increasing to 114% in April 2006

6.8 Recycled water

Around 52% of the volume of wastewater that passed through treatment plants in the basin was recycled for consumptive use (Table 6-13), mostly for agricultural purposes. This represents a 10% increase on the proportion recycled from 2004-05, due mainly to increased reuse at the Echuca Treatment Plant.

Table 6-13 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Bellbridge	36	36	100%	0	36	0	0	0	0
Bundalong	0	0	0%	0	0	0	0	0	0
Cobram	401	401	100%	0	401	0	0	0	0
Cohuna	0	0	0%	0	0	0	0	0	0
Corryong	106	94	88%	0	94	0	0	13	0
Dartmouth	7	0	0%	0	0	0	0	7	0
Echuca	1,038	1,038	100%	0	1,038	0	0	0	0
Gunbower / Leitchville[4]	0	0	0%	0	0	0	0	0	0
Koondrook	51	0	0%	0	0	0	0	0	51
Koorlong	1,175	1,175	100%	0	1,175	0	0	0	0
Lake Boga[4]	32	0	0%	0	0	0	0	0	32
Merbein	12	12	100%	0	12	0	0	0	0
Mildura	1,787	1,787	100%	0	1,787	0	0	0	0
Nathalia	63	63	100%	0	63	0	0	0	0
Numurkah	167	167	100%	0	167	0	0	0	0
Nyah/Nyah West	51	0	0%	0	0	0	0	0	51
Omeo	20	20	100%	0	20	0	0	0	0
Red Cliffs	147	147	100%	147	0	0	0	0	0
Robinvale	194	194	100%	0	194	0	0	0	0
Strathmerton[4]	0	0	0%	0	0	0	0	0	0
Swan Hill	1,344	0	0%	0	0	0	0	0	1,344
Tallangatta	126	126	100%	0	126	0	0	0	0
Wodonga	3,982	156	4%	156	0	0	0	3,826	0
Yarrawonga	282	282	100%	0	282	0	0	0	0
Total 2005/06	**11,021**	**5,698**	**52%**	**303**	**5,395**	**0**	**0**	**3,845**	**1,477**
Total 2004/05	**12,196**	**5,649**	**46%**	**453**	**5,196**	**0**	**0**	**3,891**	**2,537**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

(4) Treatment plants at Lake Boga, Gunbower/Leitchville and Strathmerton were inadvertently omitted from the 2004/05 State Water Report.

6.9 Water for the environment

6.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Murray basin (Victoria) EWR comprised the following components:

- the River Murray Flora and Fauna Reserve Bulk Entitlement of 27,600 ML held by the Minister for the Environment
- the Barmah-Millewa Forest Environmental Water Allocation (EWA)
- passing flows released by North East Water as a condition of its consumptive bulk entitlements and River Murray Water as a condition of the Murray Darling Basin Agreement
- surplus River Murray flows of 25,093 ML
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

6.9.2 Entitlements for the environment

The formal entitlements for the environment in the Murray basin in 2005/06 comprised the following:

- the River Murray Flora and Fauna Reserve Bulk Entitlement of 27,600 ML held by the Minister for the Environment. In 2005/06 some 61,130 ML was released, which included surplus water made available to River Murray Water from surplus flow, Snowy Water savings, and donated water from the Sunraysia region
- the EWA for watering the Barmah-Millewa Forest. In 2005/06 the largest release of water for the environment in Australia's history of 513,000 ML was drawn from the EWA account. The release flooded the lower 50% of the Barmah-Millewa wetlands which are listed as wetlands of international significance under the Ramsar convention. Over 55% of the wetland system was flooded which triggered extensive breeding in the native fish, frogs and waterbirds and a number of White-bellied Sea Eagles. The flooding also achieved regeneration of natural grasses. As at 30 June 2006, the EWA account held 6,000 ML for Victoria and 44,000 ML for New South Wales.

6.9.3 Compliance with passing flow requirements

Table 6-14 shows the passing flow requirements in the River Murray Flora and Fauna bulk entitlement.

Table 6-14 Passing flow requirements 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 the Environment
	Compliance point	Not applicable
	Passing flow rules	Lindsay River dilution water: less than 91.3 GL/year Barmah-Milewa Forest Water: high security entitlement 50 GL/year; lower security entitlement 25 GL/year

North East Water reported that it met all passing flow requirements under its bulk entitlements in 2005/06.

6.9.4 Water leaving the basin

The Victorian Component of water flowing from the Murray basin was 1,471,000 ML in 2005/06. This represents 33% of the total inflows into the basin, compared to 27% in 2004/05. This water comprises consumptive water that was not used under entitlements, traded water, and the EWR (environmental entitlement, passing flows, and any water above cap).

Important environmental assets depend on the EWR in the Murray basin. The Barmah-Millewa Forest, Gunbower Forest and Kerang Wetlands are located along the River Murray and are all internationally significant wetlands listed under the Ramsar convention. These sites rely on the freshwater inputs from the River Murray for their ecological functioning.

6.10 Murray basin summary

The availability of water in the Murray basin increased in 2005/06 compared to 2004/05 due to increased inflows in the upper part of the Murray basin. The annual flows, however, remained below average. Victoria's share of the Murray storages increased by 400,000 ML during the year and allocations to Victoria's Murray-supplied irrigation systems increased from 100% in 2004/05 to 144% (gravity districts) and 114% (pumped districts) in 2005/06. Urban customers in towns supplied by the Murray (for example Swan Hill and Mildura) experienced little or no restrictions on use. This was in contrast to the situation in many of the Victorian basins that flow into the Murray (for example the Campaspe) where inflows, outflows and allocations fell.

Significant volumes of water were used for environmental purposes in the Murray basin in 2005/06. Some 513,000 ML was released during the spring and early summer months under the Barmah-Millewa Forest EWA account. This flooded the lower 50% of the Barmah-Millewa wetlands which are listed as wetlands of international significance under the Ramsar convention.

In addition, 61,130 ML was released under the River Murray Flora and Fauna entitlement as well as water made available to River Murray Water from surplus flow, Snowy Water savings, and donated water from the Sunraysia region.

7 Kiewa basin

Table 7-1 Key features of the Kiewa basin, 2005/06

- Rainfall across the basin was 80-100% of the long term average, and inflows were 97% of the long term average.
- 97% of total inflows left the basin at the River Murray.
- Storage volume increased slightly during the year from 28% of capacity at the start of the year to 29% at the end of 2005/06.

7.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall in the Kiewa basin ranged between 80% and 100% of the long term average, in line with the previous two years. Inflows were almost identical to those estimated in the previous two years and were close to the long term average (697,000 ML).

7.2 Responsibilities for management of water resources

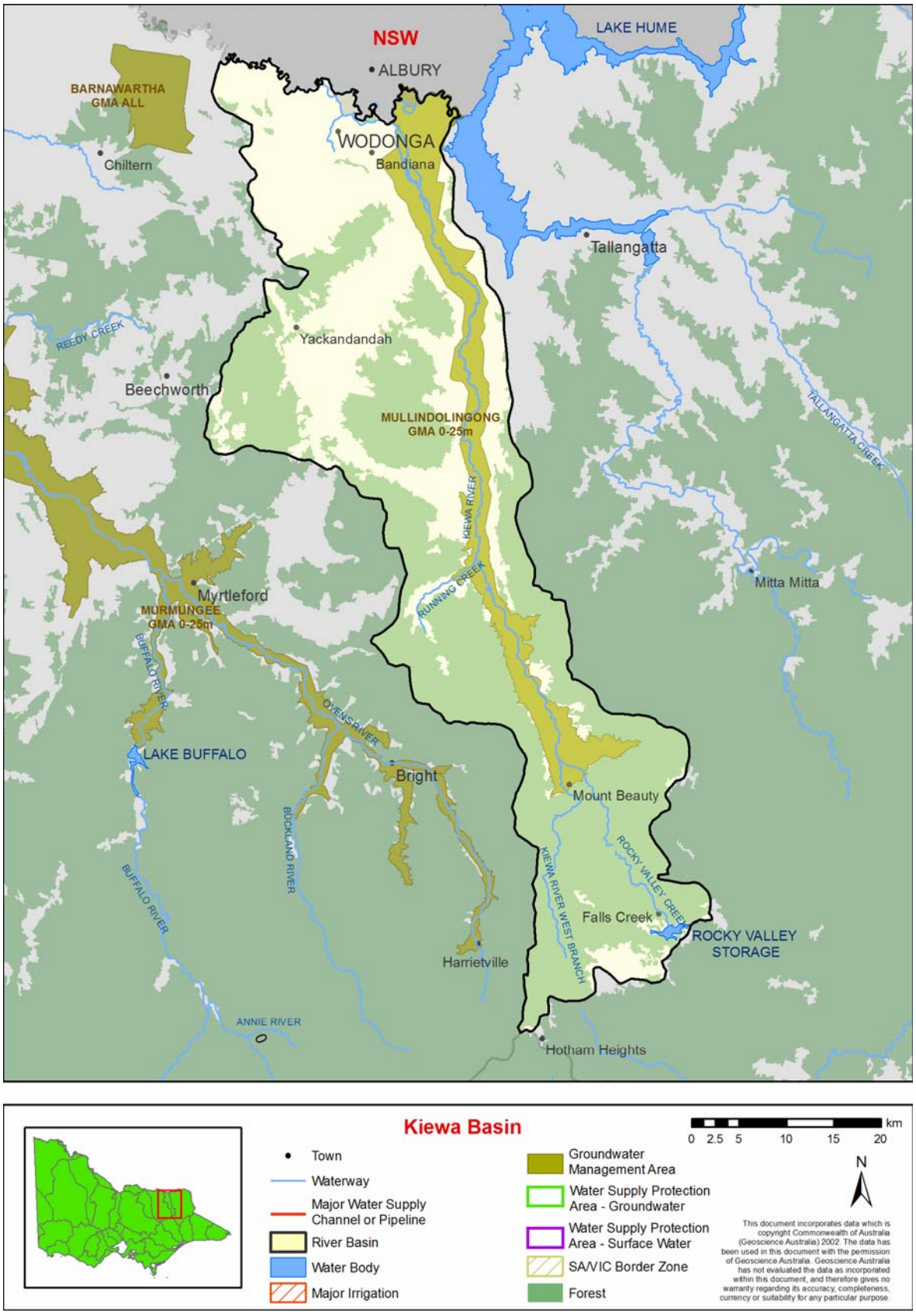
Table 7-2 shows the responsibilities of various authorities within the Kiewa basin.

Table 7-2 Responsibilities for water resources management within the Kiewa basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Goulburn-Murray Water		Groundwater and surface water private diversions		
North East Water			Across the whole basin, including Wodonga and Mount Beauty	
AGL Hydro				Reservoirs in the upper parts of the Kiewa basin for hydropower operations Obligation to meet passing flow requirements
North-East Catchment Management Authority				Waterway management for the whole of the Kiewa basin

7.3 Location of water resources

Figure 7-1 Map of 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 7-3. Only a small proportion of the surface and groundwater resources in the Kiewa basin was extracted for consumptive use.

Construction of the Wodonga Huon Hill Clear Water Storage commenced under the management of North East Water. The covered clear water reservoir will increase storage capacity by 14 ML.

In 2005/06 the Alpine Resorts Commission constructed a 27 ML storage at Mt Hotham. Once wastewater treatment facilities are completed, this storage will be used to store recycled water for snowmaking during winter. This will reduce diversions from Swindlers Creek (a tributary of the Mitta Mitta River) by 90 ML per annum. It will also eliminate the discharge of 90 ML of secondary treated effluent into the Dargo River (located in the Mitchell basin).

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

Table 7-3 Summary of total water resources and water use in the Kiewa basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	657,600	14,000
Groundwater	7,000	700
Recycled water	230	140

7.5 Surface water resources

7.5.1 Water balance

A surface water balance for the Kiewa basin is shown in Table 7-4.

Only those storages greater than 1,000 ML capacity have been included in the water balance. In the Kiewa basin these include Rocky Valley Reservoir and Lake Guy. Although hydropower utilises a significant volume of surface water in the Kiewa basin, this use is non-consumptive and is not included in the surface water balance. Storages in the Kiewa basin increased by 1% during 2005/06 to 29% of capacity at year end.

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

Table 7-4 Balance of surface water in the Kiewa basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	7,700	9,100
Volume in storage at end of year	8,300	7,700
Change in storage	**600**	**-1,400**
Inflows		
Catchment inflow [1]	657,500	648,600
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	100	180
Sub-total	**657,600**	**648,800**
Usage		
Urban diversions	660	580
Licensed private diversions from unregulated streams	9,400	5,100
Small catchment dams	3,900	3,900
Sub-total	**14,000**	**9,600**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams	1,100	1,100
In-stream infiltration to groundwater, flows to floodplain and evaporation[2]	4,100	4,200
Sub-total	**5,200**	**5,300**
Water passed at outlet of basin		
Kiewa basin outflow to River Murray – Victoria share[1]	318,900	317,650
Kiewa basin outflow to River Murray – NSW share[1]	318,900	317,650

Notes:

(1) Inflows have been back-calculated from outflows plus diversions. In the 2004/05 State Water Report, inflows were split between Victoria and NSW. The 2005/06 State Water Report has presented inflows as a consolidated volume and split the outflows.

(2) Losses estimated using loss functions from the Kiewa River REALM model.

7.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 7-5 below are based on the estimated average annual impact.

Table 7-5 Small catchment dam information, 2005/06

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

7.5.3 Water entitlement transfers

A summary of the transfer of entitlements within the Kiewa basin is shown in Table 7-6. All trades were of a temporary nature and were traded within the basin.

Table 7-6 Transfer of entitlements in the Kiewa basin

Entitlement[1]	Permanent entitlement transfer				Temporary entitlement transfer			
	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)
Licensed diversions from unregulated streams	0	0	0	0	640	640	24	0
Total 2005/06	**0**	**0**	**0**	**0**	**640**	**640**	**24**	**0**
Total 2004/05	**0**	**0**	**n/a**	**0**	**640**	**640**	**n/a**	**0**

Notes:

(1) Entitlements for which no trades were recorded are not shown.

n/a: information not available

7.5.4 Volume diverted

The volume of water diverted under North East Water and AGL Hydro Limited's bulk water entitlements is shown in Table 7-7.

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 2005/06.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Goulburn-Murray Water.

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

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)	Entitlement volume compliance?
North East Water					
Kiewa - Tangambalanga	1	179	0	0	Yes
Mount Beauty - Tawonga	1	719	0	446	Yes
Yackandandah	1	202	0	188	Yes
AGL Hydro Ltd					
Bogong Village	1	50	0	25	Yes
Kiewa - Southern Hydro Ltd[1]	0	0	0	0	Yes
Total annual volume of bulk entitlements 2005/06		**1,150**	**0**	**659**	
Total annual volume of bulk entitlements 2004/05		**1,150**	**-30**	**578**	
Licensed diversions from unregulated streams 2005/06		*14,475*		*9,400*	
Licensed diversions from unregulated streams 2004/05		*12,667*		*5,100*	

(1) The Kiewa – Southern Hydro Ltd bulk entitlement held by AGL Hydro Ltd is for non-consumptive purposes and therefore volumes have not been included.

7.6 Groundwater resources

Licensed groundwater entitlements and use for the Mullindolingong GMA in the Kiewa basin, excluding domestic and stock use, are shown in Table 7-8.

Table 7-8 Compliance with licensed groundwater volumes, Kiewa basin 2005/06

Water supply protection area/Groundwater management area[1]	GMA/WSPA depth limits (m)[2]	Allocation limit (ML/year)[3]	Licensed entitlement allocated (ML/year)[4]	Metered use (ML)	Estimated use in unmetered bores (ML)[5]	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Mullindolingong GMA (97%)	≤25	6,980	1,285	0	514	514	450

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) In non-metered areas, Goulburn-Murray Water has provided an estimate of use.

An estimate of domestic and stock groundwater use is provided in Table 7-9.

Table 7-9 Number of domestic and stock bores and estimated use, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Mullindolingong GMA[3]	77	154

Notes:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in Table 7-8.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

(3) The number of domestic and stock bores in the 2004/05 State Water Report was incorrectly reported as 385, with an estimated use of 770 ML. The correct number of bores in 2004/05 was 78, with an estimated use of 156 ML.

7.7 Seasonal allocations and restrictions on water use, diversions and extractions

There were no urban restrictions in the Kiewa basin in 2005/06.

No bans or restrictions were imposed on groundwater licensed diversions in the Kiewa basin during 2005/06.

Table 7-10 Seasonal allocations and restrictions on water use in Kiewa basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban		No restrictions
Licensed diversions on unregulated streams	Sheepwash Creek (tributary of Hellhole Creek), Middle Creek	Irrigation ban from February to June 2006

7.8 Recycled water

There are four wastewater treatment plants in the Kiewa basin: three operated by North East Water and the Dinner Plain treatment plant operated by East Gippsland Water. The proportion of wastewater treated and recycled increased from 37% in 2004/05 to 60% in 2005/06 due to an increase in the proportion recycled at the Yackandandah treatment plant (Table 7-11).

Table 7-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Baranduda[4]	0	0	0%	0	0	0	0	0	0
Dinner Plain[4]	42	42	100%	0	42	0	0	0	0
Mount Beauty	100	5	5%	0	5	0	0	95	0
Yackandandah	93	93	100%	0	93	0	0	0	0
Total 2005/06	**235**	**140**	**60%**	**0**	**140**	**0**	**0**	**95**	**0**
Total 2004/05	**284**	**104**	**37%**	**0**	**104**	**0**	**0**	**180**	**0**

Notes:

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

(2) Water that is reused in sewage treatment processes, e.g. backflushing of filters.

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

(4) Dinner Plain and Baranduda treatment plants were inadvertently omitted from the 2004/05 State Water Report.

7.9 Water for the environment

7.9.1 Environmental Water Reserve (EWR)

In 2005/06 the environmental Water Reserve in the Kiewa basin comprised the following components:

- passing flows released as a condition of bulk entitlements held by North East Water and AGL Hydro Limited
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

7.9.2 Compliance with passing flow requirements

Table 7-12 shows the passing flow requirements in the Kiewa basin for one 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.

Table 7-12 Selected passing flow requirements 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 Ltd) Conversion Transfer Order 1998
	Responsible authority	AGL Hydro Ltd
	Compliance point	Mount Beauty Regulating Pondage
	Passing flow rules	The lesser of 100 ML/day or the daily average of the natural inflow to the waterway recorded over the previous 7 days

North East Water and AGL Hydro both reported that they met all passing flow requirements under their bulk entitlements in 2005/06.

7.9.3 Streamflow management plans (SFMPs)

Technical studies and administrative processes are underway in preparation for the development of an SFMP for the Kiewa River.

7.9.4 Water leaving the basin

The amount of water flowing from the Kiewa basin into the River Murray was 637,800 ML in 2005/06. This includes the New South Wales share of Kiewa River flows under the Murray-Darling Basin Agreement. This represents 97% of the total inflows into the basin, compared to 98% in 2004/05. This water comprises consumptive water that was not used under entitlements, traded water and the EWR (passing flows and any water above cap).

Important environmental assets are dependent on water from the EWR in the Kiewa basin. The Barmah-Millewa Forest, Gunbower Forest and Kerang Wetlands are located along the River Murray and are all internationally significant wetlands listed under the Ramsar convention. These sites rely on the freshwater inputs from the Kiewa basin and River Murray for their ecological functioning.

7.10 Kiewa basin summary

Unlike most Victorian basins, inflows to the Kiewa basin did not fall significantly in 2005/06 and were close to average. Consumptive allocations in the Kiewa basin are very low compared with the average inflows. The Kiewa River is a major resource for the River Murray system.

8 Ovens basin

Table 8-1 Key features of the Ovens basin, 2005/06

- Storages fell from 74% of capacity at the beginning of the year to 32% at year end.
- Inflows to the basin were 84% of average.
- 97% of total inflows left the basin at the River Murray.

8.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall across the Ovens basin ranged between 80% and 100% of the long term average, which was consistent with rainfall recorded in 2004/05. Inflows in 2005/06 were 84% of the long term annual average (1,692,000 ML) compared to 89% in 2004/05 and 95% in 2003/04.

8.2 Responsibilities for management of water resources

Table 8-2 shows the responsibilities of various authorities within the Ovens basin.

Table 8-2 Responsibilities for water resources management within the Ovens basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Goulburn-Murray Water		Groundwater and surface water licensed diversions		Major reservoirs Lake Buffalo and Lake William Hovell Obligation to meet passing flow requirements
North East Water			Towns including Bright, Myrtleford, Beechworth and Chiltern	Obligation to meet passing flow requirements
North-East Catchment Management Authority				Waterway management for the whole of the Ovens basin

8.3 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 8-3. As consumptive allocations are low compared with inflows, only a small proportion of the surface water and groundwater resources in the Ovens basin 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.

8.4 Location of water resources

Figure 8-1 Map of the Ovens basin

Table 8-3 Summary of total water resources and water use in the Ovens basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	1,425,800	49,700
Groundwater	18,800	7,500
Recycled water	2,860	870

8.5 Surface water resources

8.5.1 Water balance

A surface water balance for the Ovens basin is shown in Table 8-4. Only those storages greater than 1,000 ML capacity have been included in the water balance. In the Ovens basin these include Lake Buffalo and Lake William Hovell. The volume in these two storages halved over the course of the year: at the end of the year 11,900 ML (32% of capacity) was in storage compared with 28,000 ML (74%) at the start.

The largest diversion of water from the basin was via licensed diversions from regulated and unregulated streams. These were around 50% more in 2005/06 than in 2004/05.

Table 8-4 Balance of surface water in the Ovens basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	28,000	25,100
Volume in storage at end of year	11,900	28,000
Change in storage	**-16,100**	**2,900**
Inflows		
Catchment inflow(1)	1,423,800	1,506,900
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	2,000	2,070
Sub-total	**1,425,800**	**1,509,000**
Usage		
Urban diversions	7,250	6,740
Licensed private diversions from regulated streams	13,200	9,800
Licensed private diversions from unregulated streams	13,300	6,900
Small catchment dams	15,900	15,900
Sub-total	**49,700**	**39,300**
Losses		
Net evaporation losses from major storages(2)	300	0
Evaporation from small catchment dams	4,500	4,500
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	9,400	9,400
Sub-total	**14,200**	**13,900**
Water passed at outlet of basin		
Ovens basin outflow to River Murray	1,378,000	1,452,900

Notes:

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

(2) Evaporation reported in the 2004/05 State Water Report included was calculated using gross evaporation, rather than net evaporation. The 2004/05 evaporation volume has been amended in Table 8-4; net evaporation is reported as zero when rainfall exceeds evaporation.

(3) This figure is the average annual loss from the Ovens River REALM model. It is used because insufficient data is available to readily calculate losses specific to 2005/06.

8.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 8-5 are based on the estimated average annual impact.

Table 8-5 Small catchment dam information, 2005/06

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

8.5.3 Water entitlement transfers

Transfers of water entitlements within the Ovens basin are listed in Table 8-6. North East Water made a number of temporary water entitlement transfers between its systems to manage water supplies and there was a small net temporary transfer into the basin under Goulburn-Murray Water's Ovens River bulk entitlement.

Table 8-6 Transfer of entitlements in the Ovens basin

Entitlement[1]	Permanent entitlement transfer				Temporary entitlement transfer			
	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)
North East Water								
Chiltern	0	0	0	0	64	0	1	64
Ovens River System	0	0	0	0	16	1	3	15
Goulburn-Murray Water								
Ovens River System	0	0	0	0	1,872	1,861	118	11
Total 2005/06	**0**	**0**	**0**	**0**	**1,952**	**1,862**	**122**	**90**
Total 2004/05	**383**	**433**	**n/a**	**-50**	**567**	**536**	**n/a**	**31**

Notes:

(1) Entitlements for which no trades were recorded are not shown.

n/a: information not available.

8.5.4 Volume diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 8-7.

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 2005/06.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Goulburn-Murray Water.

Table 8-7 Volume of water diverted under surface water entitlements in the Ovens basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML) (1)	Entitlement volume compliance?
North East Water					
Beechworth	1	1,100	0	610	Yes
Bright	1	704	0	700	Yes
Chiltern	1	180	64	244	Yes
Glenrowan	1	90	0	83	Yes
Harrietville	1	91	0	71	Yes
Porepunkah	1	166	0	160	Yes
Springhurst	1	36	0	35	Yes
Whitfield	1	34	0	34	Yes
Wangaratta	1	7,832	15	4,539	Yes
Myrtleford	2	1,212	0	774	Yes
Goulburn-Murray Water					
Ovens River System	1	24,200	11	13,162	Yes
Total annual volume of bulk entitlements 2005/06		**35,039**	**90**	**20,412**	
Total annual volume of bulk entitlements 2004/05		**3,613**	**31**	**16,555**	
Licensed diversions from unregulated streams 2005/06		*20,462*		*13,300*	
Licensed diversions from unregulated streams 2004/05		*17,180*		*6,900*	

Notes:

(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2005, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2005/06 period. The actual maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

8.6 Groundwater resources

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

Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts. The Ovens basin contains all of the Barnawartha GMA and the Murmungee GMA.

Table 8-8 Compliance with licensed groundwater volumes, Ovens basin 2005/06

Water supply protection area/ Groundwater management area[1]	GMA/ WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Barnawartha GMA (100%)	All depths	2,100	595	0	194	194	170
Murmungee GMA (100%)	≤25	16,710	12,012	0	4,717	4,717	4,127

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses.

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

(3) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) In non-metered areas, Goulburn-Murray Water has provided an estimate of use

An estimate of domestic and stock groundwater use is provided in Table 8-9.

Table 8-9 Number of domestic and stock bores and estimated use, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Barnawartha GMA	28	56
Murmungee GMA	1,285	2,570

Note:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in Table 8-8.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

Groundwater is used within the Ovens basin as a back-up urban water supply for the townships of 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 8-10.

Table 8-10 Urban groundwater usage

Town supplied	Licensed allocation (ML)	Metered use 2005/06	Metered use 2004/05
Moyhu[1]	15	0	0
Myrtleford	75	0	0
Springhurst	20	0	0
Wangaratta	150	83	0

Note:

(1) Moyhu was inadvertently omitted from the 2004/05 State Water Report.

8.7 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions on unregulated streams are shown in Table 8-11.

No bans or restrictions were imposed on groundwater extraction in the Ovens basin during 2005/06.

Table 8-11 Seasonal allocations and restrictions on water use in Ovens basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	Bright, Harrietville, Porepunkah and Wandiligong	Voluntary restrictions from February to April 2006
Unregulated diversions	Roberts Creek, Havilah Creek, Jackson Creek, Happy Valley Creek	Irrigation ban February to June 2006
	Hurdle Creek	Irrigation ban February to May 2006

8.8 Recycled water

Wastewater treatment plants in the Ovens basin are operated by North East Water. Approximately 30% of the wastewater that passed through treatment plants in the basin was recycled, a reduction from 37% in 2004/05. This was largely due to lower sales of recycled water to farmers (Table 8-12).

Table 8-12 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Barnawartha	25	25	100%	0	25	0	0	0	0
Beechworth	369	51	14%	0	51	0	0	318	0
Bright / Porepunkah	226	22	10%	22	0	0	0	205	0
Chiltern	57	57	100%	0	57	0	0	0	0
Myrtleford	275	0	0%	0	0	0	0	275	0
Rutherglen / Wahgunyah	254	254	100%	68	186	0	0	0	0
Wangaratta	1,656	456	28%	9	447	0	0	1,200	0
Total 2005/06	**2,863**	**865**	**30%**	**99**	**766**	**0**	**0**	**1,997**	**0**
Total 2004/05	**3,291**	**1,221**	**37%**	**115**	**1,105**	**0**	**0**	**2,070**	**1**

Notes:

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

(2) Water that is reused in sewage treatment processes, e.g. backflushing of filters.

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

8.9 Water for the environment

8.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Ovens basin EWR comprised the following components:

- passing flows released as a condition of consumptive bulk entitlements held by North East Water and Goulburn Murray Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

8.9.2 Compliance with passing flow requirements

Table 8-13 shows the passing flow requirements 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.

Table 8-13 Selected passing flow requirements in the Ovens basin

River	Passing flow	
Ovens River	Instrument where passing flows are specified	Bulk Entitlement (Bright) Conversion Order 2000
	Responsible authority	North East Water
	Compliance point	Bright diversion weir
	Passing flow rules	• When flow is less than 2 ML/day, the authority must pass the entire flow • When flow is between 2 and 3.6 ML/day, the authority must pass a minimum flow of 2 ML/day • When flow is between 3.6 and 39.5 ML/day, the authority must pass a minimum flow of 2 ML/day plus 20% of the total of flow less 3.6 ML/day. • When flow is 39.5 ML/day or greater, the authority must pass 9.5 ML/day
Buckland River	Instrument where passing flows are specified	Bulk Entitlement (Porepunkah) Conversion Order 1999
	Responsible authority	North East Water
	Compliance point	Porepunkah Pump Station
	Passing flow rules	• When flow is less than 2.6 ML/day, half the flow • When flow is 2.6 ML/day or greater, the entire flow, less 1.3 ML/day
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)
	Passing flow rules	• From November to May inclusive, the lesser of 20 ML/day or natural flow • From June to October inclusive, the lesser of 30 ML/day or natural flow

North East Water and Goulburn-Murray Water reported that they met all their passing flow requirements under their bulk entitlements in 2005/06.

8.9.3 Streamflow management plans (SFMPs)

Technical studies and administrative processes are underway in preparation for the development of a management plan for the Ovens River. The proposed plan will be a combined surface water and groundwater management plan. In 2005/06 further investigations were carried out to confirm the scope of the plan.

8.9.4 Water leaving the basin

The amount of water flowing from the Ovens basin into the River Murray was 1,378,000 ML in 2005/06. This represents 97% of the total inflows into the basin, compared to 96% in 2004/05. This water comprises consumptive water that was not used under entitlements, traded water and the EWR (passing flows and any water above cap).

Important environmental assets are dependent on water from the EWR in the Ovens basin. The Barmah-Millewa Forest, Gunbower Forest and Kerang Wetlands are located along the River Murray and are all internationally significant wetlands listed under the Ramsar convention. These sites rely on the freshwater inputs from the Ovens basin and River Murray for their ecological functioning.

8.10 Ovens basin summary

Storage levels fell in the Ovens basin despite rainfall and inflows that were close to average and consistent with conditions in 2003/04 and 2004/05. This reflected higher diversions from regulated and unregulated streams in 2005/06 compared with 2004/05 due to dry summer conditions.

As with the Kiewa basin, consumptive allocations in the Ovens basin are very low compared with the average inflows; 97% of the Ovens basin's inflows passed to the River Murray in 2005/06. Flows from the Ovens are an important resource for the River Murray system.

9 Broken basin

Table 9-1 Key features of the Broken basin, 2005/06

- Rainfall across the basin was 80-100% of the long term average, with overall inflows 79% of the long term average.
- Storages in the basin started and finished the year at about 30% of capacity.
- Irrigators on the Broken River were allocated 170% of their water entitlement.
- 51% of total inflows left the basin into the Goulburn and Murray basins.

9.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall across the Broken basin ranged between 80% and 100% of the long term average, and was less than the average rainfall recorded in 2004/05. Total inflows were 79% of the long term average (326,000 ML), and more than the 68% of average experienced in 2004/05.

9.2 Responsibilities for management of water resources

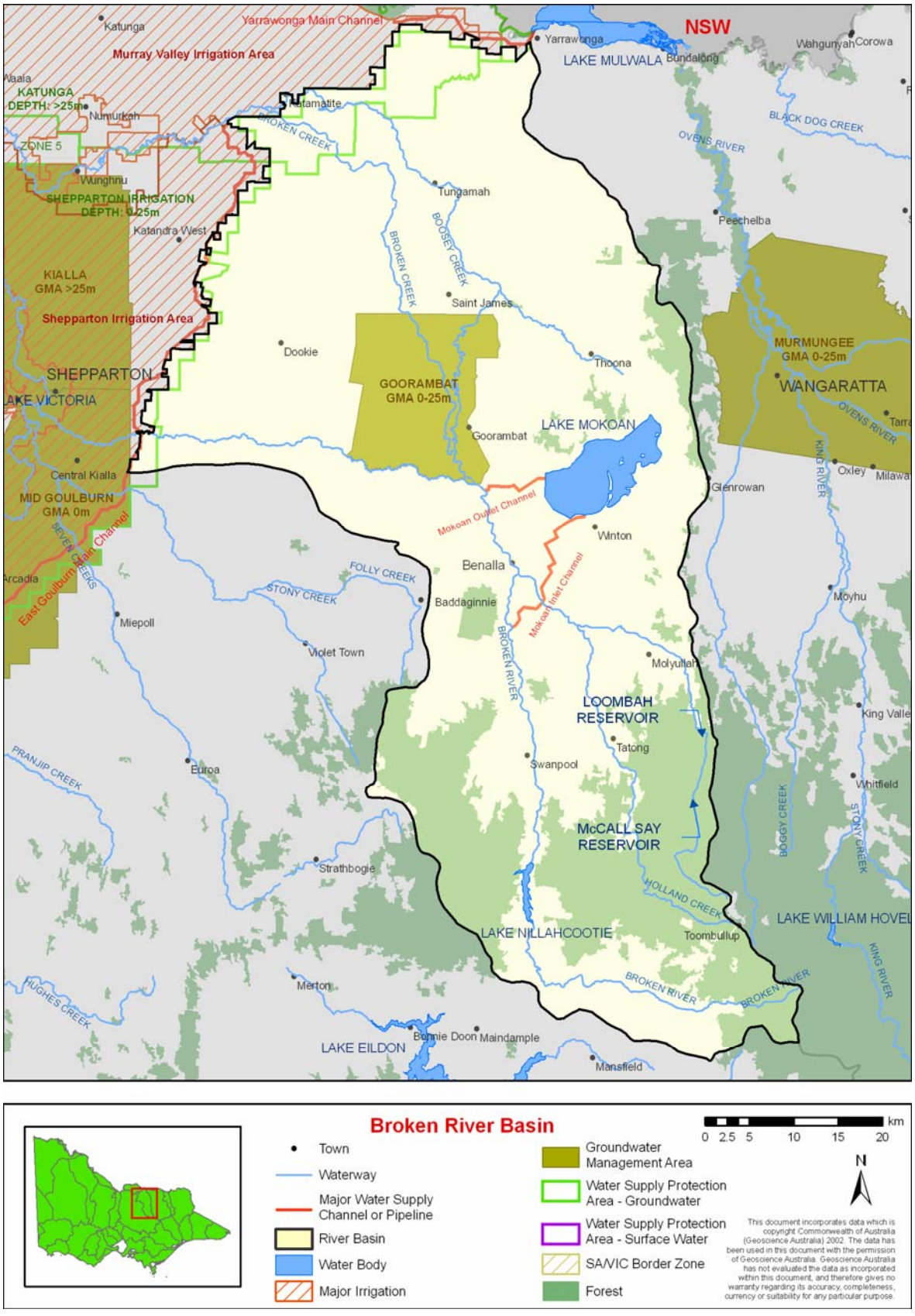
Table 9-2 shows the responsibilities of various authorities within the Broken basin.

Table 9-2 Responsibilities for water resources management within the Broken basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Goulburn-Murray Water	Tungamah domestic and stock supply system	Groundwater and surface water licensed diversions		Major reservoirs Lake Mokoan and Lake Nillahcootie Obligation to meet passing flow requirements
North East Water			Towns across most of the Broken basin, including Benalla and Glenrowan	Obligation to meet passing flow requirements
Goulburn Valley Water			Towns in the west of the basin, including Dookie	
Goulburn Broken Catchment Management Authority				Waterway management in the whole of the Broken basin

9.3 Location of water resources

Figure 9-1 Map of 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 9-3.

Two major projects are underway to increase water availability in the Broken basin. North East Water is constructing a 45 kilometre pipeline from Yarrawonga to Devenish to improve the security of supply for the townships of Tungamah, St James and Devenish. During 2005/06, the section of pipeline from St James to Devenish was completed and North East Water is aiming to have the remaining sections finalised by June 2007.

In a related project, Goulburn-Murray Water has replaced the open channel system that supplies Tungamah domestic and stock customers with 360 kilometres of pressurised pipelines. Water savings from this project will be up to 4,800 ML per annum. Approximately half of the pipeline was constructed in 2005/06 and the scheme was completed in March 2007.

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

Table 9-3 Summary of total water resources and water use in the Broken basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	257,500	43,300
Groundwater(1)	Not available	Not available
Recycled water	630	330

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

9.5 Surface water resources

9.5.1 Water balance

A surface water balance for the Broken basin is shown in Table 9-4. Note that only those storages greater than 1,000 ML capacity have been included in the water balance. This includes the combined urban system storages of McCall Say Reservoir and Loombah Weir on Ryans Creek, and the rural water storages of Lake Mokoan and Lake Nillahcootie.

The Broken basin was one of few basins to record an increase in storage levels in 2005/06, with 32% of capacity in storage at year end, compared with 30% at the start. This was mainly due to an increase in volume in Lake Mokoan.

Table 9-4 Balance of surface water in the Broken basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	123,200	110,700
Volume in storage at end of year	130,600	123,200
Change in storage	**7,400**	**12,500**
Inflows		
Catchment inflow(1)	257,200	220,400
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	310	190
Sub-total	**257,500**	**220,600**
Usage		
Urban diversions	1,850	1,790
Licensed private diversions from regulated streams(2)	21,900	16,100
Licensed private diversions from unregulated streams(3)	3,700	500
Small catchment dams	15,800	15,800
Sub-total	**43,300**	**34,200**
Losses		
Net evaporation losses from major storages(4)	49,900	37,900
Evaporation from small catchment dams	7,200	7,100
In-stream infiltration to groundwater, flows to floodplain and evaporation(5)	17,300	15,500
Sub-total	**74,400**	**60,500**
Water passed at outlet of basin		
Broken River at Gowangardie to Goulburn basin	121,500	94,900
Boosey Creek at Tungamah to Murray basin	8,300	14,900
Broken Creek at Katamatite to Murray basin	2,600	3,600

Notes:

(1) Inflows have been back-calculated from outflows plus diversions. The 2004/05 inflow figure has been adjusted per notes 2 and 3.

(2) Includes Tungamah domestic and stock system. The 2004/05 State Water Report inadvertently included diversions from unregulated streams in both the regulated and unregulated lines of the water balance, resulting in a double count. The 2004/05 diversions from regulated streams has been amended in Table 9-4.

(3) Licensed diversions from unregulated streams are derived from an estimate based on the total licensed volume of diversions. Goulburn-Murray Water's estimate of licensed volume increased from 2004/05 to 2005/06, resulting in the higher estimate of diversions in 2005/06.

(4) Evaporation reported in the 2004/05 State Water Report included was calculated using gross evaporation, rather than net evaporation. The 2004/05 evaporation volume has been amended in Table 9-4.

(5) 2005/06 loss data supplied by Department of Sustainability and Environment.

9.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 9-5 below are based on the estimated average annual impact.

Table 9-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	15,400	7,700	Not available
Registered commercial and irrigation	9,600	8,100	Not available
Total	**25,000**	**15,800**	**23,000**

9.5.3 Water entitlement transfers

Transfers of water entitlements within the Broken basin are listed in Table 9-6. Only within-basin transfers of temporary entitlements occurred during the 2005/06 period.

Table 9-6 Transfer of entitlements in the Broken basin

Entitlement[1]	Permanent entitlement transfer				Temporary entitlement transfer			
	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)
Goulburn-Murray Water								
Broken River System	0	0	0	0	1,130	1,130	30	0
Total 2005/06	**0**	**0**	**0**	**0**	**1,130**	**1,130**	**30**	**0**
Total 2004/05	**197**	**197**	**n/a**	**0**	**1,112**	**1,112**	**n/a**	**0**

Note:

(1) Entitlements for which no trades were recorded are not shown.

n/a: Information not available.

9.5.4 Volume diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 9-7.

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 2005/06.

Licences on unregulated streams are not fully metered and water usage is an estimate provided by Goulburn-Murray Water.

Table 9-7 Volume of water diverted under surface water entitlements in the Broken basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)	Entitlement volume compliance?(1)
North East Water					
Loombah-McCall Say	1	2,324	0	1,726	Yes
Tungamah, Devenish and St James	1	135	0	121	Yes
Goulburn-Murray Water					
Broken River System	1	56,611		16,018	Yes
Broken River System – Tungamah D&S, Urban Supplies	1	6,150		5,922	Yes
Minister for the Environment					
Broken System - Snowy Environmental Reserve	1	990	0	0	n/a
Total annual volume of bulk entitlements 2005/06		**66,210**	**0**	**23,786**	
Total annual volume of bulk entitlements 2004/05(2)		**2,324**	**0**	**17,886**	
Licensed diversions from unregulated streams 2005/06(3)		*5,667*		*3,700*	
Licensed diversions from unregulated streams 2004/05		*1,137*		*500*	

(1) Compliance is also assessed against the Murray-Darling Basin annual cap target for the Broken basin – refer to the MDBC's Water Audit Monitoring Report 2005/06.

(2) The diversions in the 2004/05 State Water Report for the Broken River system bulk entitlement inadvertently included diversions from unregulated streams. The 2004/05 value in the table above has been corrected.

(3) Licensed diversions from unregulated streams have been calculated using a different methodology in 2005/06 compared to 2004/05

n/a: The bulk entitlement was not in place for the entire year so compliance has not been assessed.

9.6 Groundwater resources

Licensed groundwater entitlements and use for the Goorambat GMA and Katunga WSPA in the Broken basin, excluding domestic and stock use, is shown in Table 9-8.

The Broken basin contains all of the Goorambat GMA and 8% of the Katunga WSPA by surface area. The volumes described in tables below are totals for the management areas and include the area that falls outside the Broken basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 9-8 Compliance with licensed groundwater volumes, Broken basin 2005/06

Water supply protection area/Groundwater management area[1]	GMA/WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in licensed bores (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Goorambat GMA (100%)	≤25	4,888	1,651	790	0	790	540
Katunga WSPA (8%)	>25	59,770	42,487	21,610	0	21,610	26,220

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

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, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Goorambat GMA	17	34
Katunga WSPA	593	1,186

Notes:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in Table 9-8.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

Groundwater is used as an urban water supply for the township of Goorambat. The licensed entitlements and metered use for this supply is provided in Table 9-10.

Table 9-10 Urban groundwater usage

Town supplied	Licensed allocation (ML)	Metered use 2005/06	Metered use 2004/05
Goorambat	24	20	24

9.7 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers and licensed diversions on unregulated streams are shown in Table 9-11. Urban restrictions became more severe as the year progressed.

No bans or restrictions were imposed on groundwater extraction in the Broken basin during 2005/06.

Table 9-11 Seasonal allocations and restrictions on water use in Broken basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	Glenrowan	Voluntary restrictions in February 2006, moving to Stage 1 in March 2006 and increasing to Stage 2 from April to June 2006 Goulburn Valley Water customers were subject to permanent water savings measures the entire year
Regulated diversions	Broken River	66% of licensed volume at the beginning of the season, increasing to 170% in September 2005
Unregulated diversions	Boosey Creek	Irrigation ban from July to October 2005

9.8 Recycled water

North East Water operates the sole wastewater treatment plant in the Broken basin at Benalla. Around 51% of the volume of wastewater passed through the treatment plant in the basin was recycled for consumptive use, falling from 73% in 2004/05 due to lower sales of recycled water because of intense rainfall events in the winter and spring of 2005 (Table 9-12).

Table 9-12 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Benalla	632	325	51%	0	325	0	0	307	0
Total 2005/06	**632**	**325**	**51%**	**0**	**325**	**0**	**0**	**307**	**0**
Total 2004/05	**690**	**503**	**73%**	**0**	**503**	**0**	**0**	**187**	**0**

Notes:

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

(2) Water that is reused in sewage treatment processes, e.g. backflushing of filters.

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

9.9 Water for the environment

9.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Broken basin EWR comprised the following components:

- The *Bulk Entitlement (Broken System – Snowy Environmental Reserve) Conversion Order 2006* of 990 ML, held by the Minister for the Environment, which came into effect on 8 June 2006
- passing flows released as a condition of consumptive bulk entitlements held by North East Water and Goulburn-Murray Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

9.9.2 Entitlements for the environment

The Minister for the Environment holds a 990 ML environmental bulk entitlement. In 2005/06 this was to be used for environmental purposes in the River Murray however the entitlement was not created until very late in the year; in subsequent years it is required to be used in accordance with Victoria's Snowy River obligations (i.e. as a substitute for Snowy water formerly released to the Murray).

9.9.3 Compliance with passing flow requirements

Table 9-13 shows the passing flow requirements 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.

Table 9-13 Selected passing flow requirements 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
	Passing flow rules	• The lesser of 2.75 ML/day or natural flow • From February to May when the combined storage volume is greater than a specified amount at the beginning of the month, the authority must pass 3.5 KL/day
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)
	Passing flow rules	• June to November inclusive, the lesser of 30 ML/day or natural flow
	Compliance point	Broken River between Broken Weir and Casey Weir
	Passing flow rules	• December to May inclusive, the lesser of 22 ML/day or natural flow
	Compliance point	Holland Creek downstream of Holland Weir
	Passing flow rules	• When water is diverted from Broken River and or Holland Creek to Lake Mokoan passing flow is the lesser of 22 ML/d or natural flow • When water is not being diverted from Broken Riven and or Holland Creek to Lake Mokoan the prevailing flow will be deemed as meeting environmental flows.

North East Water reported that it met all passing flow requirements under its bulk entitlements in 2005/06.

Goulburn-Murray Water reported that it met its bulk entitlement requirements in the Broken basin in 2005/06.

9.9.4 Water leaving the basin

The amount of water flowing from the Broken basin into the River Murray was 132,400 ML in 2005/06. This represents 51% of the total inflows into the basin, which is unchanged from 2004/05. This water comprises consumptive water that was not used under entitlements, traded water and the EWR (environmental entitlement, passing flows and any water above cap).

Important environmental assets are dependent on water from the EWR in the Broken basin. The Barmah-Millewa Forest, Gunbower Forest and Kerang Wetlands which are located along the River Murray and are all internationally significant wetlands listed under the Ramsar convention. These sites rely on the freshwater inputs from the Broken basin and River Murray for their ecological functioning.

9.10 Broken basin summary

Conditions in the Broken basin were close to average in 2005/06 and the basin did not experience the same shortages that occurred in basins immediately to the west. Regulated diversion allocations were at 170%, as occurred in both 2003/04 and 2004/05. Storage levels remained relatively unchanged.

An environmental entitlement was created in the Broken basin in 2005/06. This will be used to meet Victoria's Snowy River environmental obligations.

10 Goulburn basin

Table 10-1 Key features of the Goulburn basin, 2005/06

- Rainfall across the basin was 80–100% of the long term average, but overall inflows fell to 54% of the long term average.
- Storages fell from 29% of capacity at the start of 2005/06 to 24% by year end.
- Irrigators in the Goulburn System were allocated 100% of their water allocation.

10.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall across the Goulburn basin ranged between 80% and 100% of the long term average, as was the case in both 2004/05 and 2003/04. Inflows, however, were 54% of the long term average (3,366,000 ML), down from the 68% of average estimated in 2004/05 and 84% in 2003/04.

10.2 Responsibilities for management of water resources

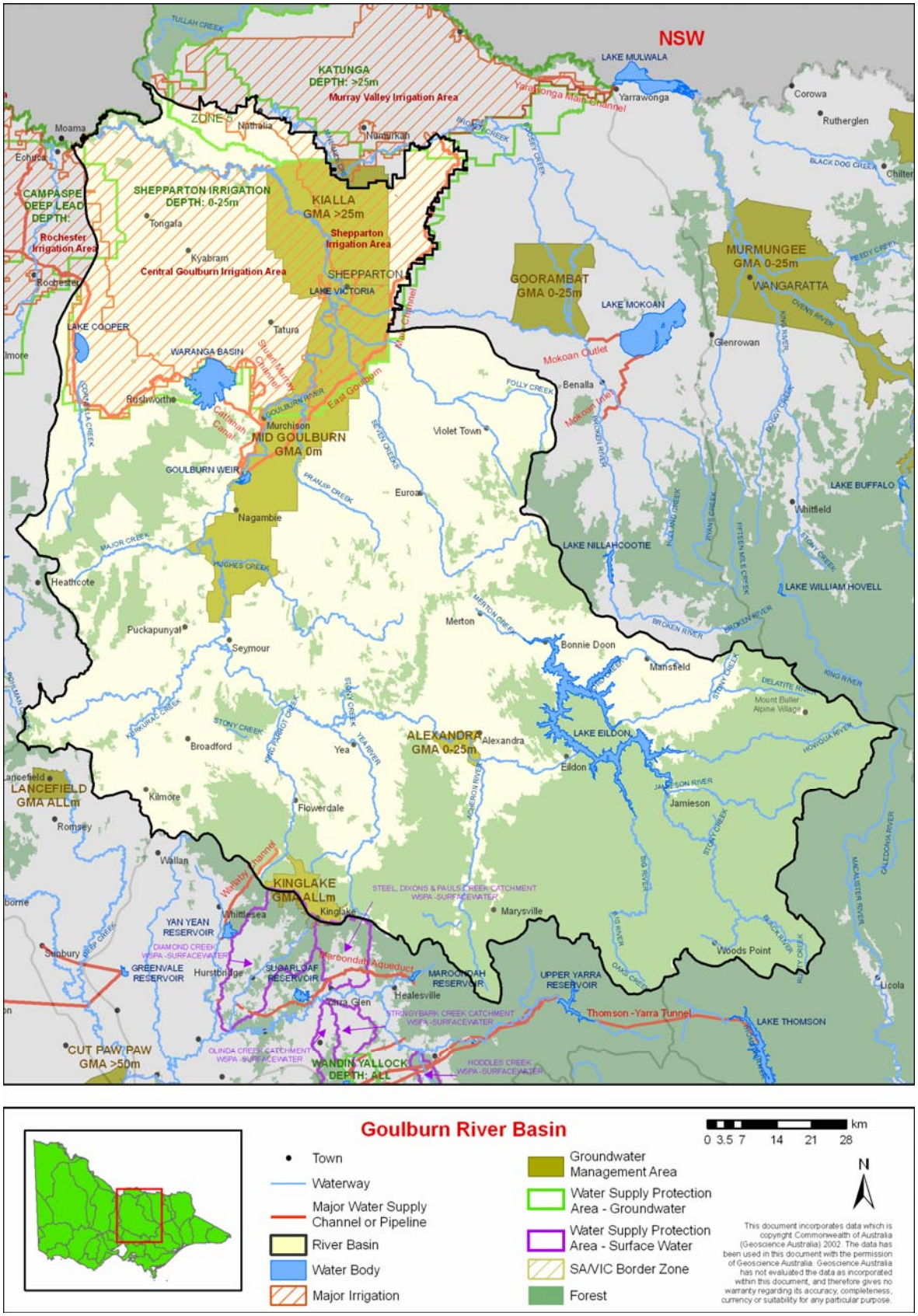
Table 10-2 shows the responsibilities of various authorities within the Goulburn basin.

Table 10-2 Responsibilities for water resources management within the Goulburn basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Goulburn-Murray Water	Central Goulburn irrigation district	Private groundwater pumping and surface water diversions	Bulk supply to many of Goulburn Valley Water's towns	Lakes Eildon and Nagambie, and the Waranga Basin Obligation to meet passing flow requirements
Goulburn Valley Water			Towns located in the Goulburn basin, including Shepparton, Alexandra and Seymour	Obligation to meet passing flow requirements for towns with supply from unregulated streams
Coliban Water			Towns located in the Loddon and Campaspe basins but supplied from the Goulburn	Obligation to meet passing flow requirements
Melbourne Water			Operates the Silver-Wallaby diversion system to Melbourne	Obligation to meet passing flow requirements
Minister for the Environment				Manages release of Snowy Environmental Reserve to the Murray for irrigation use as part of arrangements to supply Snowy environmental flows
Goulburn Broken Catchment Management Authority				Waterway management for the whole of the Goulburn basin

10.3 Location of water resources

Figure 10-1 Map of 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 10-3. Total use in 2005/06 was similar to 2004/05, however the available water resource fell by approximately 20%.

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

Table 10-3 Summary of total water resources and water use in the Goulburn basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	1,958,600	1,540,500
Groundwater(1)	Not available	Not available
Recycled water	9,390	6,660

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

10.5 Surface water resources

10.5.1 Water balance

A surface water balance for the Goulburn basin is shown in Table 10-4. Note that only those on-stream storages greater than 1,000 ML capacity have been included in the water balance. In the Goulburn basin, this includes Lake Eildon, Lake Nagambie (Goulburn Weir) and Sunday Creek Reservoir. The volume held in storage began the year at 29% of capacity and by the end of 2005/06, had reduced to 24% of capacity.

Table 10-4 Balance of surface water in the Goulburn basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	963,100	695,500
Volume in storage at end of year	771,400	963,100
Change in storage	**-191,700**	**267,600**
Inflows		
Catchment inflow(1)	1,834,400	2,300,400
Inflow from Broken River at Gowangardie	121,500	94,900
Return flow from irrigation	0	0
Treated effluent discharged back to river	2,730	2,340
Sub-total	**1,958,600**	**2,397,600**
Usage		
Urban diversions	26,290	27,890
Irrigation district diversions	1,412,600	1,434,000
Licensed private diversions from regulated streams	30,000	25,400
Licensed private diversions from unregulated streams	18,800	8,100
Silver and Wallaby Creeks to Yarra basin	5,300	9,300
Environmental water diversions	0	500
Small catchment dams	47,500	47,500
Sub-total	**1,540,500**	**1,552,700**
Losses		
Net evaporation losses from major storages(2)	7,200	0
Losses from small catchment dams	10,100	9,700
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	113,400	115,200
Sub-total	**130,700**	**124,900**
Water passed at outlet of basin		
Goulburn River to Campaspe River via Waranga Western Channel	2,000	2,700
Goulburn River outflow to River Murray	471,300	411,300
Goulburn River outflow to River Murray via Broken Creek	5,800	38,400

Notes:

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

(2) Evaporation reported in the 2004/05 State Water Report was calculated using gross evaporation, rather than net evaporation. The 2004/05 evaporation volume has been amended in Table 10-4.

(3) Losses estimated using loss functions from the Goulburn Simulation Model (REALM).

10.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 10-5 below are based on the estimated average annual impact.

Table 10-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	35,900	17,900	Not available
Registered commercial and irrigation	35,200	29,600	Not available
Total	**71,100**	**47,500**	**57,600**

10.5.3 Water entitlement transfers

Transfers of water entitlements within the Goulburn basin are listed in Table 10-6. There was a net export of permanent water entitlement from the basin, with 14,277 ML being permanently transferred out. On the other hand, the temporary market brought a net 27,576 ML into the

basin, a major shift from 2004/05 when 15,264 ML of temporary entitlement was traded out of the basin.

Table 10-6 Transfer of entitlements in the Goulburn basin

Entitlement[1]	Permanent entitlement transfer				Temporary entitlement transfer			
	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)	Bought	Sold	Number of trans-actions	Net transfer to entitlement (ML)
Goulburn Valley Water								
Alexandra	0	0	0	0	0	450	2	-450
Bonnie Doon	0	0	0	0	20	30	2	-10
Colbinabbin	0	0	0	0	0	50	1	-50
Corop	0	0	0	0	0	30	2	-30
Dookie	0	0	0	0	0	40	2	-40
Eildon	0	0	0	0	0	310	3	-310
Gigarre	0	0	0	0	0	35	1	-35
Kyabram	0	0	0	0	0	539	3	-539
Murchison	0	0	0	0	0	100	1	-100
Nagambie	0	0	0	0	0	240	2	-240
Rushworth	0	0	0	0	0	100	1	-100
Seymour	0	0	0	0	0	2,915	11	-2,915
Shepparton	0	0	0	0	0	4,004	9	-4,004
Stanhope	0	0	0	0	0	80	1	-80
Tatura	0	0	0	0	0	500	4	-500
Tongala	0	0	0	0	0	200	1	-200
Goulburn-Murray Water								
Goulburn River - Water right	132	236	12	-104	5,765	15,915	412	-10,150
Goulburn River - Sales					0	0	0	0
Central Goulburn - Water right	294	7,510	75	-7,216	80,574	54,404	3,219	26,170
Central Goulburn - Sales					344	4	0	340
Rochester - Water right	241	3,781	49	-3,540	52,716	24,415	1,469	28,301
Rochester - Sales					398	15	0	383
Shepparton Irrigation District - Water right	568	3,985	70	-3,417	25,054	33,376	1,614	-8,322
Shepparton Irrigation District - Sales					457	0	0	457
Total 2005/06	**1,235**	**15,512**	**206**	**-14,277**	**165,328**	**137,752**	**6,760**	**27,576**
Total 2004/05	**1,484**	**15,579**	**n/a**	**-14,095**	**136,131**	**151,395**	**n/a**	**-15,264**

Notes:

(1) Entitlements for which no trades were recorded are not shown.

10.5.4 Volume diverted

The volume of water diverted under bulk water entitlements is shown in Table 10-7. 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 2005/06. Licences on unregulated streams are not fully metered and water usage is an estimate provided by Goulburn-Murray Water.

Table 10-7 Volume of water diverted under surface water entitlements in the Goulburn basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)	Entitlement volume compliance?(1)
Coliban Water					
Rochester (part)	1	1,400	0	0	Yes
Lockington	1	130	0	68	Yes
Boort	1	425	0	234	Yes
Dingee	1	50	0	5	Yes
Macorna	1	40	0	10	Yes
Mitiamo	1	60	0	53	Yes
Mysia	1	15	0	6	Yes
Pyramid Hill	1	300	0	230	Yes
Goulburn Valley Water					
Alexandra	1	916	-450	460	Yes
Bonnie Doon	1	112	-10	92	Yes
Buxton	1	110	0	0	Yes
Colbinabbin	1	89	-50	33	Yes
Corop	1	44	-30	12	Yes
Dookie	1	160	-40	106	Yes
Eildon	1	480	-310	155	Yes
Euroa System	1	1,990	0	847	Yes
Gigarre	1	100	-35	46	Yes
Katandra West	1	64	0	42	Yes
Kyabram	1	2,000	-539	1,407	Yes
Longwood	1	120	0	75	Yes
Mansfield	2	1,300	0	685	Yes
Marysville	1	462	0	411	Yes
Merrigum	1	0	0	0	Yes
Mooroopna	1	500	0	162	Yes
Murchison	1	350	-100	205	Yes
Nagambie	1	825	-240	552	Yes
Pyalong	1	75	0	69	Yes
Rushworth	1	530	-100	371	Yes
Seymour	1	5,340	-2,915	1,693	Yes
Shepparton	1	18,320	-4,004	12,892	Yes
Stanhope	1	200	-80	93	Yes
Sunday Creek	1	2,238	0	1,702	Yes
Tatura	1	2,600	-500	2,165	Yes
Thornton	1	120	0	49	Yes
Tongala	1	1,404	-200	1,009	Yes
Toolamba	1	0	0	0	Yes
Upper Delatite	1	235	0	94	Yes
Violet Town	1	270	0	0	Yes
Woods Point	1	21	0	16	Yes
Yea	1	438	0	237	Yes
Minister for the Environment					
Goulburn System - Snowy Environmental Reserve	1	14,362	0	0	Yes
Gouburn-Murray Water					
Eildon - Goulburn Weir	10	1,900,434	37,179	1,442,584	Yes
Total annual volume of bulk entitlements 2005/06		**1,958,629**	**27,576**	**1,468,870**	
Total annual volume of bulk entitlements 2004/05		**1,961,915**	**-15,264**	**1,487,749**	
Licensed diversions from unregulated streams 2005/06		*28,894*		*18,800*	
Licensed diversions from unregulated streams 2004/05		*20,221*		*8,100*	

Note:

(1) Compliance is also assessed against the Murray-Darling Basin annual cap target for the Goulburn basin – refer to the MDBC's Water Audit Monitoring Report 2005/06

10.6 Groundwater resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Goulburn basin, excluding domestic and stock use, is presented in Table 10-8.

The Goulburn basin contains the whole Nagambie GMA and Alexandra GMA as well as part of the Campaspe Deep Lead WSPA, Shepparton WSPA, Katunga WSPA, Kialla GMA and Kinglake GMA. The volumes described in tables below are totals for the management areas and include the area that falls outside the Goulburn basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 10-8 Compliance with licensed groundwater volumes, Goulburn basin 2005/06

Water supply protection area/Groundwater management area[1]	GMA/WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Alexandra GMA (100%)	≤25	900	1,821	0	686	686	600
Kialla GMA (92%)	>25	4,770	2,332	0	1,062	1,062	816
Kinglake GMA (78%)	All depths	3,830	2,012	0	966	966	644
Campaspe Deep Lead WSPA (10%)	>25	46,069	46,251	23,110	344	23,454	25,713
Katunga WSPA (10%)	>25	59,770	42,487	21,610	0	21,610	26,220
Nagambie GMA (100%)	All depths	5,650	6,476	1,340	0	1,340	4,410
Shepparton WSPA (53%)	≤25	244,226	224,226	62,750	0	62,750	79,820

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) In non-metered areas, Goulburn-Murray Water has provided an estimate of use.

An estimate of domestic and stock groundwater use is provided in Table 10-9.

Table 10-9 Number of domestic and stock bores and estimated use, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Alexandra GMA	52	104
Kialla GMA	23	46
Kinglake GMA	342	684
Campaspe Deep Lead WSPA	188	376
Katunga WSPA	593	1,186
Nagambie GMA	78	156
Shepparton WSPA[3]	1,373	2,746

Notes:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in Table 10-8.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

(3) Number of bores has been revised by Goulburn-Murray Water from 2004/05.

10.7 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers and licensed diversions on unregulated streams are shown in Table 10-10. In general, urban restrictions remained the same or moved to higher stages over the course of the year.

No bans or restrictions were imposed on groundwater extraction in the Goulburn basin during 2005/06.

Table 10-10 Seasonal allocations and restrictions on water use in Goulburn basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	Sunday Creek System (Broadford, Kilmore, Clonbinane, Wandong-Heathcote Junction)	Stage 1 from July 2005 to June 2006
	Mansfield	Stage 2 March 2006
	Pyalong	Stage 2 from March to May 2006
	Tatura	Voluntary restrictions July 2005 to September 2005
		Goulburn Valley Water customers have had permanent water savings measures in place since January 2004.
Irrigation and regulated diversions	Goulburn System	7% of water right and licence volume July 2005, increasing to 100% in October 2005 for remainder of irrigation season.

10.8 Recycled water

All wastewater treatment plants in the Goulburn basin are operated by Goulburn Valley Water. Approximately 71% of the volume of wastewater passed through treatment plants in the basin was recycled. The 2005/06 reuse percentage would have been closer to the 74% achieved in 2004/05 had a 413 ML emergency discharge not occurred at the Tatura treatment plant (Table 10-11).

Table 10-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Alexandra	272	64	24%	0	64	0	0	208	0
Avenel	0	0	0%	0	0	0	0	0	0
Bonnie Doon	11	11	100%	0	11	0	0	0	0
Broadford	73	73	100%	0	73	0	0	0	0
Eildon	200	0	0%	0	0	0	0	200	0
Euroa	263	263	100%	0	263	0	0	0	0
Girgarre	0	0	0%	0	0	0	0	0	0
Kilmore	306	306	100%	0	306	0	0	0	0
Kyabram / Merrigum	260	260	100%	0	260	0	0	0	0
Mansfield	280	250	89%	39	211	0	0	30	0
Marysville	95	95	100%	0	95	0	0	0	0
Mooroopna	585	585	100%	0	585	0	0	0	0
Murchison	0	0	0%	0	0	0	0	0	0
Nagambie	132	132	100%	0	132	0	0	0	0
Seymour	593	593	100%	72	522	0	0	0	0
Shepparton	4,846	2,970	61%	0	2,970	0	0	1,876	0
Stanhope / Rushworth	0	0	0%	0	0	0	0	0	0
Tatura	1,059	647	61%	0	647	0	0	413	-1
Tongala	275	275	100%	0	275	0	0	0	0
Upper Delatite	26	26	100%	0	26	0	0	0	0
Violet Town	0	0	0%	0	0	0	0	0	0
Yea	112	112	100%	26	86	0	0	0	0
Total 2005/06	**9,386**	**6,661**	**71%**	**136**	**6,525**	**0**	**0**	**2,726**	**-1**
Total 2004/05[4]	**9,041**	**6,700**	**74%**	**140**	**6,560**	**0**	**0**	**2,341**	**0**

Notes:

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

(2) Water that is reused in sewage treatment processes, e.g. backflushing of filters.

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

(4) Responsibility for the water and wastewater supply to the town of Wallan was transferred from Goulburn Valley Water to Yarra Valley Water in January 2006. All reuse figures for Wallan from 2004/05 and 2005/06 have been removed from the above table to allow for a consistent comparison.

10.9 Water for the environment

10.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Goulburn basin EWR comprised the following components:

- passing flows released as a condition of consumptive bulk entitlements
- all other water in the basin not allocated for consumptive use.

10.9.2 Compliance with passing flow requirements

Table 10-12 shows the passing flow requirements 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.

Table 10-12 Selected passing flow requirements in the Goulburn basin

River	Passing flows	
Seven Creeks	Instrument where passing flows are specified	Bulk Entitlement (Euroa System) Conversion Order 2001
	Responsible authority	Goulburn Valley Water
	Compliance point	Polly McQuinns Reservoir
	Passing flow rules	• The lesser of 10 ML/d or observed flow
Delatite River	Instrument where passing flows are specified	Bulk Entitlement (Mansfield) Conversion Order 1995
	Responsible authority	Goulburn Valley Water
	Compliance point	Upstream of Tonga Bridge Gauging Station
	Passing flow rules	• Minimum passing flow of 18 ML/day • When flow is less than 18 ML/day, the authority must pass the entire flow • When flow is between 18 and 20.2 ML/day the authority must pass 18 ML/day • When flow is between 20.2 and 30 ML/day, the authority must pass the entire flow, less 2.2 ML/day • When flow is between 30 and 32.2 ML/day, the authority must pass 27.8ML/day • When flow is greater than 32.2 ML/day, the authority must pass the entire flow, less 4.4 ML/day
Yea River	Instrument where passing flows are specified	Bulk Entitlement (Yea) Conversion Order 1997
	Responsible authority	Goulburn Valley Water
	Compliance point	Upstream of the Yea urban offtake
	Passing flow rules	• Minimum passing flow of 3.6 ML/day • When flow is less than 7.2 ML/day, authority must pass half the flow • When flow is greater than 7.2 ML/day, the authority must pass the entire flow, less 3.6 ML/day

Goulburn Valley Water reported that it met all passing flow requirements under its bulk entitlements in 2005/06.

Goulburn-Murray Water reported that it met all its passing flow requirements in this basin.

10.9.3 Streamflow management plans (SFMPs)

Technical studies and administrative processes are underway in preparation for the development of SFMPs for the King Parrot Creek, Yea River and Seven Creeks.

10.9.4 Water leaving the basin

The amount of water flowing from the Goulburn basin into the River Murray was 477,100 ML in 2005/06. This represents 26% of the total inflows into the basin, compared to 20% in 2004/05. This water comprises consumptive water that was not used under entitlements, traded water and the EWR (passing flows, and any water above cap). The Snowy Environment Reserve, which was established to release Goulburn River water to the River Murray to substitute for Snowy River environmental flows that would formerly have been released to the River Murray, was not called upon during 2005/06.

There are important environmental assets dependent on water from the EWR in the Goulburn basin. The Gunbower Forest and Kerang Wetlands located along the River Murray are internationally significant wetlands and are listed under the Ramsar convention. These sites rely on the freshwater inputs from the Goulburn basin and River Murray for their ecological functioning.

10.10 Goulburn basin summary

At the start of 2005/06 the surface water position in the Goulburn was relatively healthy and allocations in the Goulburn system reached 100% in October. However, rainfall and inflows after this time dropped sharply below average, and allocations did not increase for the remainder of the season. Trading of water rights was low at the start of the year, but increased as the season progressed.

Lake Eildon fell from 28% to 22% full across the year as inflows failed to materialise.

Towns supplied by the irrigation system were generally on permanent water savings measures for the entire year. However, towns supplied by smaller storages or systems experienced restrictions. These include Broadford and Kilmore, which were on Stage 1 restrictions all year, and Mansfield which experienced Stage 2 restrictions from 1 March until the end of April when significant rainfall occurred.

11 Campaspe basin

Table 11-1 Key features of the Campaspe basin, 2005/06

- Rainfall across the basin was 80-100% of the long term average, however inflows were 27% of the long term average.
- Storage volumes fell from 11% of capacity at the start of the year to 8% of capacity by year end.
- Irrigators were allocated 31% of their water allocation.

11.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall across the Campaspe basin ranged from 80% to 100% of the long term average, which was the same as in 2004/05 and 2003/04. Despite similar rainfall, inflows declined significantly for the second consecutive year, with 2005/06 inflows 27% of the long term average (305,000 ML).

11.2 Responsibilities for management of water resources

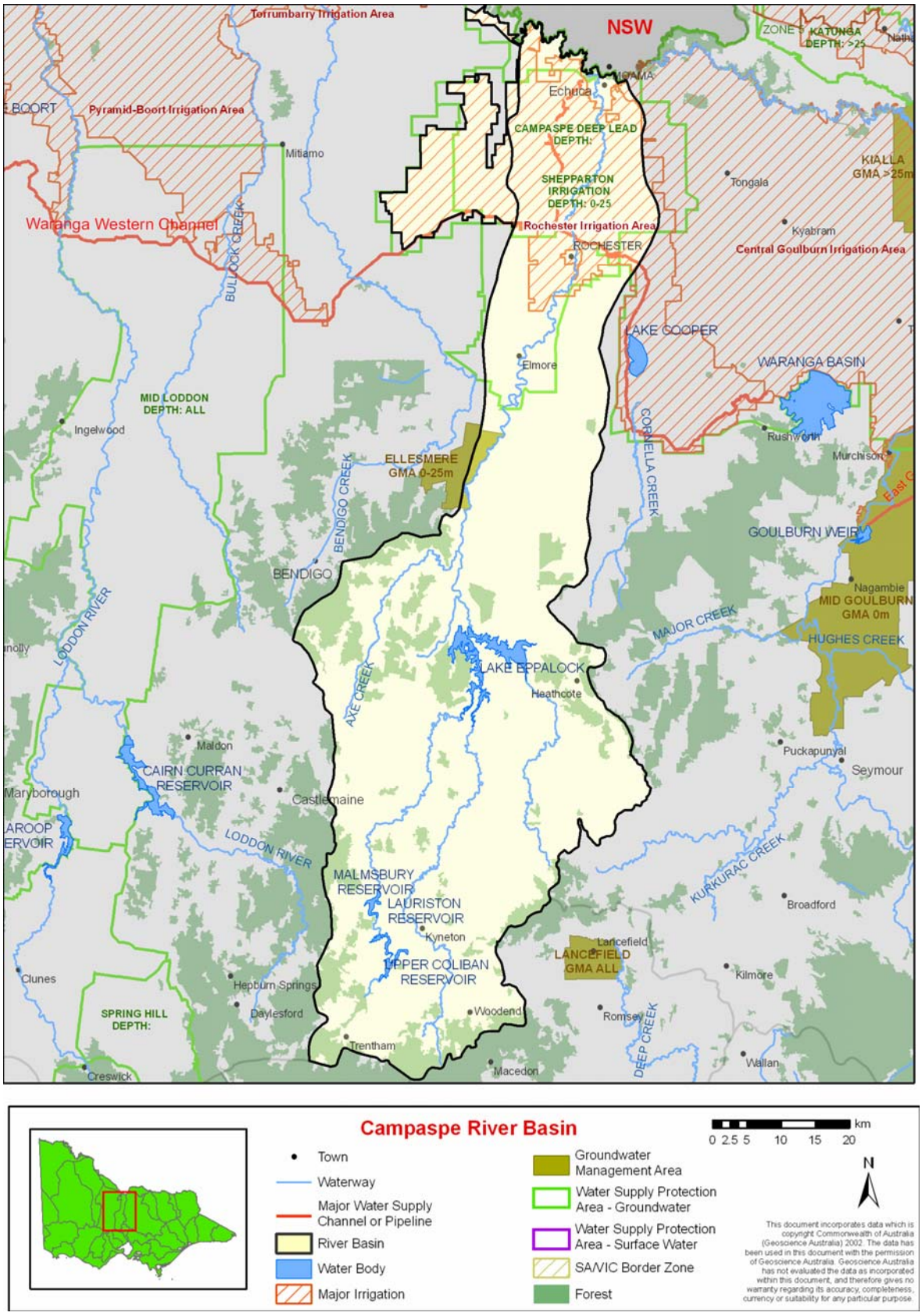
Table 11-2 shows the responsibilities of various authorities within the Campaspe basin.

Table 11-2 Responsibilities for water resources management within the Campaspe basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Goulburn-Murray Water	Rochester irrigation district and Campaspe irrigation district	Groundwater and surface water licensed diversions		Lake Eppalock Obligation to meet passing flow requirements
Coliban Water	Irrigation and domestic and stock supplies off the Coliban Main Channel		Urban water for the majority of the Campaspe basin, including Echuca, Rochester and Kyneton	Upper Coliban, Lauriston and Malmsbury Reserviors in the upper reaches of the Campaspe basin Obligation to meet passing flow requirements
Western Water			Urban water for Woodend at the southern end of the basin	Obligation to meet passing flow requirements
North Central Catchment Management Authority				Waterway management in the whole of the Campaspe basin

11.3 Location of water resources

Figure 11-1 Map of the Campaspe basin



11.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Campaspe basin are shown in Table 11-3. Water use in the basin as a proportion of available water is one of the highest in the state. The total surface water resource for the Campaspe basin includes 1,950 ML which was transferred into the basin from the Waranga Western Channel.

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

Table 11-3 Summary of total water resources and water use in the Campaspe basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	85,700	67,500
Groundwater(1)	Not available	Not available
Recycled water	1,310	580

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

11.5 Surface water resources

11.5.1 Water balance

A surface water balance for the Campaspe basin is shown in Table 11-4. Note that only those on-stream storages greater than 1,000 ML capacity have been included in the water balance. In the Campaspe basin, on-stream storages greater than 1,000 ML capacity include the Upper Coliban, Lauriston and Malmsbury Reservoirs, as well as Lake Eppalock. The volume held in storage in the Campaspe basin declined from 11% at the start of 2005/06 to 8% by the end of the year.

Table 11-4 Balance of surface water in the Campaspe basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	41,600	30,300
Volume in storage at end of year	29,300	41,600
Change in storage	**-12,300**	**11,300**
Inflows		
Catchment inflow [1]	83,400	113,400
Return flow from irrigation	0	0
Waranga Western Channel to Campaspe River	1,950	2,700
Treated wastewater discharged back to river	330	340
Sub-total	**85,700**	**116,400**
Usage		
Urban diversions	14,760	12,580
Coliban Channel rural diversions	9,200	13,600
Campaspe Irrigation District diversions	8,300	13,500
Licensed private diversions from regulated streams	3,300	4,300
Licensed private diversions from unregulated streams	3,100	600
Small catchment dams	28,800	28,800
Campaspe River to Waranga Western Channel	0	0
Sub-total	**67,500**	**73,400**
Losses		
Net evaporation losses from major storages[2]	5,700	5,600
Losses from small catchment dams	14,800	14,700
In-stream infiltration to groundwater, flows to floodplain and evaporation [3]	1,500	1,500
Sub-total	**22,000**	**21,800**
Water passed at outlet of basin		
Campaspe River outflow to River Murray	8,500	9,900

Notes:

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

(2) Evaporation reported in the 2004/05 State Water Report included was calculated using gross evaporation, rather than net evaporation. The 2004/05 evaporation volume has been amended in Table 11-4.

(3) Losses estimated using loss functions from the Goulburn Simulation Model (REALM).

11.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 11-5 below are based on the estimated average annual impact.

Table 11-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	15,000	7,500	Not available
Registered commercial and irrigation	25,300	21,300	Not available
Total	**40,300**	**28,800**	**43,600**

11.5.3 Water entitlement transfers

A summary of the transfer of entitlements within the Campaspe basin is shown in Table 11-6. There was a net import of water entitlement to the basin, with 571 ML being permanently traded out of the basin and 1,169 ML being temporarily traded into the basin.

Table 11-6 Transfer of entitlements in the Campaspe basin

Entitlement[1]	Permanent entitlement transfer				Temporary entitlement transfer			
	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)
Coliban Water								
Campaspe System	235	0	1	235	0	50	1	-50
Goulburn-Murray Water								
Campaspe District - Water right	0	388	8	-388	3,079	1,186	148	1,893
Campaspe District - Sales					10	0		10
Campaspe River - Water right	382	800	9	-418	595	1,279	78	-684
Campaspe River - Sales					0	0	0	0
Total 2005/06	**617**	**1,188**	**18**	**-571**	**3,684**	**2,515**	**227**	**1,169**
Total 2004/05	**416**	**478**	**n/a**	**-62**	**4,447**	**3,263**	**n/a**	**1,184**

Note:

(1) Entitlements for which no trades were recorded are not shown.

n/a: Information not available.

11.5.4 Volume diverted

The volume of water diverted under each water authority's 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 2005/06.

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 bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)(1)	Entitlement volume compliance?(2)
Coliban Water					
Axedale, Goornong and Part Rochester	1	349	0	118	Yes
Coliban System	1	50,572	-50	23,640	Yes
Western Water					
Woodend	1	802	0	240	Yes
Goulburn-Murray Water					
Campaspe System	10	13,014	1,219	11,604	Yes
Total annual volume of bulk entitlements 2005/06		**64,737**	**1,169**	**35,602**	
Total annual volume of bulk entitlements 2004/05		**73,887**	**1,184**	**43,981**	
Licensed diversions from unregulated streams 2005/06		*4,712*		*3,100*	
Licensed diversions from unregulated streams 2004/05		*1,559*		*600*	

Notes:

(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2005, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2005/06 period. The actual maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

(2) Compliance is also assessed against the Murray-Darling Basin annual cap target for the Campaspe basin – refer to the MDBC's Water Audit Monitoring Report 2005/06. A different method was used to assess compliance in 2005/06. This is the main reason for the difference between 2005/06 and 2004/05.

11.6 Groundwater resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Campaspe basin, excluding domestic and stock use, is presented in Table 11-8.

The Campaspe basin contains part of the Campaspe Deep Lead WSPA, the Shepparton WSPA and the Ellesmere GMA The volumes described in Table 11-8 are totals for the management areas and include the area that falls outside the Campaspe basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 11-8 Compliance with licensed groundwater volumes, Campaspe basin 2005/06

Water supply protection area/Groundwater management area[1]	GMA/WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Ellesmere GMA (28%)	≤25	1,900	2,616	1,040	400	1,440	798
Campaspe Deep Lead WSPA (76%)	>25	46,069	46,251	23,110	344	23,454	25,713
Shepparton WSPA (12%)	≤25	244,226	224,226	62,750	0	62,750	79,820

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) In non-metered areas, Goulburn-Murray Water has provided an estimate of use.

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, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Ellesmere GMA	27[2]	54
Campaspe Deep Lead WSPA	188	376
Shepparton WSPA	1,373[2]	2,746

Note:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in Table 11-8.

(2) Number of bores has been revised by Goulburn-Murray Water from 2004/05.

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 is provided in Table 11-10.

Table 11-10 Urban groundwater usage

Town supplied	Licensed allocation (ML)	Metered use 2005/06	Metered use 2004/05
Elmore	284	187	174
Trentham	48	114	16

11.7 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers and licensed diversions on unregulated streams are shown in Table 11-11. In general, urban restrictions remained the same or moved to higher stages over the course of the year. By June 2006, customers served by the Coliban and Campaspe systems were on (modified) Stage 4 restrictions.

No bans or restrictions were imposed on groundwater extraction in the Campaspe basin during 2005/06.

Table 11-11 Seasonal allocations and restrictions on water use in Campaspe basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	Coliban System (Heathcote, Kyneton, Malmsbury)	Stage 3 from July 2005, increasing to modified Stage 4 from November to June 2006(1)
	Campaspe System (Axedale)	Stage 3 from July 2005, increasing to modified Stage 4 from November to June 2006
	Murray System (Echuca)	Stage 1 from July 2005 to June 2006
	Trentham, Elmore	Stage 1 from July 2005 to June 2006 (supplied by groundwater)
	Woodend	Permanent water savings measures applied throughout the year
Licensed diversions on unregulated streams	Lower Campaspe River (Siphon to Murray)	Irrigation ban from July to December 2005
	Campaspe River, Coliban River (both above Lake Eppalock)	Irrigation ban from January to June 2006
Irrigation and regulated diversions	Campaspe System	0% of water right and licence volume from July 2005 increasing to 31% in November 2005 for the remainder of the season

Note:

(1) Modified Stage 4 restrictions are less onerous than 'full' Stage 4 restrictions, with residents allowed to use a hand held trigger nozzle hose between 7.00pm and 8.00pm on alternate days.

11.8 Recycled water

All wastewater treatment plants in the Campaspe basin are operated by Coliban Water apart from the Woodend treatment plant, which is operated by Western Water. Around 44% of the wastewater that passed through treatment plants in the basin was recycled, mostly for agricultural use (Table 11-12).

Table 11-12 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Axedale[4]	2	2	100%	0	2	0	0	0	0
Elmore	38	0	0%	0	0	0	0	0	38
Heathcote	67	67	100%	0	67	0	0	0	0
Kyneton	604	366	61%	0	366	0	0	238	0
Lockington	32	0	0%	0	0	0	0	0	32
Rochester	331	0	0%	0	0	0	0	0	331
Woodend	231	142	61%	57	85	0	0	89	0
Total 2005/06	**1,305**	**577**	**44%**	**57**	**520**	**0**	**0**	**327**	**401**
Total 2004/05	**1,344**	**725**	**54%**	**75**	**650**	**0**	**0**	**343**	**276**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

(4) Axedale treatment plant commenced operations in 2005/06 and therefore was not included in the 2004/05 State Water Report.

11.9 Water for the environment

11.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Campaspe basin EWR comprised the following components:

- passing flows released as a condition of consumptive bulk entitlements held by Coliban Water, Western Water and Goulburn Murray Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

11.9.2 Compliance with passing flow requirements

Table 11-13 shows the passing flow requirements 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 11-13 Selected passing flow requirements 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
	Passing flow rules	• The lesser of 8 ML/d or natural inflow
Campaspe River	Instrument where passing flows are specified	Bulk Entitlement (Campaspe System - Goulburn Murray Water) Conversion Order 2000
	Responsible authority	Goulburn Murray Water
	Compliance point	Between Lake Eppalock and Campaspe Weir pool

	Passing flow rules	1 July to 30 November inclusive:
		• If Lake Eppalock volume is less than 150,000 ML, the lesser of 10 ML/day or natural inflow
		• If Lake Eppalock volume is between 150,001 ML and 200,000 ML, the lesser of 50 ML/day or natural inflow
		• If Lake Eppalock volume is between 200,001 ML and 250,000 ML, the lesser of 80 ML/day or natural inflow
		• If Lake Eppalock volume is greater than 250,001 ML:
		  • In January, March, May, June and December, the lesser of 90 ML/day or natural inflow
		  • In February and April, the lesser of 80 ML/day or natural inflow
		  • In July and November, the lesser of 150 ML/day or natural inflow
		  • In August, September and October, the lesser of 200 ML/day or natural inflow

Coliban Water reported that it met all passing flow requirements under its bulk entitlement in 2005/06.

Western Water reported that compliance with the requirements of its bulk entitlements was not met for the Campaspe River and Campaspe Reservoir.

Goulburn-Murray Water reported that it did not not meet some of its daily passing flow requirements in August 2005 and June 2006 (Table 11-14).

Table 11-14 Goulburn-Murray Water compliance with minimum flow requirements

Month	Compliance	Comment
August 2005	61%	Hydrographic data received subsequent to the end of the month indicated a breach of the daily requirement occurred for 12 days, however monthly data indicates that the average flows for the month were compliant with the average requirement for the month
June 2006	80%	Five days of non-compliance resulted from interruptions to flows from maintenance works. A one day breach occurred late in the month as a result of a rainfall event, and insufficient release to meet resulting increase in passing flow requirements

11.9.3 Water leaving the basin

The amount of water flowing from the Campaspe basin into the River Murray was 8,500 ML in 2005/06. This represents 10% of the total inflows into the basin, compared to 9% in 2004/05. This water comprises consumptive water that was not used under entitlements, traded water and the EWR (passing flows and any water above cap).

There are important environmental assets dependent on water from the EWR in the Campaspe basin. The Gunbower Forest and Kerang Wetlands which are located along the River Murray are internationally significant wetlands and are listed under the Ramsar convention. These sites rely on the freshwater inputs from the Campaspe basin and River Murray for their ecological functioning.

11.10 Campaspe basin summary

The Campaspe basin was one of the basins most affected by the drought in 2005/06. Although rainfall was 80-100% of average, inflows fell to 27%, putting both groundwater and surface water supplies under pressure, particularly as storages were already at very low levels at the start of the year.

Irrigation system allocations fell to 31%, down from 39% in 2004/05. 2005/06 was the third consecutive year of allocations below 100%. Towns served by the Coliban System moved from Stage 3 restrictions to modified Stage 4 restrictions in November 2005.

The lack of basin inflows placed pressure on the Campaspe Deep Lead aquifer, which was at below average levels and declining in February 2006.

Summer streamflows were very low in 2005/06 and bans were placed on unregulated parts of the Coliban and Campaspe rivers from January to June 2006. As with irrigators, regulated diverters received 31% of allocation.

Lake Eppalock was at 5% at the end of the year, a slight reduction from 6% at the commencement.

12 Loddon basin

Table 12-1 Key features of the Loddon basin, 2005/06

- Storages decreased from 18% of capacity at the start of the year to 9% by year end.
- Inflows were 28% of the long term average.
- Towns supplied by the Coliban system (including Bendigo and Castlemaine) moved onto modified Stage 4 restrictions in November 2005.
- 5% of total inflows left the basin at the River Murray.

12.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall across the Loddon basin ranged between 60% and 100% of the long term average. However, inflows were 28% of the long term average (415,000 ML) compared to 37% of the long term average in 2004/05.

12.2 Responsibilities for management of water resources

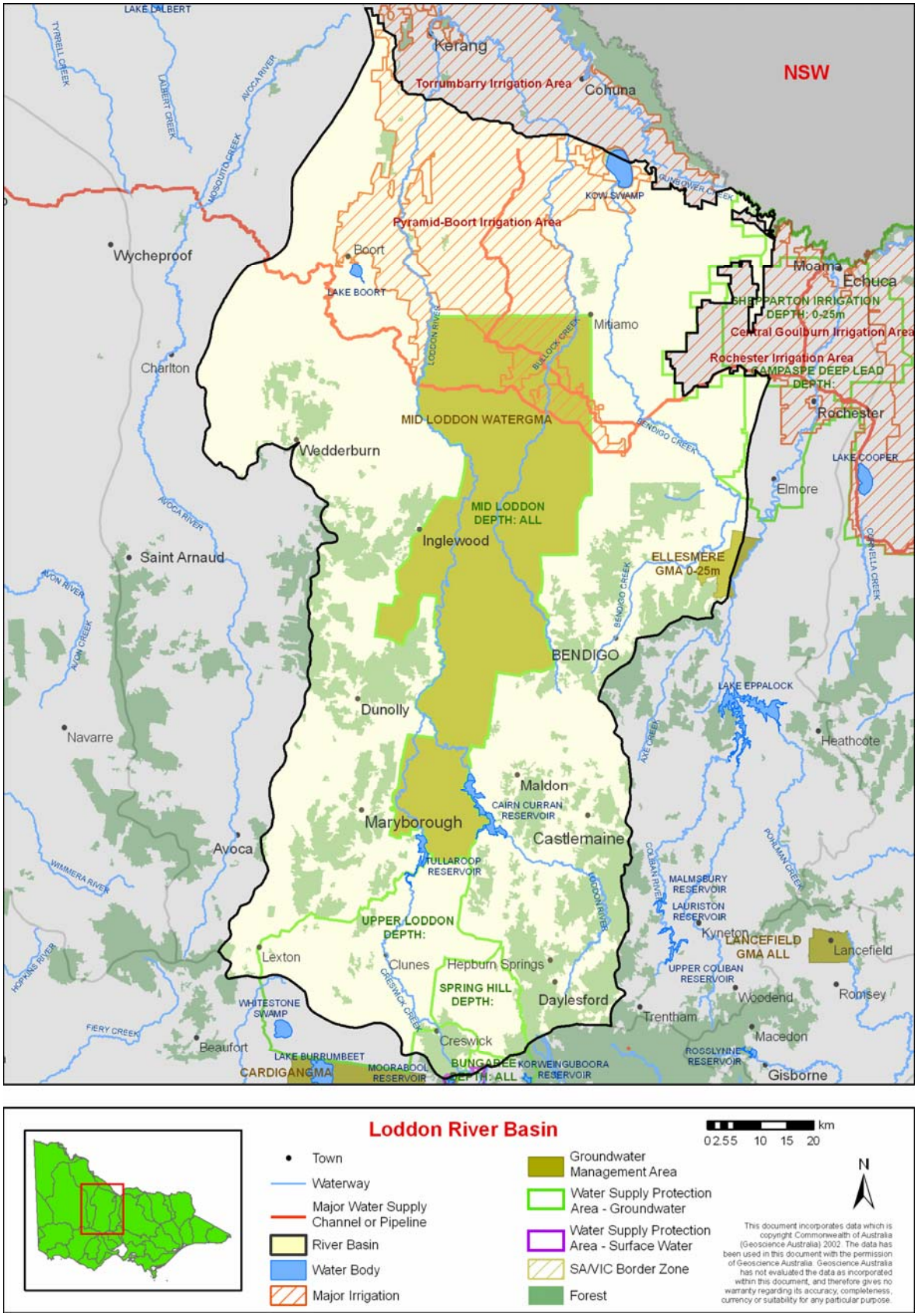
Table 12-2 shows the responsibilities of various authorities within the Loddon basin.

Table 12-2 Responsibilities for water resources management within the Loddon basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Goulburn-Murray Water	Pyramid-Boort Irrigation District and domestic and stock supplies in Normanville area	Groundwater and surface water licensed diversions in the basin	Bulk supply to Coliban Water for towns supplied from irrigation channels, including Pyramid Hill and Boort	Major reservoirs including Cairn Curran, Laanecoorie and Tullaroop reservoirs
GWMWater			Bulk supply to Coliban Water for towns supplied from the Wimmera-Mallee system (Borung, Korong Vale, Wedderburn, Wychitella)	
Central Highlands Water			Towns in the western part of the Loddon basin, including Maryborough, Creswick and Clunes	Obligation to meet passing flow requirements for unregulated systems
Coliban Water			Towns in the eastern part of the Loddon basin including Bendigo and Castlemaine	
Minister for the Environment				Obligation to meet passing flow requirements
North Central Catchment Management Authority				Waterway management for the whole of the Loddon basin

12.3 Location of water resources

Figure 12-1 Map of 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 12-3.

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

Table 12-3 Summary of total water resources and water use in the Loddon basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	121,000	85,300
Groundwater(1)	Not available	Not available
Recycled water	8,720	2,420

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

12.5 Surface water resources

12.5.1 Water balance

A surface water balance for the Loddon basin is shown in Table 12-4.

Only those storages greater than 1,000 ML capacity have been included in the water balance. In the Loddon basin, storages with greater than 1,000 ML capacity include Laanecoorie, Cairn Curran, Tullaroop, Evansford and Newlyn Reservoirs and Hepburn Lagoon. The volume held in storage halved from 18% of total capacity at the start of 2005/06 to 9% by the end of the year.

There is a degree of uncertainty in the water balance for the Loddon basin because of the interaction of the Waranga Western Channel with streams across the basin, most notably at Serpentine Creek and Loddon Weir.

Table 12-4 Balance of surface water in the Loddon basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	40,000	18,000
Volume in storage at end of year	21,100	40,000
Change in storage	**-18,900**	**22,000**
Inflows		
Catchment inflow(1)	116,000	155,100
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	5,000	6,290
Sub-total	**121,000**	**161,400**
Usage		
Urban diversions	2,600	2,910
Licensed private diversions and irrigation diversions from regulated streams	17,500	23,400
Licensed private diversions from unregulated streams	15,200	6,200
Small catchment dams	50,000	50,000
Sub-total	**85,300**	**82,500**
Losses		
Net evaporation losses from major storages(2)	8,200	8,300
Losses from small catchment dams	29,600	29,600
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	10,600	10,900
Sub-total	**48,400**	**48,800**
Water passed at outlet of basin		
Loddon River outflow to River Murray (Appin South)	3,600	4,100
Wandella Creek at Fairlea	n/a	n/a
Mount Hope Creek at Mitiamo	2,600	4,000
Bullock Creek, Calivil and Nine Mile Creek	n/a	n/a

Notes:

(1) Inflows have been back-calculated from outflows plus diversions. The 2004/05 inflow figure has also been adjusted per note 2.

(2) Evaporation reported in the 2004/05 State Water Report included was calculated using gross evaporation, rather than net evaporation. The 2004/05 evaporation volume has been amended in Table 12-4.

(3) Losses estimated using the Goulburn Simulation Model (REALM), and exclude losses from the Loddon River downstream of Loddon Weir and the Wandella Creek system (which were not readily available).

n/a: Information not available.

12.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 12-5 are based on the estimated average annual impact.

Table 12-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	31,600	15,800	Not available
Registered commercial and irrigation	40,700	34,200	Not available
Total	**72,300**	**50,000**	**79,600**

n/a: Information not available.

12.5.3 Water entitlement transfers

A summary of the transfer of entitlements within the Loddon basin is shown in Table 12-6. There was a net import of water entitlement to the basin, with 4,293 ML being permanently traded out of the basin and 16,415 ML being temporarily traded into the basin.

Table 12-6 Transfer of entitlements in the Loddon basin

Entitlement[1]	Permanent entitlement transfer				Temporary entitlement transfer			
	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)
Goulburn-Murray Water								
Loddon River - Water right	0	4	2	-4	2,022	5,269	173	-3,247
Loddon River - Sales					105	0		105
Pyramid-Boort - Water right	75	4,364	24	-4,289	47,614	28,778	1,209	18,836
Pyramid-Boort - Sales					721	0		721
Total 2005/06	**75**	**4,368**	**26**	**-4,293**	**50,462**	**34,047**	**1,382**	**16,415**
Total 2004/05	**767**	**4,783**	**n/a**	**-4,016**	**36,818**	**42,507**	**n/a**	**-5,689**

Note:

(1) Entitlements for which no trades were recorded are not shown.

n/a: Information not available.

12.5.4 Volume diverted

The volume of water diverted under each water authority's 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 2005/06.

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	Period of bulk entitlement (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)	Entitlement volume compliance?(1)
Central Highlands Water					
Creswick	1	500	0	0	Yes
Daylesford	1	916	0	591	Yes
Lexton	1	45	0	24	Yes
Loddon System (part Maryborough)(2)	1	1,200	0	976	-
Evansford & Talbot System (part Maryborough)(3)	1	3,000	0	512	-
Coliban Water					
Loddon system(2)	1	820	0	497	-
Goulburn-Murray Water					
Bullarook Creek(4)	1	n/a	0	1,215	-
Loddon(1)	1	41,408	16,415	16,295	-
Minister for the Environment					
Loddon River – Environmental Reserve(2)	1	2,000	0	2,000	-
Total annual volume of bulk entitlements 2005/06		**49,889**	**16,415**	**22,110**	
Total annual volume of bulk entitlements 2004/05		**2,236**	**-5,689**	**26,334**	
Licensed diversions from unregulated streams 2005/06		*23,423*		*15,200*	
Licensed diversions from unregulated streams 2004/05		*15,411*		*6,200*	

Notes:

(1) Compliance is also assessed against the Murray-Darling Basin annual cap target for the Loddon basin – refer to the MDBC's Water Audit Monitoring Report 2005/06.

(2) These bulk entitlements became effective in November 2005 and hence compliance has not been assessed.

(3) This bulk entitlement became effective in June 2006 and hence compliance has not been assessed.

(4) This bulk entitlement is yet to be formally legislated.

n/a: Information not available.

12.6 Groundwater resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Loddon basin, excluding domestic and stock use, is presented in Table 12-8.

The Loddon basin contains all of the Mid Loddon WSPA and Spring Hill WSPA as well as part of the Upper Loddon WSPA, Bungaree WSPA, Campaspe Deep Lead WSPA and the Ellesmere GMA. The volumes described in tables below are totals for the management areas and include the area that falls outside the Loddon basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 12-8 Compliance with licensed groundwater volumes, Loddon basin 2005/06

Water supply protection area/Groundwater management area[1]	GMA/WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Ellesmere GMA (72%)	≤25	1,900	2,616	1,040	400	1,440	798
Bungaree WSPA (9%)	All depths	5,401	5,401	2,700	0	2,700	2,610
Campaspe Deep Lead WSPA (15%)	>25	46,069	46,251	23,110	344	23,454	25,713
Mid Loddon WSPA (100%)	All depths	37,200	37,200	15,830	0	15,830	17,580
Spring Hill WSPA (100%)	≤70	4,957	4,947	1,850	0	1,850	1,370
Upper Loddon WSPA (75%)	All depths	12,991	12,991	2,380	0	2,380	6,210

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) In non-metered areas, Goulburn-Murray Water has provided an estimate of use.

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, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Ellesmere GMA	27	54
Bungaree WSPA	252	504
Campaspe Deep Lead WSPA	188	376
Mid Loddon WSPA[3]	124	248
Spring Hill WSPA[3]	64	128
Upper Loddon WSPA[3]	198	396

Notes:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in Table 12-8.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

(3) Number of bores has been revised by Goulburn-Murray Water from 2004/05.

In the Loddon basin, groundwater provides a water supply for the townships of Forest Hill, Dean, Waubra, Learmonth and Clunes. The licensed entitlements and metered use for these groundwater supplies is provided in Table 12-10.

Table 12-10 Urban groundwater usage

Town supplied	Licensed allocation (ML)	Metered use 2005/06	Metered use 2004/05
Clunes	350	288	185
Dean	30	24	21
Forest Hill	350	215	229
Learmonth	100	56	59
Waubra	100	43	44

12.7 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers and licensed diversions on unregulated streams are shown in Table 12-11. In general, urban restrictions remained the same or moved to higher stages over the course of the year. Bendigo and surrounds moved to modified Stage 4 restrictions in November 2005.

No bans or restrictions were imposed on groundwater extraction in the Loddon basin during 2005/06.

Table 12-11 Seasonal allocations and restrictions on water use in Loddon basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	Daylesford	Stage 1 from July to December 2005
	Maryborough System (Maryborough, Carisbrook)	Stage 2 from July 2005 to June 2006
	Clunes	Stage 1 from July to December 2005
	Coliban System (Bendigo, Castlemaine)	Stage 3 from July to October 2005 moving to modified Stage 4 from November 2005 to June 2006(1)
	Loddon System (Dunolly, Laanecoorie)	Stage 1 from July to August 2005 moving to Stage 3 for September and October 2005 and back to Stage 1 from November 2005 to June 2006
	Wimmera System (Wedderburn, Korong Vale, Borung, Wychitella)	Stage 3 from July 2005 to June 2006
	Goulburn System (Boort, Mitiamo, Pyramid Hill)	Stage 1 from July 2005 to June 2006
Unregulated diversions	Lake Meran	Irrigation ban from July to October 2005
	Lower Loddon River (below Fernihurst Weir)	Irrigation ban from July to November 2005
	Bullock Creek,Upper, Upper Loddon River (above Cairn Curran)	Irrigation ban from January to June 2006
	Barkers Creek	Irrigation ban from February to June 2006
Irrigation and regulated diversions	Pyramid-Boort Irrigation District	7% of water right and licence volume from July 2005, increasing to 100% in October 2005 for remainder of season
	Loddon system	1% of licence volume from July, increasing to 100% in February for remainder of season
	Bullarook System – Newlyn	100% of licence volume from July 2005, increasing to 190% in October 2005 for remainder of season
	Bullarook System – Hepburn Lagoon	69% of licence volume from July 2005, increasing to 170% in September 2005 for remainder of season

Note:

(1) Modified Stage 4 restrictions are less onerous than 'full' Stage 4 restrictions, with residents allowed to use a hand held trigger nozzle hose between 7.00pm and 8.00pm on alternate days.

12.8 Recycled water

The wastewater treatment plants in the Loddon basin are operated by Coliban Water and Central Highlands Water. Recycled water in the basin doubled from 14% in 2004/05 to 28% in 2005/06, largely due to Coliban Water's Bendigo treatment plant supplying recycled water to the Perserverance gold mine at Fosterville (Table 12-12).

Table 12-12 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Bendigo	5,732	1,709	30%	1,000	709	0	0	4,023	0
Boort[4] [6]	0	0	0%	0	0	0	0	0	0
Bridgewater / Inglewood	7	7	100%	0	7	0	0	0	0
Castlemaine	977	0	0%	0	0	0	0	977	0
Clunes	53	0	0%	0	0	0	0	0	53
Creswick	235	0	0%	0	0	0	0	0	235
Daylesford	428	362	85%	25	337	0	0	0	66
Dunolly[5] [6]	0	0	0%	0	0	0	0	0	0
Kerang	513	0	0%	0	0	0	0	0	513
Maryborough	771	341	44%	120	221	0	0	0	430
Pyramid Hill[6]	0	0	0%	0	0	0	0	0	0
Wedderburn[5] [6]	0	0	0%	0	0	0	0	0	0
Total 2005/06	**8,716**	**2,419**	**28%**	**145**	**2,274**	**0**	**0**	**5,000**	**1,297**
Total 2004/05	**9,467**	**1,295**	**14%**	**155**	**1,140**	**0**	**0**	**6,286**	**1,886**

Notes:

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

(2) Water that is reused in sewage treatment processes, e.g. backflushing of filters.

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

(4) Boort treatment plant was inadvertently omitted from the 2004/05 State Water Report.

(5) Dunolly and Wedderburn treatment plants were completed in 2005/06 and therefore were not included in the 2004/05 State Water Report

(6) All effluent at these treatment plants was evaporated on-site

12.9 Water for the environment

12.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Loddon basin EWR comprised the following components:

- the Loddon River Environmental Reserve held by the Minister for the Environment of 2,000 ML plus passing flows
- passing flows released as a condition of consumptive bulk entitlements held by Central Highlands Water and Goulburn-Murray Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

12.9.2 Entitlements for the environment

The formal entitlements for the environment for the Loddon basin in 2005/06 comprised of the *Bulk Entitlement (Loddon River Environmental Reserve)* held by the Minister for the Environment, which came into effect in November 2005. Under this entitlement, 2,000 ML was provided to the Boort district wetlands. This entitlement also includes passing flows rules for the Loddon River, some of which are specified in Table 13-13 below.

12.9.3 Compliance with passing flow requirements

Table 12-13 shows the passing flow requirements 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.

Table 12-13 Selected passing flow requirements 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 the Environment
	Compliance point	Loddon River, between Cairn Curran and Laanecoorie reservoirs

	Passing flow rules	• From November to April inclusive, the lesser of 20 ML/day or natural flow
		• From May to October inclusive, if the combined storage volume in Cairn Curran and Tullaroop reservoirs is:
		  • Greater than 60,000 ML, the authority must pass 35 ML/day
		  • Less than or equal to 60,000 ML, the authority must pass 20 ML/day
		• River freshening (3 flows of 35 ML/day for 7 consecutive days between November and April)

	Compliance point	Tullaroop Creek, between Tullaroop Dam and Laanecoorie Reservoir
	Passing flow rules	• The lesser of 10 ML/day or natural flow • River freshening (4 flows of 13.5 ML/day for 7 consecutive days between November and April)
	Compliance point	Loddon River, between Laanecoorie Weir and Serpentine Weir

	Passing flow rules	• From November to July inclusive, the lesser of 15 ML/day or natural flow
		• From August to October inclusive, if the combined storage volume in Cairn Curran and Tullaroop reservoirs is:
		  • Greater than 60,000 ML, the authority must pass 52 ML/day
		  • Less than or equal to 60,000 ML, the authority must pass 15 ML/day
		• River freshening (3 flows of 52 ML/day for 7 consecutive days between November and April)

	Compliance point	Loddon River, between Serpentine Weir and Loddon Weir

	Passing flow rules	• From November to April inclusive, the lesser of 19 ML/day or natural flow
		• From May to October inclusive, if the combined storage volume in Cairn Curran and Tullaroop reservoirs is:
		  • Greater than 60,000 ML, the authority must pass 61 ML/day
		  • Less than or equal to 60,000 ML, the authority must pass 19 ML/day
		• River freshening (3 flows of 61 ML/day for 7 consecutive days between November and April)

	Compliance point	Loddon River, between Loddon Weir and Kerang Weir

	Passing flow rules	• From November to April inclusive, cyclical over two weeks: rise from 7 to 12 ML/day in one week, followed by fall from 12 to 7 ML/day the next week
		• From May to October inclusive, if the combined storage volume in Cairn Curran and Tullaroop reservoirs is:
		  • Greater than 60,000 ML, the authority must pass 61 ML/day plus flow equal to calculated in-stream loss
		  • Less than or equal to 60,000 ML, the authority must pass 10 ML/day plus flow equal to calculated in-stream loss
		• River freshening (flow of 50 ML/day plus flow equal to calculated in-stream loss for 14 consecutive days between January and February)

Goulburn-Murray Water reported that the bulk entitlement order for the Loddon system became effective in November 2005, with a 12 month period to fine-tune the daily operations before 100% compliance was required. Accordingly, it did not report on compliance in this system for 2005/06.

Central Highlands Water reported that it met all passing flow requirements with its bulk entitlements in 2005/06 with the exception of Bullarto Reservoir which forms part of the Daylesford water supply system in the Loddon basin.

12.9.4 Water leaving the basin

The amount of water flowing from the Loddon basin into the River Murray was 6,200 ML in 2005/06. This represents 5% of the total inflows into the basin, which is unchanged from 2004/05. This water comprises consumptive water that was not used under entitlements, traded water and the EWR (environmental entitlement, passing flows, and any water above cap).

There are important environmental assets dependent on water from the EWR in the Loddon basin. The Gunbower Forest and Kerang Wetlands which are located along the River Murray are internationally significant wetlands and are listed under the Ramsar convention. These sites rely on the freshwater inputs from the Loddon basin and River Murray for their ecological functioning.

12.10 Loddon basin summary

The Loddon basin is in the grip of an extended drought. Inflows to the Loddon basin were 28% of average and reservoirs started the year at 18% after a succession of dry years.

Irrigators and towns supplied from the regulated Loddon system were able to be supplied by restricting supply and further depleting the reservoirs which finished the year at 9% of their capacity.

Restrictions applied to towns and licensed diverters on unregulated streams, with irrigation bans on on many streams.

The upper reaches of the basin were better off with regulated diverters in the Bullarook system receiving 170% to 190% of licensed volume.

The extremely dry conditions were reflected in the depletion of storage volumes in the Loddon basin to 9% of capacity and basin outflows of 5% of inflow.

13 Avoca basin

Table 13-1 Key features of the Avoca basin, 2005/06

- Redbank, St Arnaud, Charlton, Culgoa and Berriwillock continued on Stage 3 restrictions for the entire year.
- The Avoca River did not flow at Quambatook except in September and October.
- Inflows were 18% of the long term average and declined for the second consecutive year.

13.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall across the Avoca basin ranged between 80% and 100% of the long term average. Due to previously prolonged dry conditions the basin's inflows were 18% of the long term average (136,200 ML) in 2005/06 compared with 19% in 2004/05 and 25% in 2003/04.

13.2 Responsibilities for management of water resources

Table 13-2 shows the responsibilities of various authorities within the Avoca basin.

Table 13-2 Responsibilities for water resources management within the Avoca basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Central Highlands Water			Towns in the southern part of the Avoca basin, including Avoca and Redbank	
GWMWater	Domestic and stock supplies to farms via Wimmera-Mallee Channel system, the Northern Mallee Pipeline, the western end of the Waranga Western Channel and diversions from rivers	Surface water and groundwater licensing	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				Waterway management in the Avoca basin

Note:

(1) Water for these towns is sourced from outside the Avoca basin.

13.3 Location of water resources

Figure 13-1 Map of 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 13-3. An overview of the methodology used to derive the information presented in this chapter is set out in Chapter 5.

Table 13-3 Summary of total water resources and water use in the Avoca basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	24,500	14,200
Groundwater(1)	Not available	Not available
Recycled water	250	250

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

13.5 Surface water resources

13.5.1 Water balance

A surface water balance for the Avoca basin is shown in Table 13-4.There are no storages greater than 1,000 ML in the Avoca basin. Small catchment dams are the main source of water supply in the catchment.

Table 13-4 Balance of surface water in the Avoca basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage(1)		
Volume in storage at start of year	0	0
Volume in storage at end of year	0	0
Change in storage	**0**	**0**
Inflows		
Catchment inflow	24,500	25,200
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	40	20
Sub-total	**24,500**	**25,200**
Usage		
Urban diversions (2)	50	20
Licensed private diversions from unregulated streams	1,400	1,700
Small catchment dams	12,700	12,700
Sub-total	**14,200**	**14,400**
Losses		
Net evaporation losses from major storages	0	0
Losses from small catchment dams	9,800	9,700
In-stream infiltration to groundwater, flows to floodplain and evaporation (3)	500	1,100
Sub-total	**10,300**	**10,800**
Water passed at outlet of basin		
Avoca River outflow to terminal lakes	500	1,100
Avoca River overflow from the terminal lakes to the Kerang Lakes	0	0

Notes:

(1) Excludes wetlands in the Avoca basin.

(2) Urban water supply for the township of Avoca was mainly sourced from groundwater in 2005/06.

(3) Back calculated as the difference between inflows and outflows.

13.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 13-5 below are based on the estimated average annual impact.

Table 13-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	10,500	5,300	Not available
Registered commercial and irrigation	8,900	7,400	Not available
Total	**19,400**	**12,700**	**22,500**

13.5.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements, diversion licences or sales water within the basin in 2005/06.

13.5.4 Volume diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 13-6. 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 2005/06. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 13-6 Volume of water diverted under surface water entitlements in the Avoca basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)	Entitlement volume compliance?
Central Highlands Water					
Amphitheatre	1	25	0	16	Yes
Avoca[1]	1	233	0	33	Yes
Redbank[2]	1	20	0	0	Yes
Total annual volume of bulk entitlements 2005/06		**278**	**0**	**49**	
Total annual volume of bulk entitlements 2004/05		**278**	**0**	**17**	
Licensed diversions from unregulated streams 2005/06		*3,621*		*1,400*	
Licensed diversions from unregulated streams 2004/05		*3,512*		*1,700*	

Notes:

(1) Urban water supply for the township of Avoca was primarily sourced from groundwater in 2005/06.

(2) Redbank was supplied by groundwater in 2005/06 instead of its normal surface water supply.

13.6 Groundwater resources

There are no groundwater management areas or water supply protection areas located within the Avoca basin, however a proposal to declare the Avoca GMA was initiated during the year. Groundwater is being used to supply urban water for the townships of Avoca and Redbank. The licensed entitlements and metered use for these groundwater supplies is provided in Table 13-7.

Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 13-7 Urban groundwater usage

Town supplied	Licensed allocation (ML)	Metered use 2005/06	Metered use 2004/05
Avoca	200	175	175
Redbank	n/a	6	5

n/a: This is a drought relief bore with no licensed allocation.

13.7 Seasonal allocations and restrictions on water use, diversions and extractions

Redbank, St Arnaud, Charlton, Culgoa and Berriwillock remained on Stage 3 restrictions for the entire year, as occurred in 2004/05.

No bans or restrictions were imposed on groundwater extraction in the Avoca basin during 2005/06.

Table 13-8 Seasonal allocations and restrictions on water use in Avoca basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	Avoca, Amphitheatre	Voluntary restrictions from July 2005 to December 2005
	Redbank, Berriwillock, Charlton, Culgoa, St Arnaud	Stage 3 from July 2005 to June 2006
	Towns in southern part of Avoca basin including Avoca and Redbank	Permanent water savings measures were imposed for Central Highlands Water customers in February 2006
Unregulated licensed diversions	No restrictions	No restrictions

13.8 Recycled water

Recycled water in the Avoca basin amounted to 96% of wastewater available during the year. The Avoca treatment plant recycled 190% of the wastewater delivered; this occurred because of an amount held over in the Avoca treatment plant's storage lagoons from 2004/05 that was recycled in 2005/06 (Table 13-9).

Table 13-9 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Avoca[4]	29	55	190%	0	55	0	0	0	0
Charlton	25	25	100%	0	25	0	0	0	0
Sea Lake	14	14	100%	0	14	0	0	0	0
St Arnaud	174	139	80%	0	139	0	0	35	0
Wycheproof	12	12	100%	0	12	0	0	0	0
Total 2005/06	**254**	**245**	**96%**	**0**	**245**	**0**	**0**	**35**	**0**
Total 2004/05	**336**	**312**	**93%**	**1**	**311**	**0**	**0**	**0**	**24**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

(4) Water held over in storage lagoons from 2004/05 was also recycled.

13.9 Water for the environment

13.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Avoca basin EWR comprised the following components:

- passing flows released as a condition of consumptive bulk entitlements held by Central Highlands Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

13.9.2 Compliance with passing flow requirements

The Avoca River is essentially unregulated with no significant storages in the basin. Central Highlands Water operate several small urban storages in the upper reaches and report that they have complied with all passing flows.

13.9.3 Water leaving the basin

In 2005/06 no water was recorded as passing the outlet of the basin. The Avoca River discharges into a series of terminal wetlands (Lake Bael Bael and the Marshes) which overflow to the Kerang Lakes only during wet periods.

The Kerang Lakes received no inflows from the Avoca basin in 2005/06, as was the case in 2004/05. Bordering the Avoca basin, the Kerang Lakes are internationally significant wetlands listed under the Ramsar convention.

13.10 Avoca basin summary

The Avoca basin continued to be very dry. Inflows to the Avoca basin were 18% of the long term average in 2005/06 following a succession of similarly very dry years. Little surface water was available and the town of Avoca was required to source most of its water from groundwater.

Towns such as Charlton and St Arnaud are supplied from the Wimmera-Mallee system and remained on Stage 3 restrictions during the year.

The Avoca River did not flow at Quambatook except for a brief occurrence in September and October 2005.

14 Mallee basin

Table 14-1 Key features of the Mallee basin, 2005/06

- The Wimmera-Mallee summer and winter channel runs filled one dam per 400 hectares, a decrease from one per 250 hectares in the previous year.
- Town and domestic and stock supplies in the northern Mallee Pipeline area were not restricted.

14.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall across the basin ranged between 80% and 100% of the long term average, which was broadly consistent with rainfall in 2004/05 but an improvement on 2003/04 rainfall, which ranged between 60% and 100% of the long term average.

The Mallee basin generally has no 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.

14.2 Responsibilities for management of water resources

Table 14-2 shows the responsibilities of various authorities within the Mallee basin.

Table 14-2 Responsibilities for water resources management within the Mallee basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
GWMWater	Rural water supply to farms in the north of the basin via the Northern Mallee Pipeline from the River Murray and in the south of the basin via the Wimmera-Mallee channel system	Acts as the licensing authority for the Murrayville WSPA and all other groundwater bores in the Mallee basin(1)	Water supply to towns in the north of the basin via the Northern Mallee Pipeline from the River Murray and in the south of the basin via the Wimmera-Mallee channel system	
Mallee Catchment Management Authority				Waterway management in the whole of the Mallee basin

Note:

(1) Under agreement with Lower Murray Water.

14.3 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Mallee basin are shown in Table 14-3.

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

14.4 Location of water resources

Figure 14-1 Map of the Mallee basin

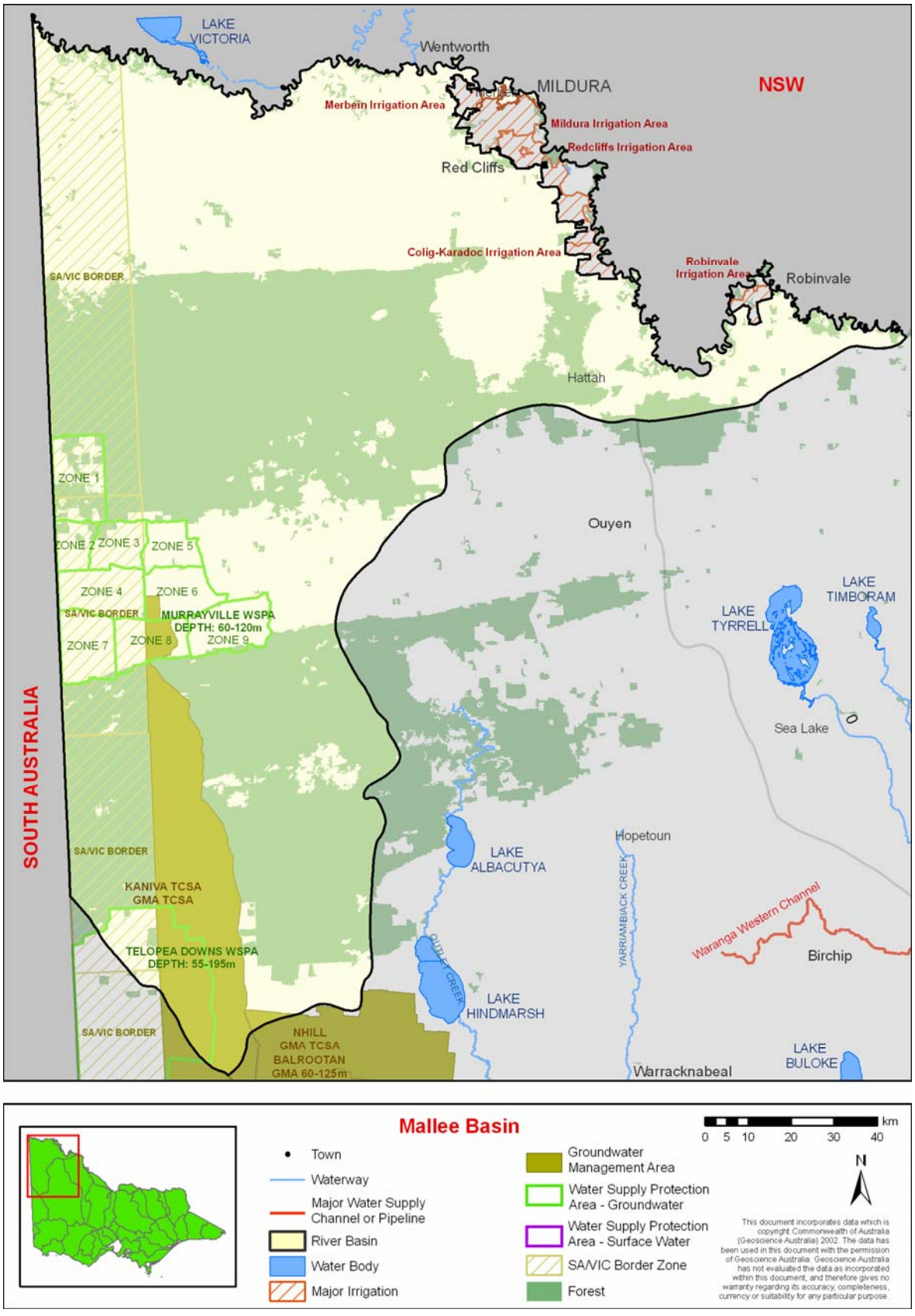


Table 14-3 Summary of total water resources and water use in the Mallee basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	0	0
Groundwater(1)	Not available	Not available
Recycled water	0	0

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

14.5 Surface water resources

14.5.1 Water balance

A water balance for the Mallee basin has not been presented. All surface water supplies are sourced external to the basin.

14.5.2 Small catchment dams

Some small catchment dams are known to be in the Mallee basin, however 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.

14.5.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements, diversion licences or sales water within the basin in 2005/06.

14.5.4 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.

14.6 Groundwater resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Mallee basin, excluding domestic and stock use, is presented in Table 14-4.

The Mallee basin contains all of the Murrayville WSPA as well as part of the Telopea Downs WSPA and Kaniva TCSA (Tertiary Confined Sand Aquifer) GMA. The volumes described in tables below are totals for the management areas and include the area that falls outside the Mallee basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 14-4 Compliance with licensed groundwater volumes, Mallee basin 2005/06

Water supply protection area/ Groundwater management area[1]	GMA/ WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Kaniva TCSA GMA (80%)	Tertiary confined sand aquifer	1,100	0	0	0	0	0
Murrayville WSPA (100%)	70-200[5]	10,883	9,634	2,870	0	2,870	4,700
Telopea Downs WSPA (38%)	All depths[5]	7,482	7,482	4,120	0	4,120	3,830

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) Depth limits were incorrectedly stated in 2004/05 State Water Report and have been adjusted

An estimate of domestic and stock groundwater use is provided in Table 14-5.

Table 14-5 Number of domestic and stock bores and estimated use, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Kaniva TCSA GMA	0	0
Murrayville WSPA	280	560
Telopea Downs WSPA	97	194

Note:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in Table 14-4.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

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 is provided in Table 14-6.

Table 14-6 Urban groundwater usage

Town supplied	Licensed allocation (ML)	Metered use 2005/06	Metered use 2004/05
Murrayville	475	171	175
Cowangie	40	9	10

14.7 Seasonal allocations and restrictions on water use, diversions and extractions

A summary of the 2005/06 restrictions on water use in the Mallee basin is presented in Table 14-7.

No bans or restrictions were imposed on groundwater extraction in the Malleee basin during 2005/06.

Table 14-7 Seasonal allocations and restrictions on water use in Mallee basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	Towns supplied from the Murray via the Northern Mallee Pipeline	No restrictions
	Towns supplied from Grampians via the Wimmera-Mallee channel system	Stage 3 restrictions all year
Domestic and stock farm supplies	Wimmera-Mallee channel system supplied from the Grampians	Winter channel run filled one dam per 400 hectares
	Northern Mallee Pipeline area	No restrictions

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 (EWR)

In 2005/06 the Mallee basin EWR comprised water outside the allocation limit for GMAs and WSPAs.

14.9.2 Entitlements for the environment

There were no entitlements for the environment in operation in the Mallee basin in 2005/06. Refer to Chapter 6 for environmental water provided to Red Gums along the River Murray floodplain that borders the Mallee basin.

14.9.3 Compliance with passing flow requirements

As all surface water supplies are externally sourced in the Mallee basin, there are no passing flow requirements.

14.9.4 Water leaving the basin

There is no reliable estimate of surface flows in the Mallee basin to estimate the volume of water leaving the basin. This water would comprise water not used under consumptive groundwater entitlements.

14.10 Mallee basin summary

The Mallee basin experienced another dry year. Water supplied to towns and farms in the basin sourced externally to the basin. Supply from the Wimmera-Glenelg basins (the Wimmera-Mallee system) is stressed and has been for some years.

Farms and towns supplied from the Wimmera-Mallee system have been restricted for several years.

Towns in the basin supplied from groundwater were not subject to restrictions except for Edenhope which is on Stage 1.

15 Wimmera basin

Table 15-1 Key features of the Wimmera basin, 2005/06

- Storages in the Wimmera basin were 10% of capacity by the end of 2005/06 after starting the year 12% full.
- Clear Lake, Dimboola and Natimuk moved to Stage 4 restrictions in November 2005. Other towns on the channel system were on Stage 3.
- Domestic and stock supplies to farms for the winter channel run was limited to one dam per 400 hectares.
- Irrigators were allocated 5% of their water entitlement late in the season but elected not to take it due to the seriousness of the regional water supply situation and the allocation's minimal commercial value.
- Almost 100% of the volume of wastewater passed through the 15 wastewater treatment plants was reused.

15.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall across the Wimmera basin ranged between 60% and 100% of the long term average. Although inflows were 35% of the long term average (316,400 ML) in 2005/06, this was an increase on 2004/05 inflows (23%).

15.2 Responsibilities for management of water resources

Table 15-2 shows the responsibilities of various authorities within the Wimmera basin.

Table 15-2 Responsibilities for water resources management within the Wimmera basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
GWMWater	Wimmera-Mallee water supply system delivers water to farms in the Wimmera basin(1)	Groundwater and surface water licensed diversions	Most towns in the Wimmera basin(1) Bulk supply to Coliban Water's towns	Wimmera-Mallee water supply system that includes Lakes Bellfield, Wartook, Lonsdale and Fyans and Taylors and Pine Lakes
Central Highlands Water			Towns of Landsborough and Navarre	Obligation to meet passing flow requirements
Coliban Water			Towns supplied with bulk water from the Wimmera-Mallee system (Borung, Korong Vale, Wedderburn, and Wychitella)	
Goulburn Murray Water	Bulk supply to GWMWater for domestic and stock use (supplied from the Goulburn system via the Waranga Main Channel)		Bulk supply from the Goulburn system to GWMWater for Quambatook	
Wimmera Catchment Management Authority				Waterway management in the Wimmera River catchment
North Central Catchment Management Authority				Waterway management in the Avon and Richardson river catchments

Note:

(1) Also supplies farms located in the Avoca and Mallee basins

15.3 Location of water resources

Figure 15-1 Map of 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 15-3.

GWMWater is constructing the Wimmera Mallee Pipeline, which will ultimately replace 17,500 kilometres of open earthen channels with a pressurised pipeline system. The first pipes were laid in September 2005 and, once completed, the project will return an estimated 83,000 ML in annual water savings.

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

Table 15-3 Summary of total water resources and water use in the Wimmera basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	115,400	84,500
Groundwater(1)	Not available	Not available
Recycled water	2,040	2,030

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

15.5 Surface water resources

15.5.1 Water balance

A surface water balance for the Wimmera basin is shown in Table 15-4. At the beginning of the year, the major storages in the Wimmera basin held 12% of their capacity. This had reduced to 10% of capacity by the end of the year.

Table 15-4 Balance of surface water in the Wimmera basin

Water account component	2005/06 (ML)	2004/05[1] (ML)
Major on-stream storage		
Volume in storage at start of year[1]	47,900	65,700
Volume in storage at end of year[1]	38,200	47,900
Change in storage	**-9,700**	**-17,800**
Inflows		
Catchment inflow[2]	109,600	73,900
Transfer from Glenelg basin	5,800	32,500
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**115,400**	**106,400**
Usage		
Urban diversions and use	11,100	9,680
Diversions for irrigation and domestic and stock use	57,300	67,300
Licensed private diversions from unregulated streams	1,700	1,700
Small catchment dams	14,400	14,400
Sub-total	**84,500**	**93,100**
Losses[3]		
Net evaporation losses from major storages	18,200	14,200
Losses from small catchment dams	8,600	8,500
In-stream infiltration to groundwater, flows to floodplain and evaporation[4]	3,200	7,200
Sub-total	**30,000**	**29,900**
Water passed at outlet of basin		
River outflows to Lake Hindmarsh (measured at Lochiel)	10,600	1,200
River outflows to Lake Buloke	0	40

Notes:

(1) For the Wimmera basin, in 2004/05, the reporting year for storage volumes is from 1 November 2004 to 31 October 2005. As a result, the volume in storage as shown at the start of the 2005/06 year is as at 31 October 2005. Reporting arrangements for 2005/06 were brought in line with other basins and the volume in storage as shown at the end of the 2005/06 year is as at 30 June 2006.

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

(3) The losses accounted for in the water balance do not include any of the considerable losses that occur while water is being transferred from storages to the point where releases from the headworks to the Wimmera-Mallee system are measured.

(4) Losses estimated using loss functions in the Grampians Wimmera Mallee REALM model.

15.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 15-5 below are based on the estimated average annual impact.

Table 15-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	12,900	6,500	Not available
Registered commercial and irrigation	9,400	7,900	Not available
Total	**22,300**	**14,400**	**23,000**

15.5.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements, diversion licences or sales water within the basin in 2005/06.

15.5.4 Volume diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 15-6. 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 2005/06.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 15-6 Volume of water diverted under surface water entitlements in the Wimmera basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)(1)	Entitlement volume compliance?(2)
Coliban Water					
Wimmera and Glenelg	1	385	0	160	Yes
Central Highlands Water					
Landsborough - Navarre	1	60	0	0	Yes
GWMWater					
Elmhurst(3)	n/a	n/a	n/a	0	n/a
Willaura, Moyston, Lake Bolac and Wickliffe(3)	n/a	n/a	n/a	0	n/a
Wimmera and Glenelg Rivers - Grampians Water	5	16,109	0	10,703	Yes
Wimmera and Glenelg Rivers - Wimmera Mallee Water	5	149,211	0	57,326	Yes
Wannon Water					
Wimmera and Glenelg Rivers	1	465	0	87	Yes
Minister for the Environment					
Wimmera and Glenelg Rivers(4)	5	40,563	0	824	Yes
Total annual volume of bulk entitlements 2005/06		**206,793**	**0**	**69,100**	
Total annual volume of bulk entitlements 2004/05		**205,780**	**0**	**84,507**	
Licensed diversions from unregulated streams 2005/06		*2,486*		*1,700*	
Licensed diversions from unregulated streams 2004/05		*2,421*		*1,700*	

Notes:

(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2005, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2005/06 period. The actual maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

(2) Compliance is also assessed against the Murray-Darling Basin annual cap target for the Wimmera and Mallee basins – refer to the MDBC's Water Audit Monitoring Report 2005/06.

(3) Bulk entitlements for Elmhurst and Willaura, Moyston, Lake Bolac and Wickliffe reported in the 2004/05 State Water Report were not completed in 2005/06.

(4) The bulk entitlement held by the Minister for the Environment is reported under both the Glenelg and Wimmera basins, with the volume released for each system shown separately. The 824 ML in Table 15-6 was released prior to the Minister postponing further environmental flows in August 2006.

15.6 Groundwater resources

A summary of the licensed entitlements and use for groundwater management areas that overlap the Wimmera basin, excluding domestic and stock use, is presented in Table 15-7.

The Wimmera basin contains all of the Balrootan (Nhill) GMA, and parts of the Nhill GMA and Goroke GMA. The volumes described in tables below are totals for the management areas and include the area that falls outside the Wimmera basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 15-7 Compliance with licensed groundwater volumes, Wimmera basin 2005/06

Water supply protection area/ Groundwater management area[1]	GMA/ WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)[5]	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Balrootan (Nhill) GMA (100%)	60-125	980	1,522	690	690	1,380	370
Goroke GMA (63%)	Tertiary confined sand aquifer	2,200	0	0	0	0	0
Nhill GMA (98%)	Tertiary confined sand aquifer	1,200	0	0	0	0	0

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) In non-metered areas, GWMWater has provided the estimate of use based on the percent of bores that are metered.

An estimate of domestic and stock groundwater use is provided in Table 15-8.

Table 15-8 Number of domestic and stock bores and estimated use, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Balrootan (Nhill) GMA[3]	51	102
Goroke GMA	0	0
Nhill GMA	0	0

Note:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in the Table 15-7.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

(3) Number of bores has been revised by GWMWater from 2004/05.

Groundwater is used as an urban water supply to the townships of Landsborough, Nhill, Boroka and Kiata. The licensed entitlements and metered use for these groundwater supplies is provided in Table 15-9.

Table 15-9 Urban groundwater usage

Town supplied	Licensed allocation (ML)	Metered use 2005/06	Metered use 2004/05
Boroka	30	0	0
Kiata	40	5	4
Landsborough(1)	n/a	36	28
Nhill	1,000	445	335

Note:

(1) Landsborough is supplied by a drought relief bore and has no licensed allocation.

15.7 Seasonal allocations and restrictions on water use, diversions and extractions

Customers in both the rural and urban areas of the Wimmera basin faced rectrictions on water use in 2005/06. Some urban customers moved to Stage 4 restrictions in November 2005 and rural customers received low allocations throughout the season (Table 15-10).

No bans or restrictions were imposed on groundwater extraction in the Wimmera basin during 2005/06.

Table 15-10 Seasonal allocations and restrictions on water use in Wimmera basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	Landsborough, Navarre, Birchip, Donald, Horsham, Nhill, Ouyen, Stawell, Warracknabeal and others	Stage 3 from July 2005 to June 2006
	Clear Lake, Dimboola, Jung, Natimuk	Stage 3 from July 2005, increasing to Stage 4 from November 2005 to June 2006
Domestic and stock and irrigation	Wimmera Mallee system	Irrigation customers received 5% of their full allocation late in the season but elected not to take it Supply-by-agreement customers received 40% of allocation Summer domestic and stock channel run filled one dam per 400 hectares Winter channel run filled one dam per 400 hectares
Environment	Wimmera and Glenelg Rivers	Environment allocated 5,110 ML of its 40,560 ML (combined) entitlement

15.8 Recycled water

GWMWater operates 15 wastewater treatment plants in the Wimmera basin, and reuses almost all wastewater at 12 of these plants for purposes including irrigation of pasture, horticulture and vineyards, and watering of recreational facilities and parks (Table 15-11). Wastewater produced at the three other plants is evaporated on-site.

Table 15-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Birchip	18	18	100%	0	18	0	0	0	0
Dimboola	77	77	100%	0	77	0	0	0	0
Donald	60	60	100%	0	60	0	0	0	0
Halls Gap	65	65	100%	0	65	0	0	0	0
Hopetoun[4]	0	0	0%	0	0	0	0	0	0
Horsham	934	934	100%	155	779	0	0	0	0
Jeparit	31	31	100%	0	0	0	31	0	0
Minyip[4]	0	0	0%	0	0	0	0	0	0
Murtoa	29	29	100%	0	29	0	0	0	0
Natimuk	14	14	100%	0	0	0	14	0	0
Nhill	181	181	100%	0	181	0	0	0	0
Ouyen[4]	0	0	0%	0	0	0	0	0	0
Rainbow	32	32	100%	0	0	0	32	0	0
Stawell	489	480	98%	301	179	0	0	0	9
Warracknabeal	112	108	97%	108	0	0	0	0	4
Total 2005/06	**2,041**	**2,028**	**99%**	**564**	**1,388**	**0**	**77**	**0**	**13**
Total 2004/05	**2,327**	**2,327**	**100%**	**403**	**1,924**	**0**	**0**	**0**	**0**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

(4) Hopetoun, Minyip and Ouyen treatment plants commenced operations in 2005/06 and therefore were not included in the 2004/05 State Water Report. All wastewater produced is evaporated on-site.

15.9 Water for the environment

15.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Wimmera basin EWR comprised the following components:

- the Wimmera and Glenelg Rivers Flora and Fauna bulk entitlement of 40,563 ML
- passing flows released as a condition of consumptive bulk entitlements held by GWMWater
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

15.9.2 Entitlements for the environment

The formal entitlement for the environment for the Wimmera basin in 2005/06 comprised the Wimmera and Glenelg Rivers Flora and Fauna Environmental Reserve held by the Minister for the Environment. The implementation of the Wimmera Mallee Pipeline will provide increased water for the environment through the environmental Water Reserve.

The Inter Catchment Advisory Group (ICAG) determines the share of environmental allocations between the two catchments. The full entitlement for the Wimmera Glenelg system is 40,563 ML. Due to continued dry conditions the 2005/06 environmental allocation to the total Wimmera Glenelg system was 8,689 ML which included an additional allocation of 50 ML in compensation flows for the Glenelg River as well as a carryover of 4,438 ML from 2004/05.

In 2005/06 some 442 ML of environmental flow releases were made in the Wimmera basin for the MacKenzie River between Mt Zero offtake and the junction with the Wimmera River. No further releases were made due to the withholding of allocations in August 2006.

The environment was also allocated 382 ML or 20% of the development reserve, as per the agreed management of this entitlement during dry conditions.

15.9.3 Compliance with passing flow requirements

All environmental water has been incorporated into the environmental bulk entitlement and therefore there are no obligations on the water authority to provide passing flows.

15.9.4 Streamflow management plans (SFMPs)

Development of an SFMP for the upper Wimmera River has been halted pending further technical input.

15.9.5 Water leaving the basin

The amount of water flowing from the Wimmera basin into the terminal lakes in the basin was 10,600 ML in 2005/06. This represents 10% of the total inflows into the basin, compared to 2% in 2004/05. This water comprises consumptive water that was not used under entitlements and the EWR (environmental entitlement, passing flows, and any water above cap).

There are important environmental assets dependent on water from the EWR in the Wimmera basin. Lake Albacutya in the Wimmera basin is an internationally significant wetland listed under the Ramsar convention. This site relies on freshwater inputs from the Wimmera basin for its ecological functioning.

15.10 Wimmera basin summary

The west of the state has been hardest hit by the drought and Wimmera basin experienced another year of significantly reduced rainfall and streamflows – a pattern which has continued since 1997. To illustrate the severity of the reductions, streamflows in 1996 in the Wimmera River (as gauged at Eversley) were 36,700 ML. This single year total is greater than aggregate streamflow in the entire nine years from 1997 to 2006, which was 33,300 ML.

Major storages in the Wimmera basin continued to remain at historically low levels, and fell from an average 12% to 10%, including some that are empty. As a consequence, restrictions on water use continued. Urban customers remained on Stage 3 (of five stage) restrictions across the entire year and although irrigators received 5% of their full allocation they elected not to use it, resulting in their fourth year without water. The winter channel run (June to October 2005) allowed 35% of dams to be filled and the summer run (November to December 2005) 25%.

16 East Gippsland basin

Table 16-1 Key features of the East Gippsland basin, 2005/06

- Inflows increased compared to 2004/05, but were still substantially below long term averages.
- More than 99% of total inflows left the basin at the outlet.

16.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall in the East Gippsland basin ranged between 80% and 125% of the long term average. Despite experiencing close to average rainfall, streamflows were well below average due to the ongoing effect of previous dry years having depleted soil moisture. Inflows to the East Gippsland basin in 2005/06 were 45% of the long term average (1,122,000 ML), an improvement on the two prior years, which were 14% of the long term average.

16.2 Responsibilities for management of water resources

Table 16-2 shows the responsibilities of various authorities within the East Gippsland basin.

Table 16-2 Responsibilities for water resources management within the East Gippsland basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Southern Rural Water		Licensed diversions from groundwater and surface water sources		
East Gippsland Water			Urban water to towns including Mallacoota, Cann River and Bemm River	Obligation to meet passing flow requirements
East Gippsland Catchment Management Authority				Waterway management in the whole of the East Gippsland basin

16.3 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 16-3. There is very low extraction of surface water (0.3%) relative to the available resource in the basin. All wastewater is recycled for productive purposes.

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

Table 16-3 Summary of total water resources and water use in the East Gippsland basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	508,600	1,600
Groundwater	0	0
Recycled water	70	70

16.4 Location of water resources

Figure 16-1 Map of the East Gippsland basin

16.5 Surface water resources

16.5.1 Water balance

The surface water balance for the East Gippsland basin for 2005/06 is shown in Table 16-4. There was a substantial increase in catchment inflows in 2005/06 compared to 2004/05.

No reservoir information is recorded in the water balance as there are no storages in the East Gippsland basin with a capacity greater than 1,000 ML.

The inflows to the East Gippsland basin originate from both New South Wales and Victoria. On average, New South Wales contributes around 26% of total inflows to the basin. The water balance includes total flow for the basin in both states.

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

Table 16-4 Balance of surface water in the East Gippsland basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	0	0
Volume in storage at end of year	0	0
Change in storage	**0**	**0**
Inflows		
Catchment inflow(1)	508,600	159,300
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**508,600**	**159,300**
Usage		
Urban diversions	300	240
Licensed private diversions from unregulated streams	200	400
Small catchment dams	1,100	1,100
Sub-total	**1,600**	**1,700**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams	100	100
In-stream infiltration to groundwater, flows to floodplain and evaporation(2)	0	0
Sub-total	**100**	**100**
Water passed at outlet of basin		
River outflows	506,900	157,500

Notes:

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

(2) Assumed to be zero because data is not readily available.

16.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 16-5 below are based on the estimated average annual impact.

Table 16-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	800	400	Not available
Registered commercial and irrigation	900	700	Not available
Total	**1,700**	**1,100**	**1,200**

16.5.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements, diversion licences or sales water within the basin or across basin boundaries in 2005/06.

16.5.4 Volume diverted

The volume of water diverted under East Gippsland Water's bulk entitlements is shown in Table 16-6.

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 2005/06.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 16-6 Volume of water diverted under surface water entitlements in the East Gippsland basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)	Entitlement volume compliance?
East Gippsland Water					
Bemm River	1	100	0	34	Yes
Cann River	1	192	0	60	Yes
Mallacoota	1	330	0	201	Yes
Total annual volume of bulk entitlements 2005/06		**622**	**0**	**295**	
Total annual volume of bulk entitlements 2004/05		**622**	**0**	**241**	
Licensed diversions from unregulated streams 2005/06		*755*		*200*	
Licensed diversions from unregulated streams 2004/05		*724*		*400*	

16.6 Groundwater resources

There are no groundwater management areas or water supply protection areas located within the East Gippsland basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

East Gippsland Water operates a groundwater bore in the East Gippsland basin for the town of Mallacoota with a licensed volume of 70 ML a year. However, as in 2004/05, the bore was not used in 2005/06.

Table 16-7 Urban groundwater usage

Town supplied	Licensed allocation (ML)	Metered use 2005/06	Metered use 2004/05
Mallacoota	70	0	0

16.7 Seasonal allocations and restrictions on water use, diversions and extractions

There were no domestic or rural restrictions on water use in the East Gippsland basin in 2005/06. No bans or restrictions were imposed on groundwater use in the East Gippsland basin during 2005/06.

Table 16-8 Seasonal allocations and restrictions on water use in East Gippsland basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban		No restrictions Permanent water savings measures were introduced in October 2005
Licensed diversions from unregulated streams		No restrictions

16.8 Recycled water

The wastewater treatment plant at Mallacoota is operated by East Gippsland Water. All the wastewater that passed through this treatment plant was recycled for applications including pasture and tree plantations. The Cann River sewerage scheme was officially opened in November 2005. Around 200 properties will be connected to the scheme and treated wastewater will be recycled for use on local pastures.

Table 16-9 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	Volume recycled (%)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Cann River	n/a	-	-	-	-	-	-	-	-
Mallacoota	65	65	100%	0	65	0	0	0	0
Total 2005/06	**65**	**65**	**100%**	**0**	**65**	**0**	**0**	**0**	**0**
Total 2004/05	**33**	**33**	**100%**	**0**	**33**	**0**	**0**	**0**	**0**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

n/a: Information not available.

16.9 Water for the environment

16.9.1 Environmental Water Reserve (EWR)

In 2005/06 the East Gippsland basin EWR comprised the following components:

- passing flows released as a condition of consumptive bulk entitlements held by East Gippsland Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

16.9.2 Compliance with passing flow requirements

Table 16-10 shows the passing flow requirements 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.

Table 16-10 Selected passing flow requirements 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
	Passing flow rules	• When flow is less than or equal to 3.1 ML/day, then the authority must pass half the flow • When flow is greater than 3.1 ML/day the passing flow must be equal to or greater than 1.55 ML/day

East Gippsland Water reported that it met all passing flow requirements under its bulk entitlement in 2005/06.

16.9.3 Water leaving the basin

The amount of water flowing from the East Gippsland basin into Bass Strait was 506,900 ML in 2005/06. This represents more than 99% of the total inflows into the basin, which is unchanged from 2004/05. This water comprises consumptive water that was not used under entitlements and the EWR (passing flows and any water above cap).

16.10 East Gippsland basin summary

Water availability improved in the East Gippsland basin in 2005/06 due to high rainfall and inflows. However, because consumptive allocations are very low compared to average inflows, there was little impact on consumptive use.

17 Snowy basin

Table 17-1 Key features of the Snowy basin, 2005/06

- 99% of the total inflows from the Victorian portion of the basin flowed into Bass Strait at Marlo.
- The Victorian and New South Wales governments have an obligation to increase flows to the Snowy River. Victoria has provided water savings of 26,600 ML under this commitment.

17.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall in the Snowy basin ranged between 80% and 125% of the long term average annual rainfall. Despite this, inflows were below average due to the ongoing effect of previous dry years having depleted soil moisture.

Total inflows in 2005/06 were 75% of the long term average (1,447,285 ML), which was approximately double that recorded in 2004/05 and 2003/04.

17.2 Responsibilities for management of water resources

Table 17-2 shows the responsibilities of various authorities within the Snowy basin.

Table 17-2 Responsibilities for water resources management within the Snowy basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Southern Rural Water		Groundwater and surface water licensed diversions		
East Gippsland Water			Including the towns of Buchan, Cann River, Genoa, Bonang, Mallacoota Orbost and Marlo	Obligation to meet passing flow requirements
East Gippsland Catchment Management Authority				Waterway management for the whole of the Snowy basin

17.3 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 17-3. There is a very low consumptive use of surface water relative to the available resource in the basin. All treated wastewater is reused for productive purposes.

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

17.4 Location of water resources

Figure 17-1 Map of the Snowy basin

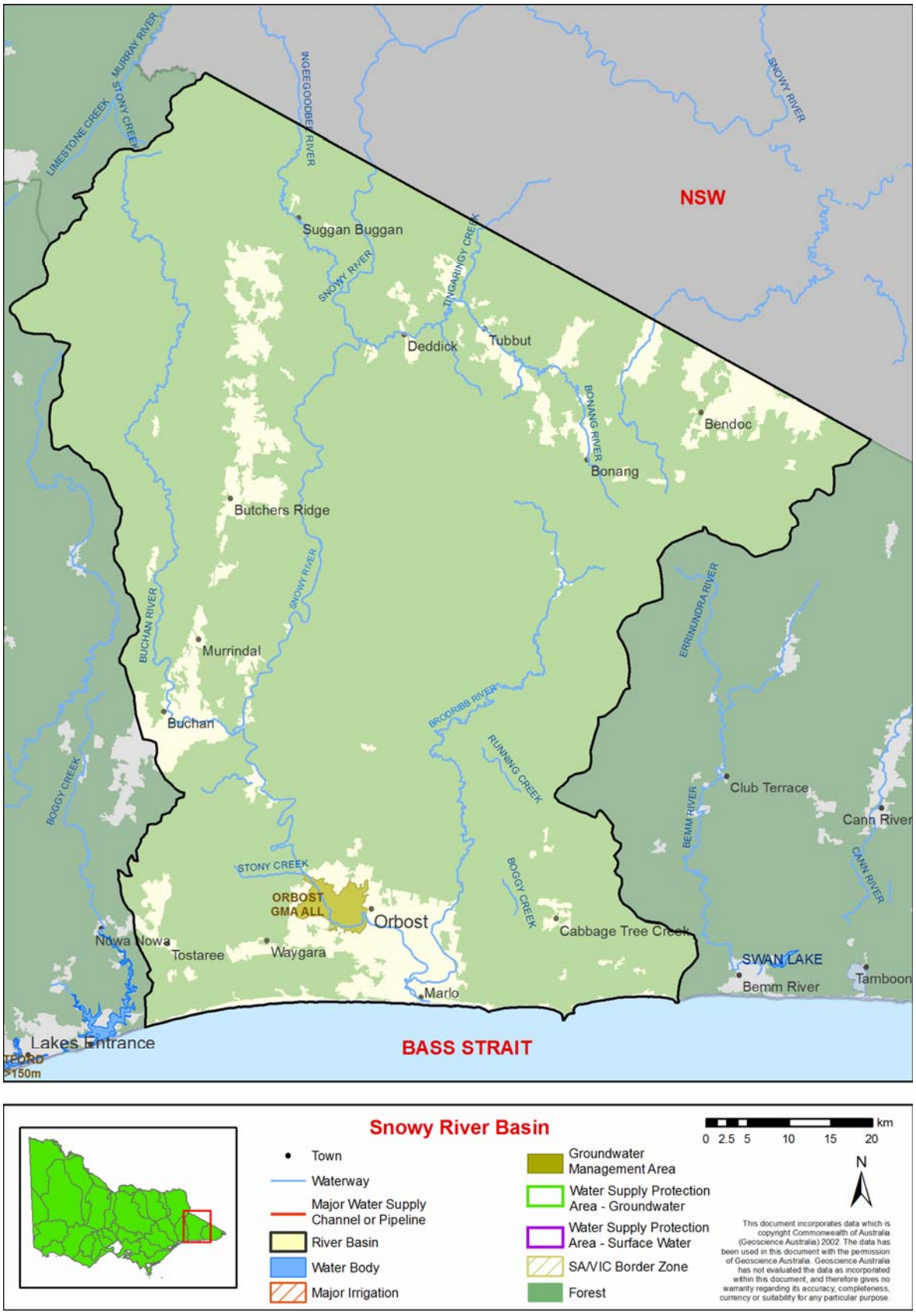


Table 17-3 Summary of total water resources and water use in the Snowy basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	1,078,300	5,400
Groundwater[1]	1,200	350
Recycled water	280	280

Note:

(1) Approximately 95% of the Snowy basin is an unincorporated area that contains a significant groundwater resource not represented in these totals.

17.5 Surface water resources

17.5.1 Water balance

A surface water balance for the Snowy basin is shown in Table 17-4. 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 storages in the Victorian Snowy basin with a capacity greater than 1,000 ML.

The inflow from the Victorian catchment of the Snowy basin was estimated to be 843,600 ML in 2005/06, representing 58% of the long term average.

The diversions in Victoria from the Snowy basin represents less than 1% of the total inflows.

Table 17-4 Balance of surface water in the Snowy basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	0	0
Volume in storage at end of year	0	0
Change in storage	**0**	**0**
Inflows		
Catchment inflow from Victoria[1]	843,600	444,300
Catchment inflow from NSW[2]	234,700	85,900
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**1,078,300**	**530,200**
Usage		
Urban diversions	900	870
Licensed private diversions from unregulated streams	1,100	2,300
Small catchment dams	3,400	3,400
Sub-total	**5,400**	**6,600**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams	700	600
In-stream infiltration to groundwater, flows to floodplain and	0	0
Sub-total	**700**	**600**
Water passed at outlet of basin		
River outflows to the ocean	1,072,200	523,000

Notes:

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

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

(3) Assumed to be zero becaused data is not available.

17.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 17-5 below are based on the estimated average annual impact.

Table 17-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	3,100	1,600	Not available
Registered commercial and irrigation	2,100	1,800	Not available
Total	**5,200**	**3,400**	**4,100**

17.5.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements, diversion licences or sales water within the basin in 2005/06.

17.5.4 Volume diverted

The volume of water diverted under East Gippsland Water's bulk water entitlements is shown in Table 17-6. 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 2005/06.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 17-6 Volume of water diverted under surface water entitlements in the Snowy basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)	Entitlement volume compliance?
East Gippsland Water					
Buchan	1	170	0	27	Yes
Orbost	1	2,031	0	868	Yes
Total annual volume of bulk entitlements 2005/06		**2,201**	**0**	**895**	
Total annual volume of bulk entitlements 2004/05		**2,201**	**0**	**871**	
Licensed diversions from unregulated streams 2005/06		*3,858*		*1,100*	
Licensed diversions from unregulated streams 2004/05		*3,856*		*2,300*	

17.6 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.

Table 17-7 Compliance with licensed groundwater volumes, Snowy basin 2005/06

Water supply protection area/ Groundwater management area[1]	GMA/ WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Orbost GMA (100%)	20-45	1,200	1,200	350	0	350	270

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses.

(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies. Depth limit for Orbost GMA has been revised since the 2004/05 State Water Report, where it was reported as 'All Depths'.

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

There are no domestic and stock bores in the Snowy basin.

No urban groundwater supplies were recorded within the Snowy basin.

17.7 Seasonal allocations and restrictions on water use, diversions and extractions

No towns within the Snowy basin were subject to urban restrictions in 2005/06.

No bans or restrictions were imposed on groundwater use in the Snowy basin during 2005/06.

Table 17-8 Seasonal allocations and restrictions on water use in Snowy basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban		No restrictions Permanent water savings measures were introduced in October 2005
Licensed diversions from unregulated streams		No restrictions

17.8 Recycled water

The wastewater treatment plant at Orbost is operated by East Gippsland Water. All of the wastewater that passed through this treatment plant was recycled and used for a number of 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	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Orbost	276	276	100%	0	276	0	0	0	0
Total 2005/06	**276**	**276**	**100%**	**0**	**276**	**0**	**0**	**0**	**0**
Total 2004/05	**217**	**217**	**100%**	**0**	**217**	**0**	**0**	**0**	**0**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

17.9 Water for the environment

17.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Snowy basin EWR comprised the following components:

- passing flows released as a condition of consumptive bulk entitlements held by East Gippsland Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

17.9.2 Entitlements for the environment

There were no entitlements for the environment in the Snowy basin in 2005/06.

However, the inter-governmental commitment between the Commmonwealth, Victorian and New South Wales Governments provides for returning 212,000 ML (21%) of the original flow to the Snowy River below Jindabyne by 2012, and 28% in the longer term. In 2005/06 the Victorian and New South Wales Governments achieved the first three-year target of the Snowy River project by returning an annual total of 38,000 ML, thereby increasing the flows below Jindabyne from the original 1% to 6%.

In 2005/06, water saving projects in Victoria generated 26,600 ML of water savings for the Snowy from the Normanville and Woorinen pipeline projects in the Murray basin and a domestic and stock metering project in the Goulburn-Murray Irrigation District.

17.9.3 Compliance with passing flow requirements

Table 17-10 shows the passing flow requirements in the Snowy 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 17-10 Selected passing flow requirements 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
	Passing flow rules	• The lesser of 1 ML/d or natural inflow • Flow greater than 1 ML/d, the authority must pass 1 ML/d
	Compliance point	Brodribb River
	Passing flow rules	• East Gippsland Water is not obliged to provide minimum passing flows

17.9.4 Water leaving the basin

The amount of water flowing from the Snowy basin into Bass Strait was 1,072,200 ML in 2005/06. This represents 99% of the total inflows into the basin, which is unchanged from 2004/05. This water comprises consumptive water that was not used under entitlements and the EWR (passing flows, and any water above cap).

17.10 Snowy basin summary

Flows in the Snowy basin increased in 2005/06 due to greater rainfall and the provision of increased flows by the Victorian and New South Wales Governments.

18 Tambo basin

Table 18-1 Key features of the Tambo basin, 2005/06

- Inflows were 29% of long term average.
- 96% of total inflows passed through the basin to the Gippsland Lakes.

18.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall in the Tambo basin ranged between 80% and 100% of the long term average, however inflows were 29% of the long term average (570,000 ML). Nevertheless, this represented an improvement from the two previous years when inflows were less than 20% of the long term average.

18.2 Responsibilities for management of water resources

Table 18-2 shows the responsibilities of various authorities within the Tambo basin.

Table 18-2 Responsibilities for water resources management within the Tambo basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Southern Rural Water		Groundwater and surface water licensed diversions		
East Gippsland Water			Including Lakes Entrance, Bruthen, and Swifts Creek	Obligation to meet passing flow requirements
East Gippsland Catchment Management Authority				Waterway management in the whole of the Tambo basin

18.3 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 18-3.

The total diversions do not include the surface water transferred from the Mitchell River to the towns of Bruthen, Nicholson, Johnsonville, Swan Reach, Metung and Lakes Entrance, which are located in this basin. Consumptive allocations are low compared to the available resource in the basin.

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

Table 18-3 Summary of total water resources and water use in the Tambo basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	167,500	5,400
Groundwater	0	0
Recycled water	780	780

18.4 Location of water resources

Figure 18-1 Map of the Tambo basin

18.5 Surface water resources

18.5.1 Water balance

A surface water balance for the Tambo basin is shown in Table 18-4. Inflows to the Tambo basin were 29% of the long term average, which is 570,000 ML a year. The largest diversion of water from the basin was via small catchment dams.

No reservoir information is recorded in the water balance as there is no reservoir in the Tambo basin with a capacity greater than 1,000 ML.

Table 18-4 Balance of surface water in the Tambo basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	0	0
Volume in storage at end of year	0	0
Change in storage	**0**	**0**
Inflows		
Catchment inflow(1)	167,500	97,400
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**167,500**	**97,400**
Usage		
Urban diversions	60	60
Licensed private diversions from unregulated streams	1,400	2,500
Small catchment dams	3,900	3,900
Sub-total	**5,400**	**6,500**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams	2,100	2,000
In-stream infiltration to groundwater, flows to floodplain and evaporation(2)	0	0
Sub-total	**2,100**	**2,000**
Water passed at outlet of basin		
River outflows to the ocean	160,000	88,900

Notes:

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

(2) Assumed to be zero because data is not readily available.

18.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 18-5 below are based on the estimated average annual impact.

Table 18-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	4,500	2,200	Not available
Registered commercial and irrigation	2,100	1,700	Not available
Total	**6,600**	**3,900**	**6,000**

18.5.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements or diversion licences within the basin in 2005/06.

18.5.4 Volume diverted

The volume of water diverted under East Gippsland Water's bulk water entitlement is shown in Table 18-6. 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 2005/06.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

No water was extracted under the Bruthen and Lakes Entrance bulk entitlements. These towns were supplied with water diverted from the Mitchell basin under East Gippsland Water's Bairnsdale bulk entitlement.

Table 18-6 Volume of water diverted under surface water entitlements in the Tambo basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)	Entitlement volume compliance?
East Gippsland Water					
Bruthen	1	313	0	0	Yes
Lakes Entrance	1	2,993	0	0	Yes
Nowa Nowa	1	118	0	23	Yes
Swifts Creek	1	224	0	36	Yes
Total annual volume of bulk entitlements 2005/06		**3,648**	**0**	**59**	**Yes**
Total annual volume of bulk entitlements 2004/05		**3,648**	**0**	**59**	
Licensed diversions from unregulated streams 2005/06		*3,789*		*1,400*	
Licensed diversions from unregulated streams 2004/05		*4,082*		*2,500*	

18.6 Groundwater resources

There are no groundwater management areas or water supply protection areas located within the Tambo basin.

Groundwater allocation and use for unincorporated areas have not been included in the 2005/06 water accounts.

There was no urban groundwater supply in the Tambo basin.

18.7 Seasonal allocations and restrictions on water use, diversions and extractions

There were no domestic or rural restrictions in the Tambo basin in 2005/06.

No bans or restrictions were imposed on groundwater use in the Tambo basin during 2005/06.

Table 18-7 Seasonal allocations and restrictions on water use in Tambo basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	All towns	No restrictions Permanent water savings measures were introduced in October 2005
Licensed diversions from unregulated streams	All streams	No restrictions

18.8 Recycled water

The wastewater treatment plants at Lakes Entrance and Metung are operated by East Gippsland Water. All of the wastewater that passed through these treatment plants was recycled and used for a number of applications including pasture and tree plantations, racecourses and golf courses (Table 18-8).

Table 18-8 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation (1)	Within process (2)		
Lakes Entrance	629	629	100%	0	629	0	0	0	0
Metung	149	149	100%	0	149	0	0	0	0
Total 2005/06	**778**	**778**	**100%**	**0**	**778**	**0**	**0**	**0**	**0**
Total 2004/05	**772**	**772**	**100%**	**66**	**706**	**0**	**0**	**0**	**0**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

18.9 Water for the environment

18.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Tambo basin EWR comprised the following components:

- passing flows released as a condition of consumptive bulk entitlements held by East Gippsland Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

18.9.2 Compliance with passing flow requirements

Table 18-9 shows the passing flow requirements in the Tambo 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.

Table 18-9 Selected passing flow requirements in the Tambo basin

River	Passing flow	
Nicholson River	Instrument where passing flows are specified	Bulk Entitlement (Lakes Entrance) Conversion Order 1997
	Responsible authority	East Gippsland Water
	Compliance point	Nicholson River Reservoir Weir

	Passing flow rules	• From June to November inclusive:
		  • When flow is less than 60 ML/day, the authority must pass half the flow
		  • When flow is greater than 60 ML/day the authority must pass 30 ML/day
		• From December to May inclusive:
		  • When flow is less than 14 ML/day, the authority must pass half the flow
		  • When flow is greater than 14 ML/day the authority must pass 7 ML/day
		• Instantaneous minimum passing flow:
		  • When flow is less than 6 ML/day, the authority must pass half the flow
		  • When flow is greater than 6 ML/day the authority must pass 3 ML/day

18.9.3 Water leaving the basin

The amount of water flowing from the Tambo basin into the Gippsland Lakes was 160,000 ML in 2005/06. This represents 96% of the total inflows into the basin, compared to 91% in 2004/05. This water comprises consumptive water that was not used under entitlements and the EWR (passing flows, and any water above cap).

The Mitchell, Tambo, Latrobe and Thomson basins are capped at the current level of diversions. An additional 2,000 ML across the four basins has also been provided for the interim period, pending the findings of an investigation of the freshwater needs of the Gippsland Lakes.

There are important environmental assets dependent on water from the EWR in the Tambo basin. The Gippsland Lakes are listed as internationally significant wetlands under the Ramsar convention and rely on the freshwater inputs from the Tambo basin for their ecological functioning.

18.10 Tambo basin summary

Water availability improved in the Tambo basin in 2005/06 due to average rainfall. However, because consumptive allocations are very low compared to average inflows, there was little impact on consumptive use.

19 Mitchell basin

Table 19-1 Key features of the Mitchell basin, 2005/06

- Inflows were 50% of long term average.
- 97% of total inflows left the basin at the Gippsland Lakes.

19.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall in the Mitchell basin ranged between 80% and 100% of the long term average, however dry catchment conditions meant that inflows were 50% of the long term average (1,355,000 ML). Similar catchment conditions prevailed in 2003/04 and 2004/05.

The Mitchell basin has a high level of forest cover and a low level of development of its water resources, meaning that inflow conditions are close to their 'natural' state across most of the basin. However, irrigation and urban diversions from the lower Mitchell in summer can put stress on this part of the river.

19.2 Responsibilities for management of water resources

Table 19-2 shows the responsibilities of various authorities within the Mitchell basin.

Table 19-2 Responsibilities for water resources management within the Mitchell basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Southern Rural Water		Groundwater and surface water licensed diversions		
East Gippsland Water			In the Mitchell basin, including Bairnsdale and Paynesville	Obligation to meet passing flow requirements
East Gippsland Catchment Management Authority				Waterway management in the entire Mitchell basin

19.3 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 19-3. Consumptive allocations in the Mitchell basin are very low compared to the average inflows. The Mitchell River is also the source of supply for the towns of Bruthen, Nicholson, Johnsonville, Swan Reach, Metung and Lakes Entrance in adjacent river basins.

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

19.4 Location of water resources

Figure 19-1 Map of the Mitchell basin

Table 19-3 Summary of total water resources and water use in the Mitchell basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	675,700	17,600
Groundwater[1]	7,500	1,300
Recycled water	1,490	1,490

Note:

(1) Groundwater management areas in the Mitchell basin cover less than 10% of the basin surface area and refer to specific aquifer depths. Aquifers not included in the management plans (e.g. the shallow aquifer in the Stratford GMA) and the unincorporated areas contain a significant groundwater resource.

19.5 Surface water resources

19.5.1 Water balance

A surface water balance for the Mitchell basin is shown in Table 19-4. During 2005/06, inflows in the Mitchell basin were approximately 50% of the long term average flow of 1,355,000 ML per annum. Approximately 3% of the total basin inflows were diverted for consumptive use.

No storage information is recorded in the water balance as there is no major on-stream storage in the Mitchell basin with a capacity greater than 1,000 ML.

Table 19-4 Balance of surface water in the Mitchell basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	0	0
Volume in storage at end of year	0	0
Change in storage	**0**	**0**
Inflows		
Catchment inflow[1]	675,700	614,300
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**675,700**	**614,300**
Usage		
Urban diversions	4,380	4,830
Licensed private diversions from unregulated streams	8,700	9,000
Small catchment dams	4,500	4,500
Sub-total	**17,600**	**18,300**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams	1,100	1,100
In-stream infiltration to groundwater, flows to floodplain and evaporation[2]	400	300
Sub-total	**1,500**	**1,400**
Water passed at outlet of basin		
River outflows to the ocean	656,600	594,600

Notes:

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

(2) Losses are calculated from the Wonnangatta River between Waterford and Angusvale and part upstream of Waterford, covering approximately 50% of the basin. Losses in the 2004/05 State Water Report were

assumed to be zero as one gauging station (out of two) had no data available. In 2005/06, data based on the one gauging station with data has been used to estimate losses and has resulted in a revised 2004/05 figure.

19.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 19-5 below are based on the estimated average annual impact.

Table 19-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	4,200	2,100	Not available
Registered commercial and irrigation	2,900	2,400	Not available
Total	**7,100**	**4,500**	**5,600**

19.5.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements, diversion licences or sales water within the basin in 2005/06.

19.5.4 Volume diverted

The volume of water diverted under the single bulk entitlement established for the Mitchell basin is shown in Table 19-6. 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 2005/06.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 19-6 Volume of water diverted under surface water entitlements in the Mitchell basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)	Entitlement volume compliance?
East Gippsland Water					
Bairnsdale	1	5,902	0	4,377	Yes
Total annual volume of bulk entitlements 2005/06		**5,902**	**0**	**4,377**	
Total annual volume of bulk entitlements 2004/05		**5,902**	**0**	**4,833**	
Licensed diversions from unregulated streams 2005/06		*15,650*		*8,700*	
Licensed diversions from unregulated streams 2004/05		*15,401*		*9,000*	

19.6 Groundwater resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Mitchell basin, excluding domestic and stock use, is presented in Table 19-7.

The Mitchell basin contains the whole Wy Yung WSPA as well as part of the Sale WSPA and Stratford GMA. The volumes described in tables below are totals for the management areas and include the area that falls outside the Mitchell basin.

Table 19-7 Compliance with licensed groundwater volumes, Mitchell basin 2005/06

Water supply protection area/Groundwater management area[1]	GMA/ WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Stratford GMA (7%)	Zone 1 >150 Zone 2 >350	31,553	31,553	17,690	0	17,690	17,230
Sale WSPA (7%)	25-200	21,519	21,519	10,450	0	10,450	7,680
Wy Yung WSPA (100%)	≤25	7,521	7,521	1,110	0	1,110	790

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses.

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

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, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Stratford GMA	410	820
Sale WSPA	919	1,838
Wy Yung WSPA	116	232

Note:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in Table 19-7.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

19.7 Seasonal allocations and restrictions on water use, diversions and extractions

There were no domestic or rural restrictions in the Mitchell basin in 2005/06.

No bans or restrictions were imposed on groundwater use in the Mitchell basin during 2005/06.

Table 19-9 Seasonal allocations and restrictions on water use in Mitchell basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	All towns	No restrictions Permanent water savings measures were introduced in October 2005
Licensed diversions from unregulated streams	All streams	No restrictions

19.8 Recycled water

The wastewater treatment plants at Bairnsdale, Lindenow and Paynesville are operated by East Gippsland Water. All of the wastewater that passed through the Paynesville and Lindenow treatment plants was recycled and used for a number of applications including pasture and tree plantations, racecourses and golf courses (Table 19-10).

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 being released into the morass to provide environmentally beneficial freshwater 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	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation [1]	Within process [2]		
Bairnsdale	1,177	1,177	100%	0	51	1,126	0	0	0
Lindenow[4]	20	20	100%	0	0	20	0	0	0
Paynesville	289	289	100%	0	289	0	0	0	0
Total 2005/06	**1,486**	**1,486**	**100%**	**0**	**340**	**1,146**	**0**	**0**	**0**
Total 2004/05	**1,721**	**1,721**	**100%**	**34**	**305**	**1,381**	**0**	**0**	**0**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

(4) Lindenow treatment plant was inadvertently omitted from the 2004/05 State Water Report.

19.9 Water for the environment

19.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Mitchell basin EWR comprised the following components:

- passing flows released as a condition of consumptive bulk entitlements held by East Gippsland Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

19.9.2 Compliance with passing flow requirements

Table 19-11 shows the passing flow requirements in the Mitchell 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.

Table 19-11 Selected passing flow requirements 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
	Passing flow rules	• When flow is less than 30 ML/day, no diversion is permitted • When flow is between 30 and 46 ML/day, the authority must pass 30 ML/day • When flow is between 46 and 246 ML/day, the authority must pass the entire flow, less 16 ML/day • When flow is between 246 and 265 ML/day the authority must pass the entire flow, less 16 ML/day • When flow is greater than 265 ML/day the authority must pass the entire flow, less 35 ML/day

East Gippsland Water reported that it met all passing flow requirements under its bulk entitlement in 2005/06.

19.9.3 Water leaving the basin

The amount of water flowing from the Mitchell basin into the Gippsland Lakes was 656,600 ML in 2005/06. This represents 97% of the total inflows into the basin, which is unchanged from 2004/05. This water comprises consumptive water that was not used under entitlements and the EWR (passing flows, and any water above cap).

The Mitchell, Tambo, Latrobe and Thomson basins are capped at the current level of diversions. An additional 2,000 ML across the four basins has also been provided for the interim period, pending the findings of an investigation of the freshwater needs of the Gippsland Lakes.

The Gippsland Lakes are important environmental assets 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 the freshwater inputs from the Mitchell basin for their ecological functioning.

19.10 Mitchell basin summary

Similar to conditions in 2003/04 and 2004/05, inflows to the Mitchell basin were 50% of the long term average in 2005/06. This did not affect consumptive usage, which represented 3% of basin inflows, and flows in the lower reaches during summer were sufficient to avoid the need for restrictions on diversions.

20 Thomson basin

Table 20-1 Key features of the Thomson basin, 2005/06

- Inflows were 35% of long term average.
- The Thomson Reservoir ended the year at 39% of capacity after beginning the year at 44%.
- 50% of total inflows left the basin at the confluence of the Latrobe River.
- 9,539 ML of bulk entitlement for the environment was released over summer.

20.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall in the Thomson basin ranged between 80% and 100% of the long term average. Inflows were quite varied across the basin. Inflows on the Macalister River at Licola were 63% of the long term average (1,414,000 ML), whereas on the Avon River at Stratford inflows were 32% of the long term average. The reasons for this variation are not clear, but the variation is consistent with the flows observed in 2004/05. Overall, total inflows were significantly below average (35%) and followed a recent pattern that has emerged from 2004/05 (49%) and 2003/04 (60%).

20.2 Responsibilities for management of water resources

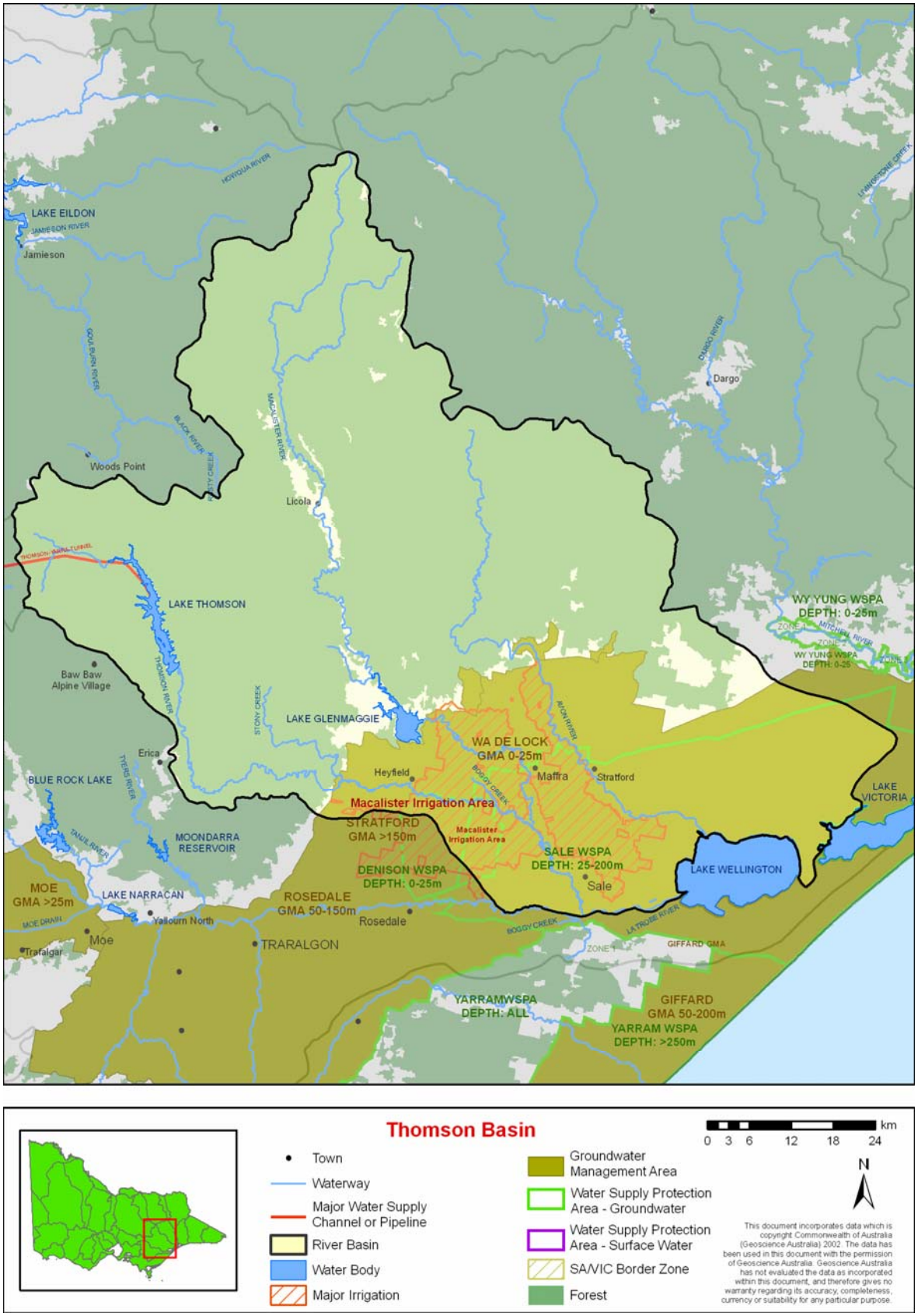
Table 20-2 shows the responsibilities of various authorities within the Thomson basin.

Table 20-2 Responsibilities for water resources management within the Thomson basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Melbourne Water				Thomson Reservoir, which supplies water to Melbourne and irrigators in the MID. Releases water to the Thomson River for environmental flows Obligation to meet passing flow requirements
Southern Rural Water	Irrigation supplies to the Macalister Irrigation District	Groundwater and surface water licensed diversions in the Thomson basin	Bulk water for towns supplied by Gippsland Water	Operation of Lake Glenmaggie Obligation to meet passing flow requirements
Gippsland Water			Urban water supply, including the towns of Sale, Maffra, Heyfield, Stratford and Boisdale	Obligation to meet passing flow requirements
Minister for the Environment				Provide environmental flows in the regulated parts of the Thomson and Macalister Rivers
West Gippsland Catchment Management Authority				Waterway and environmental flow management in the Thomson basin

20.3 Location of water resources

Figure 20-1 Map of the Thomson basin



20.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Thomson basin are shown shown in Table 20-3.

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

Table 20-3 Summary of total water resources and water use in the Thomson basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	538,700	316,300
Groundwater(1)	Not available	Not available
Recycled water	380	350

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

20.5 Surface water resources

20.5.1 Water balance

A surface water balance for the Thomson basin is shown in Table 20-4. The largest diversions occurring within the basin were for irrigation usage and were equivalent to 33% of total inflows. The Thomson Reservoir supplies water to Melbourne. In 2005/06 Melbourne Water transferred 129,090 ML, or 26% of the basin inflows, from the Thomson basin to the Yarra basin. This was almost double the volume of transfers in 2004/05. The Thomson Reservoir began the year at 44% of total capacity and fell to 39% by the end of 2005/06.

Table 20-4 Balance of surface water in the Thomson basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	533,400	465,300
Volume in storage at end of year	450,100	533,400
Change in storage	**-83,300**	**68,100**
Inflows		
Catchment inflow[1]	498,700	688,800
Transfers from other basins	0	0
Return flow from irrigation	40,000	18,600
Treated wastewater discharged back to river	33	40
Sub-total	**538,700**	**707,400**
Usage		
Urban diversions to towns in Thomson River basin	1,750	2,000
Transfers to Yarra River basin for urban use	129,090	71,710
Irrigation district diversions	166,900	274,600
Licensed private diversions from unregulated streams	11,600	11,600
Small catchment dams	7,000	7,000
Sub-total	**316,300**	**366,900**
Losses		
Net evaporation losses from major storages	15,800	14,900
Evaporation from small catchment dams	2,500	2,500
In-stream infiltration to groundwater, flows to floodplain and evaporation[2]	19,700	14,700
Sub-total	**38,000**	**32,100**
Water passed at outlet of basin		
River outflows to the Latrobe River	216,700	168,600
River outflows direct to Lake Wellington	51,100	71,700

Notes:

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

(2) Losses estimated based on loss functions within the Thomson-Macalister REALM.

20.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 20-5 below are based on the estimated average annual impact.

Table 20-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	5,600	2,800	Not available
Registered commercial and irrigation	5,000	4,200	Not available
Total	**10,600**	**7,000**	**9,500**

20.5.3 Water entitlement transfers

A summary of the transfer of entitlements within the Thomson basin is shown in Table 20-6. All transfers of both permanent and temporary entitlements were traded within the basin. Trading was significantly more active in 2005/06 compared with 2004/05.

Table 20-6 Transfer of entitlements in the Thomson basin

Entitlement[1]	Permanent entitlement transfer				Temporary entitlement transfer			
	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)	Bought	Sold	Number of trans-actions	Net transfer to entitlement (ML)
Southern Rural Water								
Thomson/ Macalister	603	603	14	0	13,733	13,733	318	0
Total 2005/06	**603**	**603**	**14**	**0**	**13,733**	**13,733**	**318**	**0**
Total 2004/05	**87**	**87**	**n/a**	**0**	**1,951**	**1,951**	**n/a**	**0**

Note:

(1) Entitlements for which no trades were recorded are not shown.

n/a: Information not available.

20.5.4 Volume diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 20-7. 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 2005/06.

Bulk entitlements held by Melbourne Water and Southern Rural Water in the basin are applied over a five year period, where the five year rolling average usage must be less than the bulk entitlement volume.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 20-7 Volume of water diverted under surface water entitlements in the Thomson basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)	Entitlement volume compliance?
Gippsland Water					
Thomson/Macalister Urbans	1	2,335	0	1,751	Yes
Melbourne Water					
Thomson River	5	171,800	0	129,093	Yes
Southern Rural Water					
Thomson/Macalister	5	274,800	0	166,916	Yes
Minister for the Environment					
Thomson River - Environment[2]	1	10,000		9,539	n/a
Total annual volume of bulk entitlements 2005/06		**458,935**	**0**	**307,299**	
Total annual volume of bulk entitlements 2004/05		**446,600**	**0**	**346,300**	
Licensed diversions from unregulated streams 2005/06		*13,833*		*11,600*	
Licensed diversions from unregulated streams 2004/05		*13,830*		*11,600*	

Notes:

(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2005, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2005/06 period. The actual maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

(2) This bulk entitlement was established in August 2005 and hence compliance has not been assessed.

20.6 Groundwater resources

A summary of the licensed entitlements and use for groundwater management areas that overlap the Thomson basin, excluding domestic and stock use, is presented in Table 20-8.

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 volumes described in tables below are totals for the management areas and include the area that falls outside the Thomson basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 20-8 Compliance with licensed groundwater volumes, Thomson basin 2005/06

Water supply protection area/Groundwater management area[1]	GMA/ WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Rosedale GMA (35%)[6]	Zone 1 50-150 Zone 2 25-350 Zone 3 200-300	9,000	13,102	10,860	0	10,860	9,920
Stratford GMA (42%)[6]	Zone 1 >150 Zone 2 >350	31,553	31,553	17,690	0	17,690	17,230
Wa De Lock Zone GMA (100%)	≤25	11,500	26,865	0	8,059	8,059	9,403
Denison WSPA (51%)	≤25	13,733	13,733	6,680	0	6,680	6,500
Sale WSPA (72%)	25-200	21,519	21,519	10,450	0	10,450	7,680

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) In non-metered areas, Southern Rural Water has estimated use at 30% of licensed entitlement.

(6) Depth limits were incompletely stated in 2004/05 State Water Report and have been adjusted.

An estimate of domestic and stock groundwater use is provided in Table 20-9.

Table 20-9 Number of domestic and stock bores and estimated use, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Rosedale GMA	1	2
Stratford GMA	410	820
Wa De Lock Zone GMA	482	964
Denison WSPA	297	594
Sale WSPA	919	1,838

Notes:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in Table 20-8.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

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 is provided in Table 20-10.

Table 20-10 Urban groundwater usage

Town supplied	Licensed allocation (ML)	Metered use 2005/06	Metered use 2004/05
Boisdale	37	11	18
Briagolong	160	81	93
Sale	3,500	2,041	2,046

20.7 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers and licensed diversions on unregulated streams are shown in Table 20-11. Urban restrictions eased halfway through the year and irrigators received sales water of 15%.

No bans or restrictions were imposed on groundwater use in the Thomson basin during 2005/06.

Table 20-11 Seasonal allocations and restrictions on water use in Thomson basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	All towns serviced by Gippsland Water (e.g. Sale, Maffra, Boisdale)	Stage 1 from July 2005 to December 2005 Permanent water savings measures were introduced in December 2005
Licensed diversions on unregulated streams	Valencia Creek Avon River section 1 Avon River section 2 & 3	Stage 1 (roster) from October 2005 to April 2006 Stage 4 (75% reduction) from January to April 2006 Stage 2 (25% reduction) and Stage 3 (50% reduction) from January to April 2006
Irrigation	Macalister Irrigation District and regulated licensed diversions	Opening allocation of 80% from August 2005, increasing to 115% in February 2006

20.8 Recycled water

Gippsland Water operates four wastewater treatment plants in the Thomson basin. Recycled water is mainly used to irrigate pasture and for watering recreational reserves such as the Maffra Recreational Reserve. A total of 91% of wastewater was reused in the basin (Table 20-12).

Table 20-12 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Heyfield	54	54	100%	0	54	0	0	0	0
Maffra	203	203	100%	8	195	0	0	0	0
Rawson	33	0	0%	0	0	0	0	33	0
Stratford	88	88	100%	0	88	0	0	0	0
Total 2005/06	**378**	**345**	**91%**	**8**	**338**	**0**	**0**	**33**	**0**
Total 2004/05	**550**	**510**	**93%**	**10**	**500**	**0**	**0**	**40**	**0**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

20.9 Water for the environment

20.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Thomson basin EWR comprised the following components:

- a bulk entitlement for the Environment of 10,000 ML, gazetted in August 2005
- passing flows released as a condition of consumptive bulk entitlements held by Melbourne Water and Southern Rural Water
- all other water in the basin not allocated under entitlements.

20.9.2 Entitlements for the environment

A bulk entitlement for the environment of 10,000 ML was provided through water saving initiatives implemented through the White Paper *Our Water Our Future*.

A list of the flow releases for 2005/06 is shown in Table 20-13.

Table 20-13 Actual environmental flow releases in 2005/06

Release Dates	Flow component	Duration of peak (days)	Total volume (ML)
December 2005 - January 2006	High flow fresh	4	5,818
February 2006 - March 2006	Low flow fresh	3	940
March 2006	Low flow fresh	3	1390
April 2006	Low flow fresh	3	1391
Total			**9,539**

20.9.3 Compliance with passing flow requirements

Table 20-14 shows the passing flow requirements 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.

Table 20-14 Selected passing flow requirements 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 the Environment(1)
	Compliance point	Thomson Reservoir
	Passing flow rules	From November to February, 75 ML/day From March to October, 25 ML/day
	Compliance point	The Narrows Gauging Station
	Passing flow rules	From November to February, 120 ML/day From March to October, 80 ML/day
	Compliance point	Coopers Creek Gauging Station
	Passing flow rules	• In July, 216 ML/day • In August, 238 ML/day • In September, 245 ML/day • In October, 225 Ml/day • In November, 205 Ml/day • From December to January, 200 Ml/day • In February, 180 Ml/day • From March to April, 155 Ml/day • From May to June, 150 Ml/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 & Wandocka
	Passing flow rules	• 125 ML/day or natural (if natural inflow is lower than 125 ML/day) • 50 ML/day if natural flow is less than 50 ML/day
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

	Passing flow rules	• 60 ML/day, but reduced to 30 ML/day when the following conditions occur:
		  • Between June and October, if inflow to Lake Glenmaggie is less than the 80th percentile
		  • In November, if storage volumes are less than 13,000 ML
		  • Once dropped to 30 ML/day, passing flows must stay as this until the end of May
		• However, passing flows must be increased back up to 60 ML/day when:
		  • If between June to October, inflow for the previous month is greater than the 80th percentile
		  • If between August to January, storage volume is greater than 185,000 ML
		  • If inflow to Lake Glenmaggie is less than the calculated passing flows, then passing flow may be reduced to this value

Notes:

(1) While the Minister for the Environment holds the environmental bulk entitlement, Melbourne Water manages the releases of the passing flows immediately downstream of the Thomson Dam and reports on compliance with these requirements.

Southern Rural Water and Melbourne Water reported full compliance with their passing flow requirements under their bulk entitlements in 2005/06.

20.9.4 Streamflow management plans (SFMPs)

The proposal to declare a WSPA, which is the first step in preparing a SFMP, has been advertised for the Avon River. Technical studies are also underway in preparation for the development of the SFMP.

20.9.5 Water leaving the basin

The amount of water flowing from the Thomson basin directly into the Gippsland Lakes (Lake Wellington) via the Perry and Avon rivers was 51,100 ML in 2005/06. The amount of water flowing from the basin into the Latrobe River was 216,700 ML. Combined, this totals 267,800 ML which represents 54% of the total inflows into the basin, compared to 35% in 2004/05. This water comprises consumptive water that was not used under entitlements, traded water and the EWR (environmental entitlement, passing flows, and any water above cap).

The Mitchell, Tambo, Latrobe and Thomson basins are capped at the current level of diversions. An additional 2,000 ML across the four basins has also been provided for the interim period, pending the findings of an investigation of the freshwater needs of the Gippsland Lakes.

The Gippsland Lakes are important environmental assets 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 for their ecological functioning.

20.10 Thomson basin summary

Inflows to the Thomson basin showed a similar pattern to the Latrobe basin and also declined for the second consecutive year. In 2005/06 they were 35% of the long term average, although there were variations across the basin.

The Thomson reservoir fell from 44% to 39% of capacity across the year, reflecting both lower inflows as well as increased transfers to the Yarra basin because of dry conditions there. Lake Glenmaggie fell from 39% to 16% across the year and, although it is a seasonal storage which usually empties and fills across the year, the low level in July 2006 had implications for opening allocations in the Macalister Irrigation District for the 2006/07 season. In 2005/06 irrigators in the Macalister Irrigation District received a 115% allocation, down from 140% in 2004/05.

Low streamflows in the Macalister River may have contributed to the algal blooms experienced in the Macalister River and Lake Glenmaggie during 2006.

In 2005/06 a bulk entitlement for the environment came into effect in the Thomson basin. A total of 9,539 ML was released into the Thomson River over summer under this bulk entitlement.

21 Latrobe basin

Table 21-1 Key features of the Latrobe basin, 2005/06

- Inflows were 58% of the long term average.
- Outflows to the Gippsland Lakes fell by around 20% compared to 2004/05.

21.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall in the Latrobe basin ranged between 80% and 100% of the long term average. However, overall, inflows in the basin in 2005/06 were 58% of the long term average (875,000 ML), and less than that recorded in 2004/05 (89%) and 2003/04 (72%). As with many other basins across Victoria, this reflects depleted soil moisture conditions.

21.2 Responsibilities for management of water resources

Table 21-2 shows the responsibilities of various authorities within the Latrobe basin.

Table 21-2 Responsibilities for water resources management within the Latrobe basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Southern Rural Water	Irrigation to Macalister Irrigation District (which is supplied from the Thomson basin)	Groundwater and surface water licensed diversions		Part of the Latrobe water supply system including Blue Rock Dam and Lake Narracan for supply to Gippsland Water, power stations and licensed diverters Obligation to meet passing flow requirements
Gippsland Water			Urban water supply to towns including Warragul, Moe, Morwell and Traralgon. Industrial supply to Hazelwood and Energy Brix power stations(1), and major industry	Moondarra Reservoir Obligation to meet passing flow requirements
West Gippsland Catchment Management Authority				Waterway management 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 Dam and Lake Narracan)

21.3 Location of water resources

Figure 21-1 Map of the Latrobe basin

21.4 Total water resources in the basin

The total volume of water available and supplied from water resources in the Latrobe basin are shown in Table 21-3.

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

Table 21-3 Summary of total water resources and water use in the Latrobe basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	559,900	165,800
Groundwater(1)	Not available	Not available
Recycled water	19,980	40

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface area within the river basin boundary.

21.5 Surface water resources

21.5.1 Water balance

A surface water balance for the Latrobe basin is shown in Table 21-4. There are three major storages located in the Latrobe basin: Blue Rock Dam, Lake Narracan and Moondarra Reservoir. Storage volume reduced from 89% of capacity at the end of 2004/05 to 80% by the end of 2005/06.

The major industrial water users in the basin include a number of electricity generators and Australian Paper. In 2005/06, these entities drew 125,580 ML from river diversions and groundwater and returned approximately 48,000 ML to the Latrobe river system.

Table 21-4 Balance of surface water in the Latrobe basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	220,200	179,500
Volume in storage at end of year	197,600	220,200
Change in storage	**-22,600**	**40,700**
Inflows		
Catchment inflow(1)	507,800	780,500
Transfers from other basins	0	0
Return flow from power stations and major industry	48,000	55,600
Return flow from irrigation	0	0
Treated wastewater discharged back to river	4,110	4,360
Sub-total	**559,900**	**840,500**
Usage		
Urban and industrial diversions	125,580	130,890
Licensed private diversions from regulated streams	6,700	7,000
Licensed private diversions from unregulated streams	13,000	10,800
Small catchment dams	20,500	20,500
Sub-total	**165,800**	**169,200**
Losses		
Net evaporation losses from major storages	10,200	3,700
Evaporation from small catchment dams	5,700	5,700
In-stream infiltration to groundwater, flows to floodplain and evaporation	0	0
Sub-total	**15,900**	**9,400**
Water passed at outlet of basin		
River outflows to the Gippsland Lakes (excluding Thomson River)	400,800	621,200
River outflows to the Gippsland Lakes (including Thomson River)	617,500	789,800

Notes:

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

21.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 21-5 below are based on the estimated average annual impact.

Table 21-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	13,000	6,500	Not available
Registered commercial and irrigation	16,700	14,000	Not available
Total	**29,700**	**20,500**	**26,200**

21.5.3 Water entitlement transfers

A summary of the transfer of entitlements within the Latrobe basin is shown in Table 21-6. The small amount of trading is between licensed diverters on the Latrobe River.

Table 21-6 Transfer of Victorian entitlements in the Latrobe basin

Entitlement[1]	Permanent entitlement transfer				Temporary entitlement transfer			
	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)	Bought	Sold	Number of trans-actions	Net transfer to entitlement (ML)
Southern Rural Water								
Latrobe licensed diverters	0	0	0	0	2,716	2,716	33	0
Total 2005/06	**0**	**0**	**0**	**0**	**2,716**	**2,716**	**33**	**0**
Total 2004/05	**0**	**0**	**n/a**	**0**	**1,593**	**1,593**	**n/a**	**0**

Note:

(1) Entitlements for which no trades were recorded are not shown.

n/a: Information not available.

21.5.4 Volume diverted

The volume of water diverted under each bulk entitlement is shown in Table 21-7. 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 2005/06.

The Yallourn Energy Limited for SECV and Blue Rock unallocated entitlements are not currently being utilised.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 21-7 Volume of water diverted under surface water entitlements in the Latrobe basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)	Entitlement volume compliance?
Gippsland Water					
Boolarra	1	145	0	69	Yes
Erica	1	340	0	108	Yes
Mirboo North	1	270	0	157	Yes
Moe - Narracan Creek	1	3,884	0	2,695	Yes
Noojee	1	73	0	0	Yes
Thorpdale	1	80	0	26	Yes
CGRWA - Blue Rock[2]	3	15,150	0	5,030	Yes
Moondarra Reservoir	2	62,000	0	52,401	Yes
Southern Rural Water					
Yallourn Energy Ltd for SRW	1	20,000	0	19,138	Yes
Latrobe licensed diverters	2	13,400	0	6,722	Yes
Great Energy Alliance Corporation Pty Ltd					
Yallourn Energy Ltd for Loy Yang Power Ltd	1	40,000	0	26,036	Yes
Minister for the Environment (on behalf of the Treasurer)					
Yallourn Energy Ltd for SECV	1	25,000	0	0	Yes
Yallourn Energy Ltd					
Yallourn Energy Ltd	1	36,500	0	32,340	Yes
Total annual volume of bulk entitlements 2005/06[3]		**216,842**	**0**	**144,722**	
Total annual volume of bulk entitlements 2004/05		**256,842**	**0**	**137,897**	
Licensed diversions from unregulated streams 2005/06		*18,397*		*13,020*	
Licensed diversions from unregulated streams 2004/05		*18,351*		*10,800*	

Notes:

(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2005, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2005/06 period. The actual maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

(2) In the 2004/05 State Water Report diversions under the CGRWA - Blue Rock entitlement excluded diversions for the purposes of driving the turbines at the Blue Rock reservoir. For 2005/06 they have been included.

(3) The unallocated Blue Rock bulk entitlement, which has an annual volume of 40,000 ML, has not been included in Table 21-7.

21.6 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. The volumes described in the tables below are totals for the management areas and include the area that falls outside the Latrobe basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

A summary of the licensed entitlements and use for groundwater management units that overlap the Latrobe basin, excluding domestic and stock use, is presented in Table 21-8.

Table 21-8 Compliance with licensed groundwater volumes, Latrobe basin 2005/06

Water supply protection area/ Groundwater management area[1]	GMA/ WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Moe GMA (100%)	>25	8,193	3,299	0	990	990	1,084
Rosedale GMA (58%)[6]	Zone 1 50-150 Zone 2 25-350 Zone 3 200-300	9,000	13,102	10,860	0	10,860	9,920
Stratford GMA (38%)[6]	Zone 1 >150 Zone 2 >350	31,553	31,553	17,690	0	17,690	17,230
Denison WSPA (49%)	≤25	13,733	13,733	6,680	0	6,680	6,500
Sale WSPA (16%)	25-200	21,519	21,519	10,450	0	10,450	7,680
Yarram WSPA (12%)[6]	Zone 1 >200 Zone 2 All	25,457	25,457	11,070	0	11,070	8,100

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses.

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, Southern Rural Water has estimated use at 30% of licensed entitlement.

(6) Depth limits were incompletely stated in 2004/05 State Water Report and have been adjusted.

An estimate of domestic and stock groundwater use is provided in Table 21-9.

Table 21-9 Number of domestic and stock bores and estimated use, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Moe GMA	197	394
Rosedale GMA	1	2
Stratford GMA	410	820
Denison WSPA	297	594
Sale WSPA	919	1,838
Yarram WSPA	970	1,940

Note:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in the previous table.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

21.7 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers and licensed diversions on unregulated streams are shown in Table 21-10.

No bans or restrictions were imposed on groundwater use in the Latrobe basin during 2005/06.

Table 21-10 Seasonal allocations and restrictions on water use in Latrobe basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	All towns serviced by Gippsland Water (e.g. Erica, Moe, Traralgon, Warragul, Yallourn North)	Stage 1 from July to December 2005 Permanent water savings measures were introduced in December 2005
Irrigation and regulated diversions	Macalister Irrigation District(1) Latrobe system – river diverters	Opening allocation of 80% in August 2005, increasing to 115% in February 2005 100% of licensed volume from July 2005 to June 2006

Note:

(1) The Macalister Irrigation District is supplied from the Thomson basin.

21.8 Recycled water

Gippsland Water operates a number of wastewater treatment plants in the Latrobe basin. The majority of wastewater processed in the Latrobe basin (79%) is highly saline treated wastewater. It is disposed via two ocean outfalls and is unsuitable for any beneficial reuse. The volume of wastewater disposed by the regional outfall sewer fell by 3,231 ML in 2005/06. Less than 1% of the wastewater produced in the Latrobe basin is recycled.

Table 21-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process (2)		
Mirboo North	31	31	100%	20	11	0	0	0	0
Moe	2,054	0	0%	0	0	0	0	2,054	0
Morwell	620	0	0%	0	0	0	0	620	0
Warragul	1,436	0	0%	0	0	0	0	1,436	0
Willow Grove	10	10	100%	0	10	0	0	0	0
Dutson Downs (regional outfall sewer)	8,398	0	0%	0	0	0	0	0	8,398
Saline wastewater outfall pipeline	7,434	0	0%	0	0	0	0	0	7,434
Total 2005/06	**19,982**	**41**	**0%**	**20**	**20**	**0**	**0**	**4,110**	**15,832**
Total 2004/05	**23,531**	**88**	**0%**	**23**	**65**	**0**	**0**	**4,358**	**19,085**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

21.9 Water for the environment

21.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Latrobe basin EWR comprised the following components:

- passing flows released as a condition of consumptive bulk entitlements held by Southern Rural Water and Gippsland Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

21.9.2 Compliance with passing flow requirements

Table 21-12 shows the passing flow requirements 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.

Table 21-12 Selected passing flow requirements 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
	Passing flow rules	• The lesser of 11 ML/day or natural flow • When flow is between 11 and 27 ML/day, the authority must pass 11 ML/day • When flow is greater than 27 ML/d, the authority must pass the entire flow, less 16 ML/day Minimum passing flow is 11 ML/day
Easterbrook Creek	Instrument where passing flows are specified	Bulk Entitlement (Thorpdale) Conversion Order 1997
	Responsible authority	Gippsland Water
	Compliance point	Thorpdale pumping station
	Passing flow rules	• The lesser of 1 ML/day or natural flow • When flow is between 1 and 2.73 ML/day, the authority must pass 1 ML/day • When flow is greater than 2.73 ML/day, the authority must pass the entire flow, less 1.73 ML/day Minimum passing flow is 1 ML/day
Latrobe River & 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 Dam (to maintain flow at Tanjil South)
	Passing flow rules	The following passing flows are to be maintained: • From January to Aprril, 90 ML/day • From May to July, 100 ML/day • August to November, 150 ML/day • December, 100 ML/day
	Compliance point	Yalourn Weir
	Passing flow rules	• A minimum average weekly of 350 ML/day with a daily minimum of 300 ML/day or modified natural flow, whichever is less
	Compliance point	Swing Bridge gauging station (Sale)
	Passing flow rules	• A minimum average weekly of 750 ML/day with a daily minimum of 700 ML/day or modified natural flow, whichever is less

Southern Rural Water and Gippsland Water reported that they met all passing flow requirements under their bulk entitlements in 2005/06.

21.9.3 Streamflow management plans (SFMPs)

Technical studies and administrative processes are underway in preparation for the development of an SFMP for the upper Latrobe River.

21.9.4 Water leaving the basin

The amount of water flowing from the Latrobe basin into the Gippsland Lakes (excluding the Thomson river) was 400,800 ML in 2005/06. This represents 79% of the total inflows into the basin, compared to 80% in 2004/05. This water comprises consumptive water that was not used under entitlements and the EWR (passing flows and any water above cap).

The Gippsland Lakes are important environmental assets 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 basins including the Latrobe basin for their ecological functioning.

21.10 Latrobe basin summary

Inflows to the Latrobe basin fell for the second consecutive year and reached 58% of the long term average in 2004/05. Consumptive demands were able to be met with minimal restrictions by drawing down the reservoirs although in aggregate, major storages in the basin ended the year more than 80% full.

The reduction in inflows did result in outflows to the Gippsland Lakes falling by around 20% compared with 2004/05.

22 South Gippsland basin

Table 22-1 Key features of the South Gippsland basin, 2005/06

- Inflows were 55% of the long term average.
- Most towns in the basin experienced restrictions during 2005/06 with some towns on Stage 4 restrictions by the end of the year.
- 93% of total inflows left the basin.

22.1 Rainfall and inflow in 2005/06

In 2005/06, rainfall across the South Gippsland basin ranged between 80% and 100% of the long term average, although a small area around Phillip Island experienced slightly higher than average falls. Rainfall in the South Gippsland basin can be quite localised and during 2005/06 rainfall in some areas allowed certain storages to fill while others were declining.

While overall rainfall across the basin was similar to previous years, inflows were significantly lower. Inflows were 55% of the long term average (1,157,000 ML), compared to 2004/05 which was about average, and 2003/04 inflows which were 78% of average.

22.2 Responsibilities for management of water resources

Table 22-2 shows the responsibilities of various authorities within the South Gippsland basin.

Table 22-2 Responsibilities for water resources management within the South Gippsland basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Southern Rural Water		Groundwater and surface water licensed diversions		
South Gippsland Water			To towns including Inverloch, Wonthaggi Korumburra and Foster	Obligation to meet passing flow requirements
Westernport Water			To towns including San Remo and Phillip Island	
Gippsland Water			to Seaspray in the far east of the basin	Obligation to meet passing flow requirements
West Gippsland Catchment Management Authority				Waterway management in the whole of the South Gippsland basin

22.3 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 22-3.

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

22.4 Location of water resources

Figure 22-1 Map of the South Gippsland basin

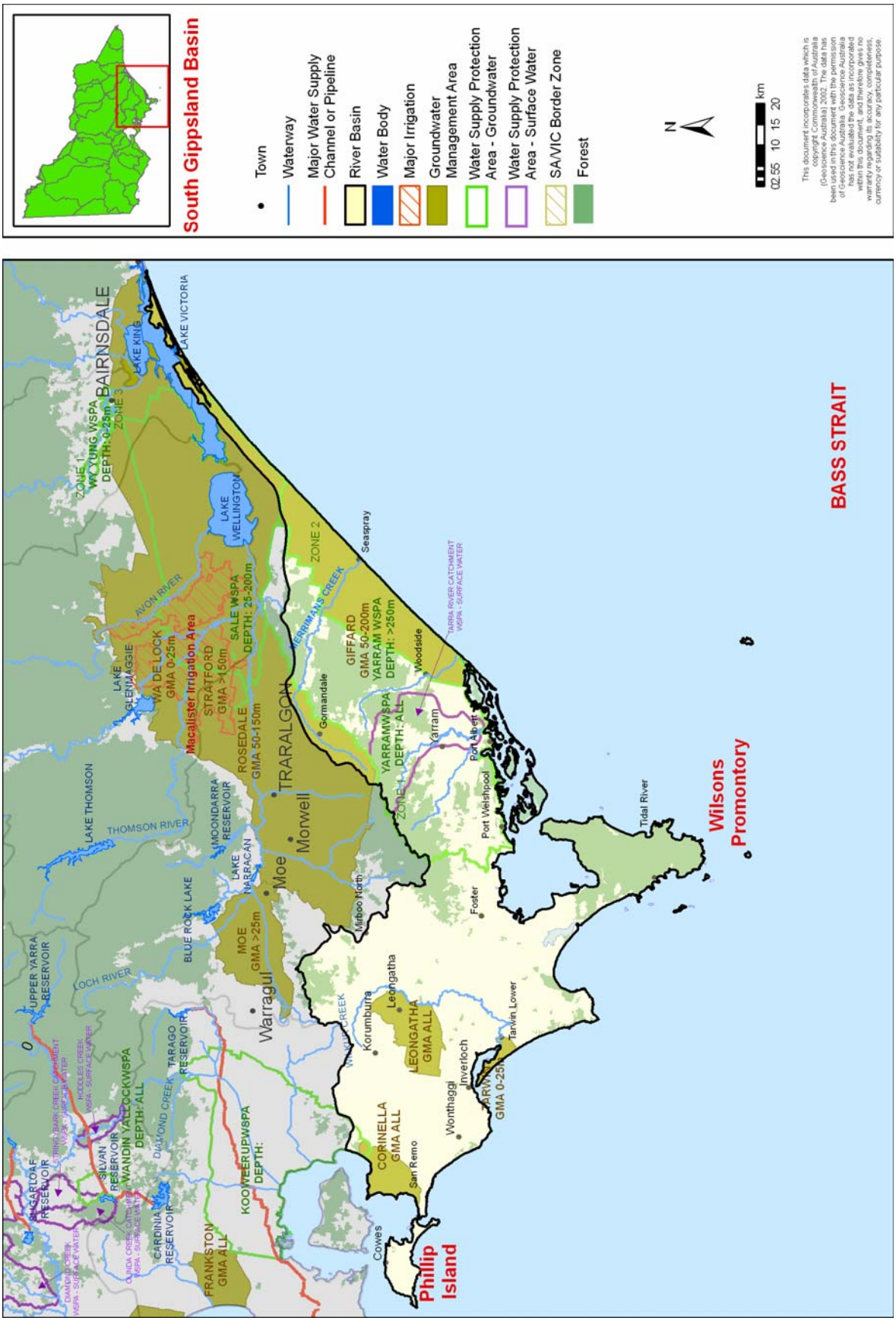


Table 22-3 Summary of total water resources and water use in the South Gippsland basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	633,800	38,600
Groundwater[1]	Not available	Not available
Recycled water	5,010	340

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

22.5 Surface water resources

22.5.1 Water balance

A surface water balance for the South Gippsland basin is shown in Table 22-4.

There are four reservoirs with a capacity greater than 1,000 ML located within the basin used for urban water supply by South Gippsland Water and Westernport Water. These storages are Candowie Reservoir, Lance Creek Reservoir, Hyland Reservoir and Western Reservoir. The South Gippsland basin was one of the few basins that recorded an increase in the volume in storage over the year. Storage volume was 51% of total capacity at the end of 2005/06, after starting the year 47% full.

Table 22-4 Balance of surface water in the South Gippsland basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	4,100	6,600
Volume in storage at end of year	4,400	4,100
Change in storage	**300**	**-2,500**
Inflows		
Catchment inflow[1]	632,600	1,120,100
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	1,240	1,040
Sub-total	**633,800**	**1,121,100**
Usage		
Urban diversions	8,440	8,630
Licensed private diversions from unregulated streams	5,900	7,800
Small catchment dams	24,300	24,300
Sub-total	**38,600**	**40,700**
Losses		
Net evaporation losses from major storages	700	400
Evaporation from small catchment dams	5,100	4,900
In-stream infiltration to groundwater, flows to floodplain and evaporation[2]	0	0
Sub-total	**5,800**	**5,300**
Water passed at outlet of basin		
River outflows to Bass Strait and Westernport Bay	589,100	1,077,600

Notes:

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

(2) Assumed to be zero because data is not readily available.

22.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 22-5 are based on the estimated average annual impact.

Table 22-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	23,000	11,500	Not available
Registered commercial and irrigation	15,200	12,800	Not available
Total	**38,200**	**24,300**	**29,400**

22.5.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements, diversion licences or sales water within the basin in 2005/06.

22.5.4 Volume diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 22-6. 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 2005/06.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 22-6 Volume of water diverted under surface water entitlements in the South Gippsland basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)	Entitlement volume compliance?
Gippsland Water					
Seaspray	1	61	0	39	Yes
South Gippsland Water					
Devon North, Alberton, Yarram and Port Albert	1	853	0	547	Yes
Dumbalk	1	100	0	31	Yes
Fish Creek	1	251	0	221	Yes
Foster	1	326	0	198	Yes
Korrumburra	1	1,000	0	743	Yes
Leongatha	1	2,476	0	2,037	Yes
Loch, Poowong and Nyora	1	420	0	322	Yes
Meeniyan	1	200	0	73	Yes
Toora, Port Franklin, Welshpool and Port Welshpool	1	1,617	0	750	Yes
Wonthaggi – Inverloch	1	3,800	0	1,928	Yes
Westernport Water					
Westernport	1	2,911	0	1,549	Yes
Total annual volume of bulk entitlements 2005/06		**14,015**	**0**	**8,438**	**Yes**
Total annual volume of bulk entitlements 2004/05		**14,015**	**0**	**8,626**	
Licensed diversions from unregulated streams 2005/06		*11,955*		*5,900*	
Licensed diversions from unregulated streams 2004/05		*11,890*		*7,800*	

22.6 Groundwater resources

A summary of the licensed entitlements and use for groundwater management units that overlap 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 and Leongatha GMA, most of the Yarram WSPA, Tarwin GMA and Giffard GMA, as well as part of the Sale WSPA, Rosedale GMA and Stratford GMA. The volumes described in tables below are totals for the management areas and include the area that falls outside the South Gippsland basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 22-7 Compliance with licensed groundwater volumes, South Gippsland basin 2005/06

Water supply protection area/ Groundwater management area[1]	GMA/ WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Corinella GMA (100%)	All depths	2,550	164	0	49	49	57
Giffard GMA (99%)	50-200	3,000	5,705	3,260	0	3,260	2,520
Leongatha GMA (100%)	All depths	6,500	1,471	0	441	441	515
Rosedale GMA (6%)[6]	Zone 1 50-150 Zone 2 25-350 Zone 3 200-300	9,000	13,102	10,860	0	10,860	9,920
Stratford GMA (7%)[6]	Zone 1 >150 Zone 2 >350	31,553	31,553	17,690	0	17,690	17,230
Tarwin GMA (98%)	≤25	1,300	41	0	12	12	14
Sale WSPA (5%)	25-200	21,519	21,519	10,450	0	10,450	7,680
Yarram WSPA (88%)[6]	Zone 1 >200 Zone 2 All depths	25,457	25,457	11,070	0	11,070	8,100

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) In non-metered areas, Southern Rural Water has estimated use at 30% of licensed entitlement.

(6) Depth limits were incompletely stated in 2004/05 State Water Report and have been adjusted.

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, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Corinella GMA	157	314
Giffard GMA	171	342
Leongatha GMA	114	228
Rosedale GMA	1	2
Stratford GMA	410	820
Tarwin GMA	806	242[3]
Sale WSPA	919	1,838
Yarram WSPA	970	1,940

Note:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in the previous table.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

(3) Household supply is the dominant domestic and stock use in the Tarwin GMA. An estimate of 0.3 ML/bore has been applied as a more realistic approximation of domestic and stock use for this area.

Groundwater was used as an urban water supply for Leongatha in 2005/06, partly reflecting low surface water flows. (There was no groundwater use in 2004/05). 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 allocation (ML)	Metered use 2005/06	Metered use 2004/05
Leongatha	400	56	0
Yarram[1]	60	0	0

(1) The licensed allocation for Yarram was inadvertently omitted from the 2004/05 State Water Report. There was no metered use in 2004/05.

22.7 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions on unregulated streams are shown in Table 22-10. Many customers of South Gippsland Water faced increasing levels of restrictions as the year passed, with some towns reaching Stage 4 restrictions in March 2006.

No bans or restrictions were imposed on groundwater use in the South Gippsland basin during 2005/06.

Table 22-10 Seasonal allocations and restrictions on water use in South Gippsland basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	Seaspray	Stage 1 from July to December 2005
	Wonthaggi, Inverloch, Cape Paterson	Stage 1 from July to August 2005
	Leongatha, Koonwarra	Stage 1 July to September 2005, lifted October 2005. Stage 2 imposed in March 2006, increasing to Stage 3 from April to June 2006
	Korumburra	Stage 2 in March 2006 increasing to Stage 3 from April to June 2006
	Fish Creek	Stage 2 in March 2006 increasing to Stage 3 from April to May 2006
	Alberton, Devon North, Port Albert, Yarram	Stage 4 from March to May 2006
		Permanent water savings measures were introduced in February 2006
Licensed diversions from unregulated streams	Bruthen Creek, Agnes River	Irrigation ban from January to April 2006
	Tarra River, Macks Creek	Stage 2 (25% reduction) from January to April 2006
	Jack River	Stage 1 (roster) from January to April 2006

22.8 Recycled water

South Gippsland Water is responsible for nine wastewater treatment plants within the basin, but only wastewater from the Inverloch and Yarram (Tarraville) treatment plants is reused. 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 both of its treatment plants at Coronet Bay and Cowes.

Across the basin 8% of wastewater was reused, up from 5% in 2004/05. This reflects an increased proportion of recyled water at the Coronet Bay treatment plant, and increased volumes at the Yarram treatment plant (Table 22-11).

Table 22-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Coronet Bay	134	129	96%	0	129	0	0	0	5
Cowes	1,085	81	7%	41	25	0	15		1,004
Foster	138	0	0%	0	0	0	0	138	0
Korumburra	349	0	0%	0	0	0	0	349	0
Korumburra trade waste	0	0	0%	0	0	0	0	0	0
Leongatha domestic	599	0	0%	0	0	0	0	599	0
Leongatha trade waste	1,284	0	0%	0	0	0	0	0	1,284
Toora	80	0	0%	0	0	0	0	80	0
Welshpool	69	0	0%	0	0	0	0	69	0
Wonthaggi/Cape Paterson/Inverloch	1,142	1	0%	0	1	0	0	0	1,141
Yarram	130	130	100%	0	130	0	0	0	0
Total 2005/06	**5,011**	**341**	**8%**	**41**	**285**	**0**	**15**	**1,235**	**3,434**
Total 2004/05	**5,634**	**289**	**5%**	**47**	**217**	**0**	**25**	**1,036**	**4,309**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

22.9 Water for the environment

22.9.1 Environmental Water Reserve (EWR)

In 2005/06 the South Gippsland basin EWR comprised the following components:

- passing flows released as a condition of consumptive bulk entitlements held by Gippsland Water and South Gippsland Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

22.9.2 Compliance with passing flow requirements

Table 22-12 shows the passing flow requirements 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.

Table 22-12 Selected passing flow requirements 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
	Passing flow rules	• When flow is between 0 and 3 ML/day, the authority must pass the entire flow • When flow is between 3 and 6 ML/day, the authority must pass 3 ML/day • When flow is between 6 and 12 ML/day, the authority must pass half the flow • When flow is greater than 12 ML/day, the authority must pass the entire flow less 6 ML/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
	Passing flow rules	• The lesser of 1 ML/day or natural flow

Gippsland Water and South Gippsland Water reported that they met all passing flow requirements under their bulk entitlements in 2005/06. Westernport Water reported that its bulk entitlement does not contain any passing flow requirements.

22.9.3 Streamflow management plans (SFMPs)

Technical studies and administrative processes are underway in preparation for the development of a streamflow management plan for the Tarra River.

22.9.4 Water leaving the basin

The amount of water flowing from the South Gippsland basin into Westernport and Bass Strait was 589,100 ML in 2005/06. This represents 93% of the total inflows into the basin, compared to 96% in 2004/05. This water comprises consumptive water that was not used under entitlements and the EWR (passing flows, and any water above cap).

There are important environmental assets dependent on water from the EWR in the South Gippsland basin. Corner Inlet and Westernport are listed as internationally significant wetlands under the Ramsar convention and rely on the freshwater inputs from the South Gippsland basin for their ecological functioning.

22.10 South Gippsland basin summary

Historically the South Gippsland basin experiences relatively consistent rainfall and streamflows and prior to 2005/06 it had been spared from the drought conditions in the rest of the state. However, in 2005/06 there was a decline in rainfall and streamflows, particularly in the upper part of the basin where some urban reservoirs failed to fill as normally expected during winter and spring. As a result it was necessary to restrict supplies to affected towns.

Other parts of the basin were less affected and the aggregate level of major storages in the basin actually increased slightly over 2005/06.

Basin inflows and outflows decreased significantly in 2005/06 and were around half the 2004/05 levels.

23 Bunyip basin

Table 23-1 Key features of the Bunyip basin, 2005/06

- Rainfall and streamflows were slightly lower than average in 2005/06.
- 94% of the total inflows left the basin.

23.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall in the Bunyip basin ranged between 80% and 100% of the long term average, a decline from 2004/05 and 2003/04, which both had average rainfall. Total inflows were 90% of the long term average (541,000 ML), slightly higher than the 86% of average inflows recorded in 2004/05.

23.2 Responsibilities for management of water resources

Table 23-2 shows the responsibilities of various authorities within the Bunyip basin.

Table 23-2 Responsibilities for water resources management within the Bunyip basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Southern Rural Water		Surface water and groundwater private diversions		
Melbourne Water			Eastern Treatment Plant and Tarago Reservoir	Waterway management responsibilities
South East Water			Urban water supply to south-eastern metropolitan Melbourne including Dandenong, Frankston, Pakenham and the Mornington Peninsula(1)	
Gippsland Water			Urban water supply to the towns in the east of the basin including Drouin and Neerim South and Warragul (in the Latrobe basin)	

Note:

(1) This water is imported into the Bunyip basin from the Yarra/Thomson supply system.

23.3 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 23-3. These figures exclude water delivered directly to customers from Melbourne Water's supply system in the Yarra River basin.

Surface water extraction is a small proportion of total streamflow. An overview of the methodology used to derive the information presented in this chapter is set out in Chapter 5.

23.4 Location of water resources

Figure 23-1 Map of the Bunyip basin

Table 23-3 Summary of total water resources and water use in the Bunyip basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	486,900	27,600
Groundwater[1]	Not available	Not available
Recycled water	159,550	23,220

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

23.5 Surface water resources

23.5.1 Water balance

A surface water balance for the Bunyip basin is shown in Table 23-4. The basin includes Tarago Reservoir, which is not currently used for Melbourne's metropolitan water supply, however it will be reconnected in coming years following construction of a water treatment plant at the reservoir. The Cardinia Reservoir is also located within the Bunyip basin, however it stores water harvested from the Yarra and is not included in the Bunyip basin figures. Storages in the Bunyip basin ended the year at 85% of total capacity, falling from 96% at the beginning of 2005/06.

Table 23-4 Balance of surface water in the Bunyip basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	24,100	23,900
Volume in storage at end of year	21,300	24,100
Change in storage	**-2,800**	**200**
Inflows		
Catchment inflow[1]	485,600	463,200
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	1,250	1,070
Sub-total	**486,900**	**464,300**
Usage		
Urban diversions	2,930	4,020
Licensed private diversions from regulated streams	2,800	2,400
Licensed private diversions from unregulated streams	6,400	5,400
Small catchment dams	15,500	15,500
Sub-total	**27,600**	**27,300**
Losses		
Net evaporation losses from major storages	900	1,700
Evaporation from small catchment dams	600	600
In-stream infiltration to groundwater, flows to floodplain and evaporation[2]	1,500	900
Sub-total	**3,000**	**3,200**
Water passed at outlet of basin		
River outflows to the ocean	459,000	433,600

Notes:

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

(2) Losses estimated using loss functions in the Tarago River REALM.

23.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 23-5 are based on the estimated average annual impact.

Table 23-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	8,000	4,000	Not available
Registered commercial and irrigation	13,700	11,500	Not available
Total	**21,700**	**15,500**	**16,100**

23.5.3 Water entitlement transfers

No information was available in relation to permanent transfer of water entitlements or diversion licences in 2005/06.

23.5.4 Volume diverted

The volume of water diverted in 2005/06 is shown in Table 23-6. No bulk entitlements were in place in the Bunyip basin in 2005/06 and hence compliance is not reported.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 23-6 Volume of water diverted under surface water entitlements in the Bunyip basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)	Entitlement volume compliance?
Gippsland Water					
Tarago/ Bunyip	n/a	n/a	0	2,926	n/a
Melbourne Water					
Tarago/ Bunyip	n/a	n/a	0	0	n/a
Southern Rural Water					
Tarago/ Bunyip	n/a	n/a	0	2,800	n/a
Total annual volume of bulk entitlements 2005/06		**n/a**	**0**	**5,726**	
Total annual volume of bulk entitlements 2004/05		**n/a**	**0**	**6,407**	
Licensed diversions from unregulated streams 2005/06		*10,162*		*6,400*	
Licensed diversions from unregulated streams 2004/05		*12,269*		*5,400*	

Note:

n/a: bulk entitlement conversion order was not finalised at the beginning of 2005/06.

23.6 Groundwater resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Bunyip basin, excluding domestic and stock use, is presented in Table 23-7.

The Bunyip basin contains the whole Frankston GMA, Nepean GMA, most of the Koo-Wee-Rup WSPA as well as part of the Moorabbin GMA. The volumes described in tables below are totals for the management areas and include the area that falls outside the Bunyip basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 23-7 Compliance with licensed groundwater volumes, Bunyip basin 2005/06

Water supply protection area/ Groundwater management area[1]	GMA/ WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Frankston GMA (100%)	All depths	3,200	1,034	0	310	310	384
Moorabbin GMA (63%)	All depths	4,305	2,202	0	661	661	725
Koo-Wee-Rup WSPA (97%)	All depths	13,854	13,854	3,460	0	3,460	3,070
Nepean GMA (100%)	All depths	5,000	6,049	0	1,815	1,815	2,117

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) In non-metered areas, Southern Rural Water has estimated use at 30% of licensed entitlement.

An estimate of domestic and stock groundwater use is provided in Table 23-8.

Table 23-8 Number of domestic and stock bores and estimated use, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Frankston GMA	199	398
Moorabbin GMA	238	476
Koo-Wee-Rup WSPA	600	1,200
Nepean GMA	1,162	349[3]

Notes:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in the previous table.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

(3) Household supply is the dominant domestic and stock use in the Nepean GMA. An estimate of 0.3 ML/bore has been applied as a more realistic approximation of domestic and stock use for this area.

23.7 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions on unregulated streams are shown in Table 23-9.

No bans or restrictions were imposed on groundwater use in the Bunyip basin during 2005/06.

Table 23-9 Seasonal allocations and restrictions on water use in Bunyip basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	All towns serviced by Gippsland Water (e.g. Drouin, Warragul, Neerim South) South East Water customers	Stage 1 from July to December 2005 Permanent water savings measures were introduced December 2005 Permanent water savings measures were in place for all of 2005/06
Licensed diversions from unregulated streams		No restrictions

23.8 Recycled water

Gippsland Water, South East Water and Melbourne Water operate wastewater treatment plants within the Bunyip basin.

The largest is the Eastern Treatment Plant operated by Melbourne Water, which recycled 14% of the total wastewater volume of 147,141 ML. Recycled wastewater was predominantly used on-site, but an increasing amount was recycled through the Eastern Irrigation Scheme.

The Victorian Government is currently examining options to increase recycling from the Eastern Treatment Plant.

Table 23-10 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)					Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				To retailers	Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Blind Bight	180	180	100%	0	0	180	0	0	0	0
Boneo	3,231	47	1%	0	30	0	0	16	3,181	0
Drouin	390	204	52%	0	0	204	0	0	186	0
Eastern Treatment Plant	147,141	20,699	14%	6,632	0	0	0	14,067	0	126,442
Koo-Wee-Rup	124	94	76%	0	0	94	0	0	30	0
Lang Lang	62	62	100%	0	0	62	0	0	0	0
Longwarry	149	149	100%	0	0	149	0	0	0	0
Mt Martha	4,869	678	14%	0	16	41	0	621	4,812	0
Neerim South	50	0	0%	0	0	0	0	0	50	0
Pakenham	1,751	952	54%	0	8	937	0	8	807	0
Somers	1,602	157	10%	0	0	157	0	0	1,445	0
Total 2005/06	**159,550**	**23,223**	**15%**	**6,632**	**55**	**1,824**	**0**	**14,712**	**10,531**	**126,442**
Total 2004/05	**165,568**	**17,500**	**11%**	**1,626**	**95**	**1,826**	**0**	**13,961**	**10,707**	**137,361**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

23.9 Water for the environment

23.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Bunyip basin EWR comprised all water in the basin not allocated for consumptive use, i.e. water above cap.

23.9.2 Compliance with passing flow requirements

There were no entitlements for the environment in the Bunyip basin in 2005/06 and therefore no statutory passing flow requirements. However Melbourne Water operates Tarago Reservoir to provide a passing flow below the reservoir.

23.9.3 Water leaving the basin

The amount of water flowing from the Bunyip basin into Port Phillip Bay and Westernport was 459,000 ML in 2005/06. This represents 95% of the total inflows into the basin, compared to 94% in 2004/05. This water comprises consumptive water that was not used under entitlements and the EWR (water above cap).

Westernport is an important environmental asset dependent on water from the EWR in the Bunyip basin. The bay is listed as internationally significant wetland under the Ramsar convention and relies on the freshwater inputs from the Bunyip basin for its ecological functioning

23.10 Bunyip basin summary

2005/06 was a relatively average year for the Bunyip basin and it generally avoided the low rainfall and streamflow conditions experienced in the rest of the state.

Diversions account for a relatively small amount of the total water available for use and will continue to be the case unless the Tarago Reservoir is reconnected.

24 Yarra basin

Table 24-1 Key features of the Yarra basin, 2005/06

- Catchment inflows fell from 1,008,700 ML in 2004/05 to 589,800 ML.
- Transfers from Thomson basin and Goulburn basin increased by 53,000 ML in 2005/06.
- Basin outflows to Port Phillip Bay dropped to 35% of inflows in 2005/06 from 55% in 2004/05.

24.1 Rainfall and inflows in 2005/06

In 2005/06 rainfall in the Yarra basin ranged between 80% and 100% of the long term average. Inflows were 56% of the long term average (1,054,000 ML) in 2005/06 and slightly more than half of those experienced in 2004/05.

24.2 Responsibilities for management of water resources

Table 24-2 shows the responsibilities of various authorities within the Yarra basin.

Table 24-2 Responsibilities for water resources management within the Yarra basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Melbourne Water		Surface water licensed diversions in the Yarra basin	Bulk water supplier to the Melbourne retail water authorities	Waterway management in the Yarra basin
Yarra Valley Water			Retail water supplier for part of the Yarra basin	
South East Water			Retail water supplier for part of the Yarra basin	
City West Water			Retail water supplier for part of the Yarra basin	
Southern Rural Water		Groundwater licensed diversions		

24.3 Location of water resources

Figure 24-1 Map of the Yarra basin

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 24-3.

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

Table 24-3 Summary of total water resources and water use in the Yarra basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	732,600	490,500
Groundwater(1)	Not available	Not available
Recycled water	9,010	400

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

24.5 Surface water resources

24.5.1 Water balance

A surface water balance for the Yarra basin is presented in Table 24-4. Melbourne Water operates seven major storages within the Yarra basin. Upper Yarra Reservoir, O'Shannassy Reservoir and Maroondah Reservoir all harvest water. Sugarloaf Reservoir, an off-stream storage, 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 located within the Bunyip basin, although it stores water harvested from the Yarra basin. The volume in Yarra basin storages started the 2005/06 year at 63% of capacity and fell to 58% by year end.

The inflows presented in Table 24-4 include transfers from other basins. During the year there was a net transfer of water into the Yarra basin from other basins. Melbourne Water imported 129,100 ML from the Thomson basin and 5,300 ML from the Goulburn basin to supply Melbourne's urban demands.

Table 24-4 Balance of surface water in the Yarra basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	131,100	133,600
Volume in storage at end of year	110,200	131,100
Change in storage	**-20,900**	**-2,500**
Inflows		
Catchment inflow[1]	589,800	1,008,700
Transfers from other basins	134,400	81,000
Return flow from irrigation	0	0
Treated wastewater discharged back to river	8,360	8,870
Sub-total	**732,600**	**1,098,600**
Usage		
Urban diversions	444,370	441,010
Licensed private diversions from unregulated streams	30,200	27,000
Small catchment dams	15,900	15,900
Transfers to Werribee Weir	0	2,400
Sub-total	**490,500**	**483,900**
Losses		
Net evaporation losses from major storages	8,400	8,200
Evaporation from small catchment dams	1,200	1,300
In-stream infiltration to groundwater, flows to floodplain and evaporation[2]	0	0
Sub-total	**9,600**	**9,500**
Water passed at outlet of basin		
River outflows to Port Phillip Bay	253,400	607,700

Notes:

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

(2) Losses estimated to be zero since no loss function is available for the Yarra basin.

24.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 24-5 below are based on the estimated average annual impact.

Table 24-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	10,500	5,300	Not available
Registered commercial and irrigation	12,600	10,600	Not available
Total	**23,100**	**15,900**	**17,100**

24.5.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements, diversion licences or sales water within the basin in 2005/06.

Melbourne Water advised that unregulated licences were traded between rural users within the Yarra system, with 10 ML of permanent water licences transferred in one transaction and 127 ML of temporary licences traded in 12 transactions.

24.5.4 Volume diverted

The volume of water diverted by Melbourne Water is shown in Table 24-6. The volume of water diverted in 2005/06 (444,365 ML) was almost identical to that in 2004/05 (441,010 ML).

Approximately half of licensed diversions on unregulated streams are metered. Compliance for these individual water users is not included in the aggregated values for the water accounts. Total licensed diversions of 30,200 ML from unregulated streams are estimated based on irrigation demand modelling and climate information.

Bulk entitlements for the Yarra basin were not completed until October 2006 and hence they are not reported in Table 25-6.

Table 24-6 Volume of water diverted under surface water entitlements in the Yarra basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)	Entitlement volume compliance?
Melbourne Water					
Melbourne water supply	n/a	n/a	0	444,365	n/a
Total annual volume taken in 2005/06		**n/a**	**0**	**444,365**	
Total annual volume taken in 2004/05		**n/a**	**0**	**441,010**	
Licensed diversions from unregulated streams 2005/06		*45,382*		*30,200*	
Licensed diversions from unregulated streams 2004/05		*35,982*		*27,000*	

n/a: Bulk entitlements for the Yarra basin were not completed until October 2006 and therefore are not reported.

24.6 Groundwater resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Yarra basin, excluding domestic and stock use, is presented in Table 24-7.

The Yarra basin contains the whole Wandin Yallock WSPA as well as part of the Kinglake GMA and Moorabbin GMA. The volumes described in tables below are totals for the management areas and include the area that falls outside the Yarra basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 24-7 Compliance with licensed groundwater volumes, Yarra basin 2005/06

Water supply protection area/ Groundwater management area[1]	GMA/ WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Kinglake GMA (22%)	All depths	3,830	2,012	0	966	966	644
Moorabbin GMA (37%)	All depths	4,305	2,202	0	661	661	725
Wandin Yallock WSPA (100%)	All depths	3,037	3,037	590	0	590	300

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) In non-metered areas, Southern Rural Water has estimated use at 30% of licensed entitlement.

An estimate of domestic and stock groundwater use is provided in Table 24-8.

Table 24-8 Number of domestic and stock bores and estimated use, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Kinglake GMA	342	684
Moorabbin GMA	238	476
Wandin Yallock WSPA	163	326

Note:

(1) A number of licensed groundwater allocations also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in Table 24-7.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

24.7 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions on unregulated streams are shown in Table 24-9.

No bans or restrictions were imposed on groundwater use in the Yarra basin during 2005/06.

Table 24-9 Seasonal allocations and restrictions on water use in Yarra basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban		No restrictions Permanent water savings measures applied during the entire year
Licensed diversions from unregulated streams	Darebin Creek	Irrigation ban in August 2005, January 2006, March 2006
	Diamond Creek	Irrigation ban in July 2005, June 2006
	Hoddles Creek	Irrigation ban from July to August 2005, December 2005, from February to March 2006, from May to June 2006
	Yarra River, Little Yarra River	Restrictions (to pumping times/days) from December 2005 to March 2006
	Don River	Restrictions from January to March 2006
	Pauls Creek	Irrigation ban from July to September 2005, June 2006
	Plenty River	Irrigation ban from July to August 2005, from December 2005 to March 2006, May 2006
	Steels and Dixons Creeks	Irrigation ban from July to August 2005, June 2006
	Wandin Yallock Creek	Irrigation ban in July 2005, from December 2005 to January 2006, March 2006, June 2006
	Woori Yallock Creek	Irrigation ban in July 2005, restrictions in December 2005 to January 2006, irrigation ban in March 2006, June 2006
	Watsons Creek	Irrigation ban in October 2005
	Mullum Mullum Creek	Irrigation ban in January 2006, March 2006

24.8 Recycled water

Yarra Valley Water operates eight wastewater treatment plants within the Yarra basin.

Wastewater was reused at four of the plants in 2005/06. Overall, 4% of wastewater was reused in the basin, which was unchanged from the percentage recycled in 2004/05.

Table 24-10 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Brushy Creek	4,105	34	1%	0	34	0	0	4,071	0
Craigieburn	1,057	89	8%	0	89	0	0	968	0
Healesville	355	0	0%	0	0	0	0	355	0
Lilydale	2,335	0	0%	0	0	0	0	2,278	56
Monbulk	15	0	0%	0	0	0	0	15	0
Upper Yarra	737	0	0%	0	0	0	0	671	66
Wallan[4]	205	167	82%	0	167	0	0	0	38
Whittlesea	204	113	55%	0	113	0	0	0	91
Total 2005/06	**9,013**	**404**	**4%**	**0**	**404**	**0**	**0**	**8,359**	**251**
Total 2004/05	**9,498**	**388**	**4%**	**0**	**190**	**0**	**16**	**8,874**	**120**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

(4) Responsibility for the water and wastewater supply to the town of Wallan was transferred from Goulburn Valley Water to Yarra Valley Water in January 2006. All reuse figures for Wallan from both 2004/05 and 2005/06 have been incorporated into the above table to allow for a consistent comparison.

24.9 Water for the environment

24.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Yarra basin EWR comprised all water in the basin not allocated for consumptive use.

24.9.2 Compliance with passing flow requirements

Melbourne Water operates the Melbourne system to comply with passing flows at harvesting points. These passing flows are established in Melbourne Water's operating rules and in the case of the Yarra at Warrandyte, established by the State Environment Protection Policy – Waters of Victoria (SEPP WoV), Schedule F7 (Waters of the Yarra Catchment).

Table 24-11shows a number of passing flow requirements in the Yarra basin for selected compliance points. The points below have been chosen as they were judged to be of community interest.

Table 24-11 Selected passing flow requirements in the Yarra basin

River	Passing flow	
Yarra River	Instrument where passing flows are specified	State Environment Protection Policy – Waters of Victoria (SEPP WoV), Schedule F7 (Waters of the Yarra Catchment)
	Responsible authority	Melbourne Water
	Compliance point	Upper Yarra Reservoir to Yarra River: Upper Yarra Dam
	Passing flow rules	• 10 ML/day
	Compliance point	Millgrove
	Passing flow rules	• 98 ML/day
	Compliance point	Yering Gorge Pump Station
	Passing flow rules	• 245 ML/day

Melbourne Water reported that compliance with the requirements of its SEPP environmental flow obligations were met for 2005/06. Melbourne Water also reported that during the third quarter of 2005/06, when low flow occurred in the Yarra below Upper Yarra Dam at Millgrove and Yering Gorge Pump Station, the authority ceased harvesting from the tributaries and at Yering Gorge as required under its obligations under the Yarra Drought Response Plan.

24.9.3 Streamflow management plans (SFMPs)

SFMPs have been completed and approved for Diamond Creek and Hoddles Creek. Melbourne Water complied with its obligations to submit an annual report on activities in 2005/06 in relation to the Diamond Creek and Hoddles Creek SFMPs.

A draft SFMP for the Plenty River has been submitted to the Minister for Water for approval.

Consultative committees have been appointed and are undertaking work to develop SFMPs for Steels, Pauls and Dixon Creeks, Olinda Creek and Stringybark Creek.

24.9.4 Water leaving the basin

The amount of water flowing from the Yarra basin into Port Phillip Bay was 253,400 ML in 2005/06. This represents 43% of the total inflows into the basin, compared to 60% in 2004/05. This water comprises consumptive water that was not used under entitlements and the EWR (water above cap).

24.10 Yarra basin summary

The level of storages located in the Yarra basin fell by around 20,000 ML in 2005/06. This was despite transfers from Thomson Reservoir and the Silver and Wallaby Creek system increasing from 81,000 ML in 2004/05 to 134,400 ML in 2005/06, and an almost unchanged level of urban diversions to supply Melbourne and surrounds.

The reason for the decline in storage levels, as well as sharply reduced outflows to Port Phillip Bay, was a substantial decline in inflows, which fell from 1,098,600 ML in 2004/05 to 732,600 ML in 2005/06. The inflows during 2005/06 were 56% of the long term average.

Low streamflows resulted in bans and restrictions on licensed diversions from many streams, including the Yarra itself.

25 Maribyrnong basin

Table 25-1 Key features of the Maribyrnong basin, 2005/06

- Rainfall was 60-100% of long term average, with inflows at 27% of long term average.
- Storages volumes decreased from 14% at the start of the year to 7% at the end.

25.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall in the Maribyrnong basin ranged between 60% and 100% of the long term average. This was slightly worse than the previous two years, both of which experienced rainfall ranging between 80% and 100% of the long term average. Depleted soil moisture again impacted inflows in 2005/06, with flows close to 30% of the long term average (113,000 ML) for the third consecutive year.

25.2 Responsibilities for management of water resources

Table 25-2 shows the responsibilities of various authorities within the Maribyrnong basin.

Table 25-2 Responsibilities for water resources management within the Maribyrnong basin, 2005/06

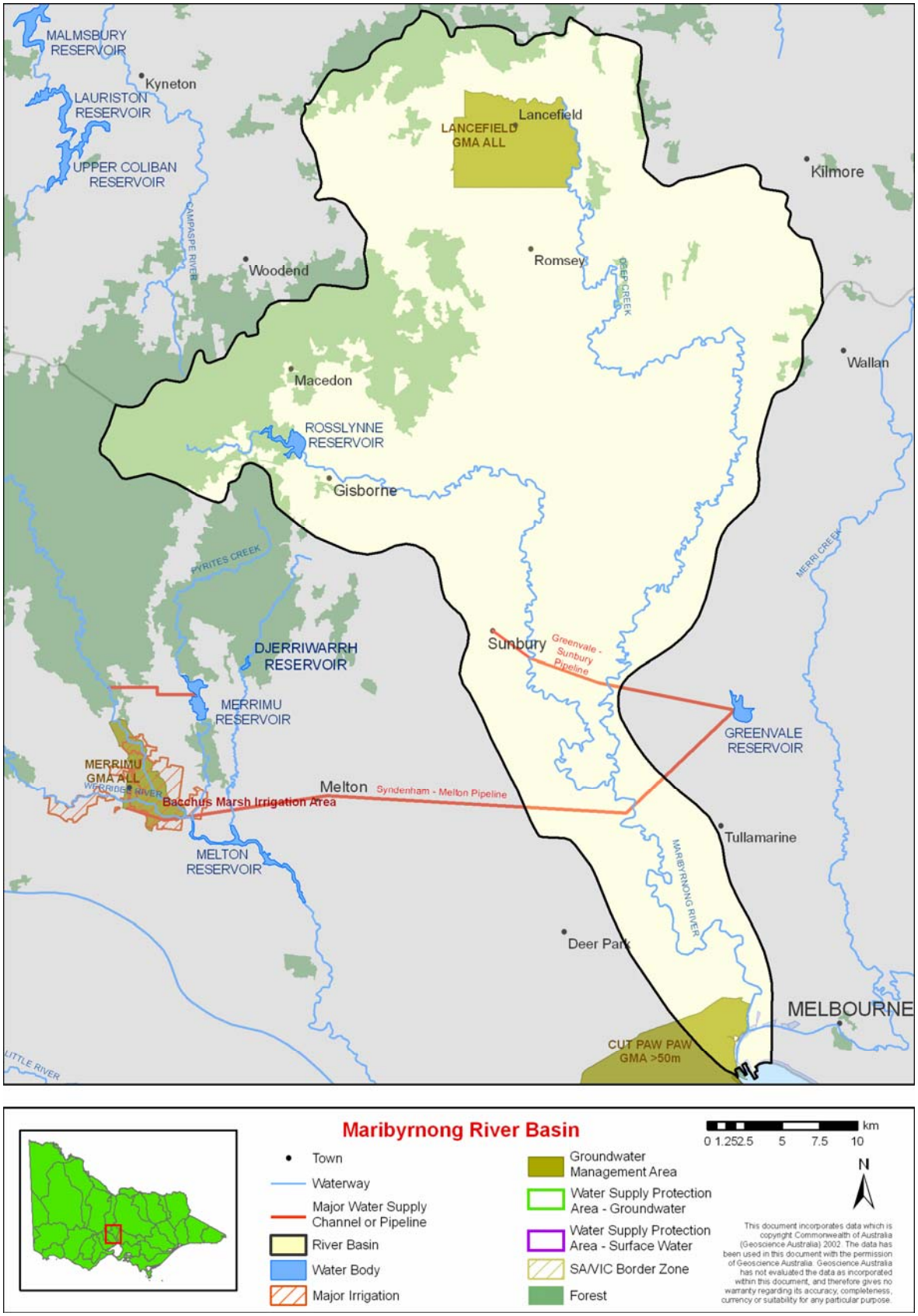
Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management waterway management, environmental obligations
Melbourne Water		Surface water licensed diversions in the lower Maribyrnong basin below the confluence with Deep Creek and the Maribyrnong River	Bulk water supplier to City West Water and Western Water (water supplied from Yarra/Thomson system)	Waterways, drainage and floodplain management in part of the Maribyrnong basin(1)
City West Water			Retail water supplier to metropolitan Melbourne (supplied from Yarra/Thomson system)	
Western Water			To urban areas in the basin located outside metropolitan Melbourne	Macedon reservoirs Obligation to meet passing flow requirements
Southern Rural Water		Surface water licensed diversions in the upper Maribyrnong basin and groundwater licensed diversions in the whole of the basin		Rosslynne Reservoir Obligation to meet passing flow requirements

Note:

(1) The government's *Our Water Our Future* action plan determined Melbourne Water's waterway management role, which was formalised in November 2005. This was previously the responsibility of Port Phillip and Western Port Catchment Management Authority.

25.3 Location of water resources

Figure 25-1 Map of 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 25-3.

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

Table 25-3 Summary of total water resources and water use in the Maribyrnong basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	31,900	10,600
Groundwater(1)	Not available	Not available
Recycled water	2,900	1,420

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

25.5 Surface water resources

25.5.1 Water balance

A surface water balance for the Maribyrnong basin is shown in Table 25-4.

Rosslynne Reservoir is the only large storage located within the basin. The storage volume was low at the start of the year at 14% of total capacity. It decreased during 2005/06, and was 7% full at the end of June 2006.

By far the largest diversion of water was for farm dams, making up about two thirds of the total diversions.

Table 25-4 Balance of surface water in the Maribyrnong basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	3,600	1,600
Volume in storage at end of year	1,800	3,600
Change in storage	**-1,800**	**2,000**
Inflows		
Catchment inflow[1]	30,400	37,000
Transfers from other basins[4]	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	1,540	1,970
Sub-total	**31,900**	**39,000**
Usage		
Urban diversions[2]	880	3,470
Licensed private diversions from regulated streams	500	400
Licensed private diversions from unregulated streams	1,400	1,300
Small catchment dams	7,800	7,800
Sub-total	**10,600**	**13,000**
Losses		
Net evaporation losses from major storages	300	200
Evaporation from small catchment dams	4,800	4,800
In-stream infiltration to groundwater, flows to floodplain and evaporation[3]	2,000	2,300
Sub-total	**7,100**	**7,300**
Water passed at outlet of basin		
River outflows to Port Phillip Bay	16,000	16,700

Notes:

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

(2) Urban diversions in the 2004/05 State Water Report inadvertently double counted licensed private diversions from regulated streams. The 2004/05 urban diversions volume in Table 25-4 has been amended downwards accordingly.

(3) Losses estimated using loss functions from the Maribyrnong REALM.

(4) Transfers from the Melbourne system to Sunbury are not shown as they were provided directly into the urban supply system and did not affect streamflows in the Maribyrnong basin.

25.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 25-5 below are based on the estimated average annual impact.

Table 25-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	5,800	2,900	Not available
Registered commercial and irrigation	5,800	4,900	Not available
Total	**11,600**	**7,800**	**12,600**

25.5.3 Water entitlement transfers

A summary of the transfer of entitlements within the Maribyrnong basin is shown in Table 25-6. The small volume of transfers was between licensed private diverters.

Table 25-6 Transfer of entitlements in the Maribyrnong basin

Entitlement[1]	Permanent entitlement transfer				Temporary entitlement transfer			
	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)
Melbourne Water								
Maribyrnong	0	0	0	0	76	76	2	0
Southern Rural Water								
Maribyrnong	10	10	1	0	10	10	1	0
Total 2005/06	**10**	**10**	**1**	**0**	**86**	**86**	**3**	**0**
Total 2004/05	**0**	**0**	**n/a**	**0**	**76**	**76**	**n/a**	**0**

Note:

(1) Entitlements for which no trades were recorded are not shown.

n/a: Information not available.

25.5.4 Volume diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 25-7. 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 2005/06.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 25-7 Volume of water diverted under surface water entitlements in the Maribyrnong basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML) (1)	Entitlement volume compliance?
Western Water					
Gisborne - Barringo Creek	1	320	0	10	Yes
Lancefield	1	315	0	46	Yes
Macedon and Mt Macedon(2)	1	645	0	441	Yes
Riddells Creek	1	300	0	1	Yes
Romsey	1	460	0	282	Yes
Maribyrnong (Rosslynne Reservoir)	5	6,100	0	102	Yes
Melbourne Water					
Maribyrnong	5	1,154	0	417	Yes
Southern Rural Water					
Maribyrnong	5	382	0	111	Yes
Total annual volume of bulk entitlements 2005/06(3)		**9,676**	**0**	**1,410**	
Total annual volume of bulk entitlements 2004/05		**8,396**	**0**	**3,843**	
Licensed diversions from unregulated streams 2005/06		*2,059*		*1,400*	
Licensed diversions from unregulated streams 2004/05		*2,063*		*1,300*	

Notes:

(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2005, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2005/06 period. The actual maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

(2) Average bulk entitlement is 645 ML/yr, but up to 873 ML can be diverted in any one year.

(3) Two more bulk entitlement conversions were established for 2005/06 - Gisborne-Barringo Creek and Macedon-Mt Macedon

25.6 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 25-8.

Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 25-8 Compliance with licensed groundwater volumes, Maribyrnong basin 2005/06

Water supply protection area/ Groundwater management area[1]	GMA/ WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Cut Paw Paw GMA (21%)	>50	3,650	533	0	160	160	186
Lancefield GMA (100%)	All depths	1,485	1,373	400	0	400	110

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) In non-metered areas, Southern Rural Water has estimated use at 30% of licensed entitlement

An estimate of domestic and stock groundwater use is provided in Table 25-9.

Table 25-9 Number of domestic and stock bores and estimated use, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Cut Paw Paw GMA	2	4
Lancefield GMA	76	152

Note:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in the Table 25-8.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

Within the Maribyrnong basin groundwater is used as an urban water supply for the township of Lancefield. The licensed entitlements and metered use for this supply is provided in Table 25-10.

Table 25-10 Urban groundwater usage

Town supplied	Licensed allocation (ML)	Metered use 2005/06	Metered use 2004/05
Lancefield	585	254	248

25.7 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions are shown in Table 25-11.

No bans or restrictions were imposed on groundwater use in the Maribyrnong basin during 2005/06.

Table 25-11 Seasonal allocations and restrictions on water use in Maribyrnong basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban		No restrictions Permanent water savings measures applied for the entire year
Licensed diversions from unregulated streams	Turitable Creek, Willimingongon Creek	Irrigation ban in July 2005, water shortage declaration from January to June 2006
	Barringo Creek, Bolinda Creek, Riddells Creek	Irrigation ban in July 2005, from January to June 2006
	Charlies/Main Creek, Number 3 Creek, Monument Creek	Irrigation ban in July 2005
	Deep Creek	Irrigation ban from January to June 2006
	Witch Creek	Irrigation ban from May to June 2006
	Maribyrnong River	Irrigation ban in July 2005, March 2006, May 2006
Irrigation and regulated diversions (Southern Rural Water)	Jacksons Creek	0% of licensed volume July 2005, increasing to 15% of allocation in August 2005
Irrigation and regulated diversions (Melbourne Water)	Maribyrnong River	River releases were delayed until November 2005 before irrigation bans were enforced from February until April 2006 (excluding one week in March) Winterfill licences were unable to be utilised on 51 days out of the 123 day winterfill period

25.8 Recycled water

All wastewater treatment plants within the basin are operated by Western Water. Overall 49% of the wastewater was reused in 2005/06, primarily for agricultural purposes. Recycled water is provided to a number of wineries and vegetable producers. Recycled water use decreased from 71% in 2004/05 to 49% in 2005/06 mainly due to the cessation of recycling at Gisborne from November 2005 and a drop of approximately 650 ML of recycled water from the Sunbury treatment plant.

Table 25-12 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Gisborne	399	302	76%	90	188	0	24	97	0
Riddells Creek	94	94	100%	0	94	0	0	0	0
Romsey	341	341	100%	0	341	0	0	0	0
Sunbury	2,066	683	33%	209	411	0	63	1,446	0
Total 2005/06	**2,900**	**1,420**	**49%**	**299**	**1,034**	**0**	**87**	**1,543**	**0**
Total 2004/05	**2,950**	**2,087**	**71%**	**287**	**594**	**1,105**	**101**	**863**	**0**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

25.9 Water for the environment

25.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Maribyrnong basin EWR comprised the following components:

- passing flows released as a condition of consumptive bulk entitlements held by Western Water and Southern Rural Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

25.9.2 Compliance with passing flow requirements

Table 25-13 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 25-13 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
	Passing flow rules	• The lesser of 3 ML/d or natural flow
	Compliance point	Sunbury gauging station
	Passing flow rules	• The lesser of 10 ML/d or natural flow
	Compliance point	Keilor gauging station
	Passing flow rules	• The lesser of 5 ML/d or natural flow

Western Water reported that compliance with the requirements of its bulk entitlements had been met.

Western Water also reported that due to the continuing drought conditions and low levels in the Rosslynne Reservoir, a temporary amendment to Southern Rural Water's bulk entitlement was approved in 2004 and ended in November 2005. This amendment was introduced to reduce draw down of the storage via environmental flow releases to Jackson's Creek. Other methods to ensure stream health, including periodic flushes, uses of treated wastewater discharge and stream monitoring, were used to maintain water quality in selected refuge pools.

Southern Rural Water reported that it met all passing flow requirements under its bulk entitlement in 2005/06.

25.9.3 Streamflow management plans (SFMPs)

Technical studies and administrative processes are underway in preparation for the development of an SFMP for the upper Maribyrnong River.

25.9.4 Water leaving the basin

The amount of water flowing from the Maribyrnong basin into Port Phillip Bay was 16,000 ML in 2005/06. This represents 53% of the total inflows into the basin, compared to 45% in 2004/05. This water comprises consumptive water that was not used under entitlements, traded water and the EWR (passing flows and any water above cap).

25.10 Maribyrnong basin summary

The Maribyrnong basin continued its water shortage after experiencing low rainfall and inflows of 30% of long term average for each of the past three years. The basin's major storage, Rosslynne Reservoir effectively failed and therefore water taken from this source during the year was limited to102 ML.

With little water available in Rosslynne Reservoir, Western Water was able to rely on its Melbourne entitlement to supply some 4,500 ML to Sunbury, Gisborne and other towns in the basin.

Diversions were banned for most streams in the basin for much of the year.

Although recycled water use in the Maribyrnong basin declined in 2005/06, the total 1,420 ML of recycled water exceeded the amount of water which was able to be diverted from the basin for urban use.

26 Werribee basin

Table 26-1 Key features of the Werribee basin, 2005/06

- Rainfall was 60-100% of long term average, although inflows were 21% of the long term average.
- Storage levels fell from an average 34% at the start of the year to 16% at the end of the year.
- Irrigators and diverters in the Werribee system were allocated 80% of their water entitlement.
- 3% of the total inflows left the basin at Port Phillip Bay.

26.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall in the Werribee basin ranged between 60% and 100% of the long term average. Inflows to the basin were 21% of the long term average (102,000 ML) and a quarter of the 2004/05 inflows. It should be noted that the 2004/05 inflows were significantly boosted by a one-in-20 year storm that hit the region in February 2005.

26.2 Responsibilities for management of water resources

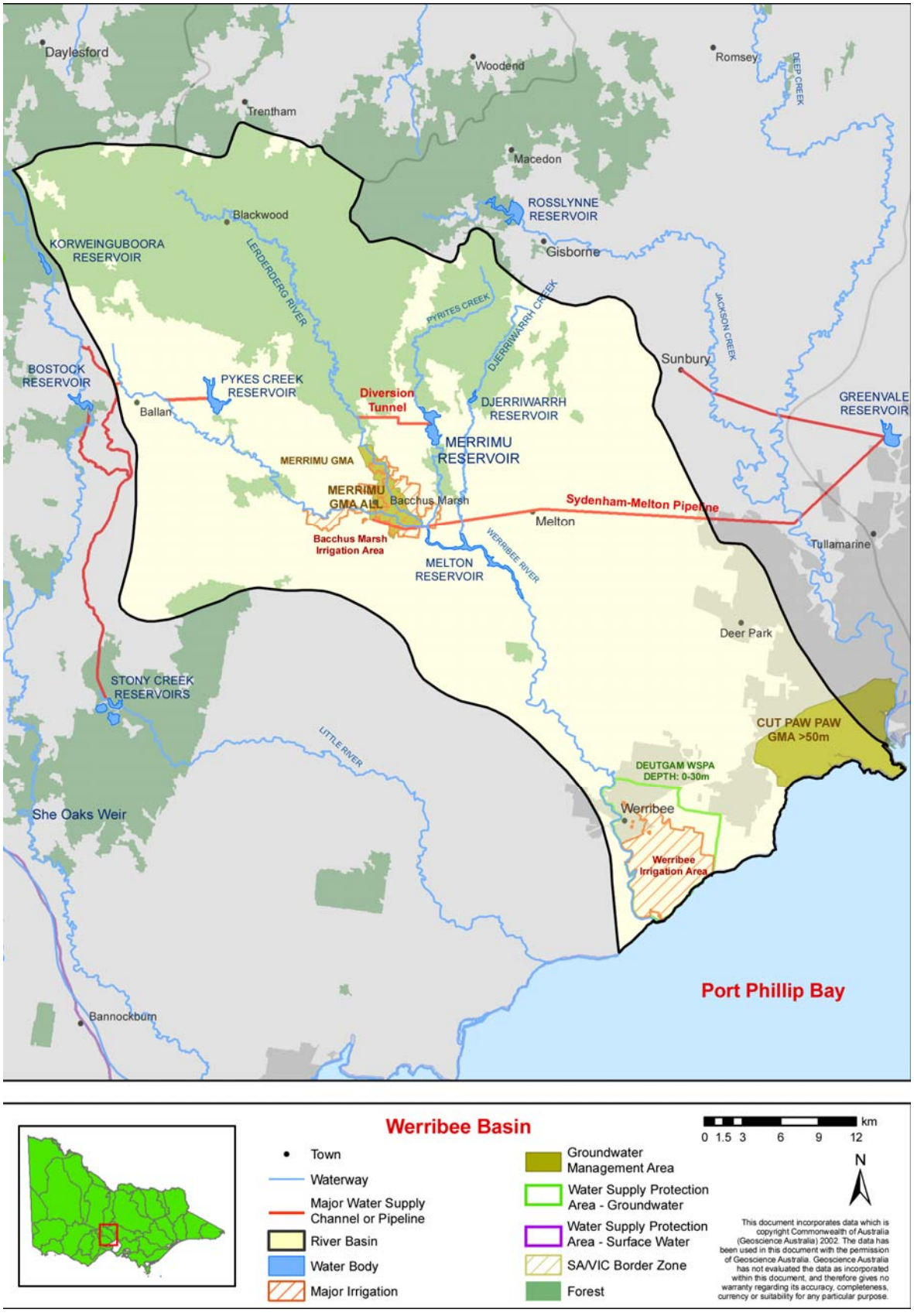
Table 26-2 shows the responsibilities of various authorities within the Werribee basin.

Table 26-2 Responsibilities for water resources management within the Werribee basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Southern Rural Water	Werribee and Bacchus Marsh irrigation districts	Groundwater and surface water licensed diversions		Pykes Creek Reservoir, Melton Reservoir and Merrimu Reservoir Obligation to meet passing flow requirements
Western Water			Urban water supply to areas in the north of the basin including Melton and Bacchus Marsh	Djerriwarrh Reservoir Obligation to meet passing flow requirements
Melbourne Water		Surface water licensed diversions for lower reaches of Kororoit Creek	Bulk water supplier to City West Water and Western Water from the Thomson/Yarra system. Operates the Western Treatment Plant and supplies recycled water to Southern Rural Water	Waterway, drainage and floodplain management in all of the Werribee basin
City West Water			Retail water and wastewater supplier to parts of metropolitan Melbourne that are in the basin	
Central Highlands Water			Urban water supply to Blackwood and Ballan	

26.3 Location of water resources

Figure 26-1 Map of 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 26-3.

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

Table 26-3 Summary of total water resources and water use, Werribee basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	22,200	19,900
Groundwater(1)	Not available	Not available
Recycled water	162,410	42,460

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

26.5 Surface water resources

26.5.1 Water balance

A surface water balance for the Werribee basin is shown in Table 26-4. Storage volumes at the start of the year were around 34% and reduced to 16% capacity by the end of the year. All of Southern Rural Water's storages were at less than 20% capacity in June 2006.

Table 26-4 Balance of surface water in the Werribee basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	22,900	5,100
Volume in storage at end of year	10,900	22,900
Change in storage	**-12,000**	**17,800**
Inflows		
Catchment inflow(1)	21,600	83,600
Transfers from other basins	0	2,400
Return flow from irrigation	600	600
Treated wastewater discharged back to river	0	0
Sub-total	**22,200**	**86,600**
Usage		
Urban diversions	130	3,930
Irrigation district diversions	10,100	16,200
Licensed private diversions from unregulated streams	400	400
Small catchment dams	9,300	9,300
Sub-total	**19,900**	**29,800**
Losses		
Net evaporation losses from major storages	2,100	1,300
Evaporation from small catchment dams	5,400	5,400
In-stream infiltration to groundwater, flows to floodplain and evaporation(2)	5,900	7,900
Sub-total	**13,400**	**14,600**
Water passed at outlet of basin		
River outflows to Port Phillip Bay	900	24,400

Notes:

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

(2) Losses estimated using loss functions from the Werribee REALM.

26.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 26-5 below are based on the estimated average annual impact.

Table 26-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	5,900	2,900	Not available
Registered commercial and irrigation	7,600	6,400	Not available
Total	**13,500**	**9,300**	**14,700**

26.5.3 Water entitlement transfers

A summary of the transfer of entitlements within the Werribee basin is shown in Table 26-6. Over 100 temporary trades occurred in Southern Rural Water's Werribee and Bacchus Marsh irrigation districts with 1,657 ML traded. No permanent trades were made.

Table 26-6 Transfer of entitlements in the Werribee basin

Entitlement[1]	Permanent entitlement transfer				Temporary entitlement transfer			
	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)	Bought (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)
Southern Rural Water								
Werribee system	0	0	0	0	1,657	1,657	104	0
Total 2005/06	**0**	**0**	**0**	**0**	**1,657**	**1,657**	**104**	**0**
Total 2004/05	**6**	**6**	**n/a**	**0**	**1,388**	**1,388**	**n/a**	**0**

Note:

(1) Entitlements for which no trades were recorded are not shown.

26.5.4 Volume diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 26-7. 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 2005/06.

Central Highlands Water did not use any water from its Ballan bulk entitlement because the demand was supplied from Lal Lal Reservoir in the Moorabool basin.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

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/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML) (1)	Entitlement volume compliance?
Central Highlands Water					
Ballan	1	451	0	0	Yes
Blackwood and Barry's Reef	1	140	0	45	Yes
Western Water					
Myrniong	1	58	0	33	Yes
Werribee system - urban	5	8,500	0	52	Yes
Southern Rural Water					
Werribee system	5	27,040	0	7,733	Yes
Total annual volume of bulk entitlements 2005/06		**36,189**	**0**	**7,863**	
Total annual volume of bulk entitlements 2004/05		**27,631**	**0**	**17,792**	
Licensed diversions from unregulated streams 2005/06		*919*		*400*	
Licensed diversions from unregulated streams 2004/05		*921*		*400*	

Notes:

(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2005, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2005/06 period. The actual maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

26.6 Groundwater resources

A summary of the licensed entitlements and use for groundwater management units that overlap 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. The volumes described in tables below are totals for the management areas and include the area that falls outside the Werribee basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 26-8 Compliance with licensed groundwater volumes, Werribee basin 2005/06

Water supply protection area/ Groundwater management area[1]	GMA/ WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Cut Paw Paw GMA (70%)	>50 metres	3,650	533	0	160	160	186
Merrimu GMA (100%)	All	452	452	120	0	120	90
Deutgam WSPA (100%)	≤30 metres	5,234	5,234	2,660	0	2,660	960

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) In non-metered areas, Southern Rural Water has estimated use at 30% of licensed entitlement

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, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Cut Paw Paw GMA	2	4
Merrimu GMA	13	26
Deutgam WSPA	257	514

Note:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in the Table 26-8.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

26.7 Seasonal allocations and restrictions on water use, diversions and extractions

Irrigation allocations and restrictions applying to urban customers, licensed diversions on unregulated streams and groundwater extractions are shown in Table 26-10. Irrigators and private diverters in the Werribee system received 80% of their water right, a decline from the 100% allocation received in 2004/05.

Table 26-10 Seasonal allocations and restrictions on water use in Werribee basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban		No restrictions Permanent water savings measures were in place for the entire year
Licensed diversions from unregulated streams	Lerderderg River	Irrigation ban in July 2005, from January to June 2006
	Kororoit Creek (Southern Rural Water)	Irrigation ban from July to August 2005, January to June 2006
	Werribee River	Irrigation ban in June 2006
	Kororoit Creek (Melbourne Water)	Irrigation ban from July to August 2005, in October 2005, March 2006
Irrigation and regulated diversions	Werribee System (Werribee Irrigation District, Bacchus March Irrigation District, Werribee River)	55% of water right in July 2005, increasing to 80% in November 2005
Groundwater	Deutgam GMA	60% of licensed volume from July 2005 to April 2006, increasing to 100% in May

26.8 Recycled water

Five wastewater treatment plants operate within the Werribee basin. Overall, 27% of wastewater was reused in 2005/06, almost double the 14% recycled in 2004/05.

Melbourne Water operates the Western Treatment Plant, which reused 25% of wastewater, including 21,707 ML for on-site irrigation and environmental management and 15,065 ML for habitat management at Ramsar-listed wetlands. This additional 15,065 ML accounted for most of the increase in recycling compared with 2004/05. The 2005/06 year was also the first full year of recycled water supply to the Werribee Irrigation District.

Table 26-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)					Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				To retailers	Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Altona	5,962	0	0%	0	0	0	0	0	0	5,962
Ballan	119	80	67%	0	0	80	0	0	0	39
Melton	3,298	3,298	100%	0	257	3,041	0	0	0	0
Parwan (Bacchus Marsh)	960	960	100%	0	0	960	0	0	0	0
Western Treatment Plant	152,074	38,126	25%	1,279	75	21,707	15,065	0	0	113,948
Total 2005/06	**162,413**	**42,464**	**26%**	**1,279**	**332**	**25,788**	**15,065**	**0**	**0**	**119,949**
Total 2004/05	**175,131**	**24,723**	**14%**	**201**	**165**	**24,357**	**0**	**0**	**0**	**150,408**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

26.9 Water for the environment

26.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Werribee basin EWR comprised the following components:

- passing flows released as a condition of consumptive bulk entitlements held by Central Highlands Water, Western Water and Southern Rural Water
- all other water in the basin not allocated for consumptive use.

26.9.2 Compliance with passing flow requirements

Table 26-12 shows the passing flow requirements 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 26-12 Selected passing flow requirements 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
	Passing flow rules	• The lesser of 5 ML/day or the natural inflow
	Compliance point	Bacchus Marsh Diversion Weir (gauging station)
		• The lesser of 12 ML/day continuous flow (averaged over any 7 day period) or the natural inflow, or • The sum of the lesser of at least 5 ML/day continuous flow or the natural inflow AND other intermittent flows from deliberate releases or spills
	Compliance point	Melton Reservoir
	Passing flow rules	May to August (inclusive): • The lesser of 15 ML/day continuous flow or the natural inflow if the reservoir is above target for that month, or • The lesser of 15 ML/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: • Targets in May, June and July are 6500 ML, target in August is 9000 ML • If the natural flow here is less than 15 ML/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
	Compliance point	Below the Lerderderg Diversion Weir

	Passing flow rules	The storage operator must provide:
		• A low flow equal to the lesser of 30 ML/day and the natural inflow
		• A fresh flow during the months of June to December inclusive of:
		  • 150 ML/day up to 5 times a year, and
		  • 1500 ML/day for 24 hours in 3 out of 4 years if the instantaneous flow at this location exceeds 1500 ML/day

	Compliance point	Below Werribee Diversion Weir
	Passing flow rules	Within the operational tolerances: • 10 ML/day if the declared seasonal allocation for the Werribee Irrigation District exceeds 130% of water right • 1 ML/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

Central Highlands Water reported that it met all passing flow requirements under its bulk entitlements at all sites in the Werribee basin.

Western Water reported that compliance with the requirements of its bulk entitlement was not met for Djerrawarrh Creek

Southern Rural Water reported that it met all passing flow requirements under its bulk entitlements in 2005/06.

26.9.3 Water leaving the basin

The amount of water flowing from the Werribee basin into Port Phillip Bay was 900 ML in 2005/06. This represents 4% of the total inflows into the basin, compared to 29% in 2004/05 (due to the one-in-20 year storm). This water comprises consumptive water that was not used under entitlements, traded water and the EWR (environmental entitlement, passing flows, and any water above cap).

26.10 Werribee basin summary

2005/06 was another dry year for the Werribee basin. While rainfall was between 60% and 100% of the long term average, the pattern of rainfall throughout the year and the low soil moisture resulting from the long succession of dry years conspired to produce not enough runoff (21% of average) to replenish the basin's reservoirs.

The Merrimu system, relying mainly on diversions from the Lerderderg River, was particularly affected. Lake Merrimu held 20% of its capacity at the end of spring and Western Water pumped 52 ML from the reservoir under its bulk entitlement (which allows an average annual take of 6,100 ML if the water is available). With the failure of this source of water, Western Water had to rely on using 5,600 ML of its Melbourne entitlement to supply towns such as Bacchus Marsh and Melton.

Irrigators in the Werribee and Bacchus Marsh districts experienced their third consecutive year of low water allocations. Their supply was maintained by depleting stored reserves. For the first time Werribee irrigators had access to recycled water for the entire water year to supplement their river water supplies.

The river reach most affected by the dry conditions is between the Lower Werribee Weir and Port Phillip Bay. The flows in most other reaches downstream of dams and weirs benefit from flows being passed for irrigation. Below Werribee Weir, there is a small nominal passing flow and in 2005/06 900 ML entered Port Phillip Bay.

27 Moorabool basin

Table 27-1 Key features of the Moorabool basin, 2005/06

- Rainfall was 60-100% of long term average, with inflows 49% of long term average.
- Storages decreased from 30% at the start of the year to 20% by year end.

27.1 Rainfall and inflow in 2005/06

In 2005/06, rainfall in the Moorabool basin ranged between 60% and 100% of the long term average, a reduction from the previous two years which experienced 80-100% of the long term average. Total inflows in 2005/06 were 49% of the long term average (97,000 ML), a substantial fall from 111% in 2004/05, which was boosted by a single summer storm.

27.2 Responsibilities for management of water resources

Table 27-2 shows the responsibilities of various authorities within the Moorabool basin.

Table 27-2 Responsibilities for water resources management within the Moorabool basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Southern Rural Water		Groundwater and surface water licensed diversions		
Barwon Water			Urban water supply to the Greater Geelong area(1)	Manages reservoirs on the East Moorabool River and has a 1/3 share of Lal Lal Reservoir. Also manages Stony Creek reservoir Obligation to meet passing flow requirements
Central Highlands Water			Supplies a number of towns in the upper Moorabool basin including Gordon, Mt Egerton and Wallace and the outskirts of Ballarat(2)	Manages reservoirs on the West Moorabool River and has a 2/3 share of Lal Lal Reservoir Obligation to meet passing flow requirements
Corangamite Catchment Management Authority				Waterway management in the whole of the Moorabool basin

Note:

(1) Geelong's water supply is sourced from both the Barwon and Moorabool basins.

(2) The vast majority of Ballarat is outside the Moorabool basin's boundary.

27.3 Location of water resources

Figure 27-1 Map of 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 27-3.

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

Table 27-3 Summary of total water resources and water use in the Moorabool basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	47,900	38,700
Groundwater(1)	Not available	Not available
Recycled water	0	0

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

27.5 Surface water resources

27.5.1 Water balance

A surface water balance for the Moorabool basin is shown in Table 27-4. Storage volumes within the Moorabool basin started at 30% of total capacity and reduced to 20% of total capacity by June 2006.

Central Highlands Water transferred 2,300 ML from the Moorabool basin to the Barwon basin to supply water to Ballarat and other towns connected to the Ballarat system.

The majority of water used for consumptive purposes in the basin is sourced from small catchment dams.

Table 27-4 Balance of surface water in the Moorabool basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	22,400	11,600
Volume in storage at end of year	17,100	22,400
Change in storage	**-5,300**	**10,800**
Inflows		
Catchment inflow[1]	47,900	108,000
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**47,900**	**108,000**
Usage		
Urban diversions[3]	12,580	8,840
Transfers to Barwon basin (White Swan Reservoir) [3]	2,300	8,800
Licensed private diversions from unregulated streams	1,600	1,300
Small catchment dams	22,200	22,200
Sub-total	**38,700**	**41,100**
Losses		
Net evaporation losses from major storages	1,800	900
Evaporation from small catchment dams	7,300	7,200
In-stream infiltration to groundwater, flows to floodplain and evaporation[2]	2,100	4,400
Sub-total	**11,200**	**12,500**
Water passed at outlet of basin		
River outflows to Port Phillip Bay (Little River)	1,500	22,300
River outflows to the Barwon River (Moorabool River)	1,800	21,300

Notes:

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

(2) Losses 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.

(3) The urban diversions figure of 12,580 ML represents water diverted from the Moorabool basin to directly supply urban customers in the Ballarat area, including in the Barwon basin. The transfer to the Barwon basin (White Swan Reservoir) of 2,300 ML is also ultimately used to supply urban customers in the Ballarat area. However, because the transfer to the Barwon basin first enters the White Swan Reservoir it is treated as an inter-basin transfer.

27.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 27-5 below are based on the estimated average annual impact.

Table 27-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	6,100	3,000	Not available
Registered commercial and irrigation	22,800	19,200	Not available
Total	**28,900**	**22,200**	**29,500**

27.5.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements, diversion licences or sales water within the basin in 2005/06.

27.5.4 Volume diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 27-6.

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 2005/06.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 27-6 Volume of water diverted under surface water entitlements in the Moorabool basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML) (1)	Entitlement volume compliance?
Barwon Water					
Meredith	1	600	0	342	Yes
Upper East Moorabool System	1	9,000	0	3,034	Yes
Lal Lal	3	7,000	0	930	Yes
She Oaks	3	2,000	0	55	Yes
Central Highlands Water					
Upper West Moorabool System	1	10,500	0	2,340	Yes
Lal Lal	3	14,000	0	8,214	Yes
Total annual volume of bulk entitlements 2005/06		**43,100**	**0**	**14,915**	
Total annual volume of bulk entitlements 2004/05		**43,100**	**0**	**17,681**	
Licensed diversions from unregulated streams 2005/06		*3,605*		*1,600*	
Licensed diversions from unregulated streams 2004/05		*3,327*		*1,300*	

Notes:

(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2005, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2005/06 period. The actual maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

27.6 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. The tables below are totals for the Bungaree WSPA, and include the area that falls outside the Moorabool basin.

There is concern that the high level of groundwater extractions in the Bungaree WSPA is reducing streamflows in the upper Moorabool catchment.

Central Highlands Water holds a licence to supply groundwater to the towns of Gordon and Mt Egerton, however as these towns are now connected to the Ballarat water supply system, no water was extracted under this licence in 2005/06.

Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 27-7 Compliance with licensed groundwater volumes, Moorabool basin 2005/06

Water supply protection area/ Groundwater management area[1]	GMA/ WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Bungaree WSPA (67%)[5]	All depths	5,401	5,401	2,700	0	2,700	2,610

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) Depth limit was incorrectedly stated in 2004/05 State Water Report and has been adjusted.

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, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Bungaree WSPA	252	504

Note:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in the Table 27-7.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

27.7 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions are shown in Table 27-9.

No bans or restrictions were imposed on groundwater use in the Moorabool basin during 2005/06.

Table 27-9 Seasonal allocations and restrictions on water use in Moorabool basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	Gordon, Wallace	Stage 2 from July 2005 to June 2006 Permanent water savings measures were introduced in May 2006 in Barwon Water's region
Licensed diversions from unregulated streams	Moorabool River	Stage 2 (25% reduction) from July to September 2005, increasing to Stage 3 (50% reduction) from October to December 2005 before an irrigation ban was enforced from January to June 2006

27.8 Recycled water

There are no sewerage treatment plants within the Moorabool basin.

27.9 Water for the environment

27.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Moorabool basin EWR comprised the following components:

- passing flows released as a condition of consumptive bulk entitlements held by Barwon Water and Central Highlands Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

27.9.2 Compliance with passing flow requirements

Table 27-10 shows the passing flow requirements in the Moorabool 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 27-10 Selected passing flow requirements 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
	Passing flow rules	• The lesser of 40 ML/day or natural flow
West Moorabool River	Instrument where passing flows are specified	Bulk Entitlement (Upper West Moorabool System) Conversion Order 1995
	Responsible authority	Southern Rural Water
	Compliance point	Moorabool reservoir
	Passing flow rules	• The lesser of 3 ML/day or natural flow
West Branch Moorabool River	Instrument where passing flows are specified	Bulk Entitlement (Lal Lal - Central Highlands) Conversion Order 1995
	Responsible authority	Southern Rural Water
	Compliance point	Lal Lal Reservoir
	Passing flow rules	• Under normal conditions 20 ML/day • Under dry conditions (when cumulative inflow into the reservoir over the previous 24 months is less than 43,000 ML), the lesser of 5 ML/day or natural flow

Barwon Water reported that overall compliance with minimum passing flow requirements was met with some non-compliance at some sites in 2005/06.

At Meredith and She Oaks, extraction limits are influenced by river flows and Barwon Water reported it was difficult to determine daily allowable extractions when flows are low and variable.

Korweinguboora and Bostock storages were close to empty and off-line towards the end of the year. Consequently, Barwon Water indicated that response to intermittent low flows was not practical after the outflow pipelines were closed.

Central Highlands Water reported that it met all passing flow requirements under its bulk entitlements at all sites in the Moorabool basin.

27.9.3 Water leaving the basin

The amount of water flowing from the Moorabool basin into Port Phillip Bay and the Barwon River was 3,300 ML in 2005/06. This represents 7% of the total inflows into the basin, compared to 40% in 2004/05 (due to the one-in-20 year storm). This water comprises consumptive water that was not used under entitlements and the EWR (passing flows and any water above cap).

27.10 Moorabool basin summary

Conditions in the Moorabool basin were similar to the neighbouring Werribee basin. Below average rainfall in 2005/06 and a continued a pattern of low inflows resulted in a depletion of storages in the upper part of the catchment. Central Highlands Water and Barwon Water found they had to deplete their reservoirs in order to maintain a restricted supply, which in turn triggered restrictions in both systems.

The dry conditions were reflected in increasingly stringent restrictions on licensed diversions on the unregulated Moorabool River which were put in place during the year, culminating in an irrigation ban in January 2006.

Low inflows and storage levels at Barwon Water's Korweinguboora and Bostock reservoirs also resulted in some instances when passing flows requirements were unable to be met.

As with the Werribee basin, streamflows in the lower reaches of the Moorabool and Little Rivers were particularly low, and less than 10% of those in 2004/05.

28 Barwon basin

Table 28-1 Key features of the Barwon basin, 2005/06

- Rainfall was 60-100% of long term average, with inflows 39% of long term average.
- Storages began the year at 54% of full capacity and ended the year at 31%.

28.1 Rainfall and inflow in 2005/06

In 2005/06, rainfall in the Barwon basin ranged between 60% and 100% of the long term average, a decrease from the 80-100% experienced in both 2004/05 and 2003/04. Overall, inflows in 2005/06 were 39% of the long term average (360,000 ML) compared with 53% in 2004/05 (2003/04 streamflows were similar to 2005/06).

28.2 Responsibilities for management of water resources

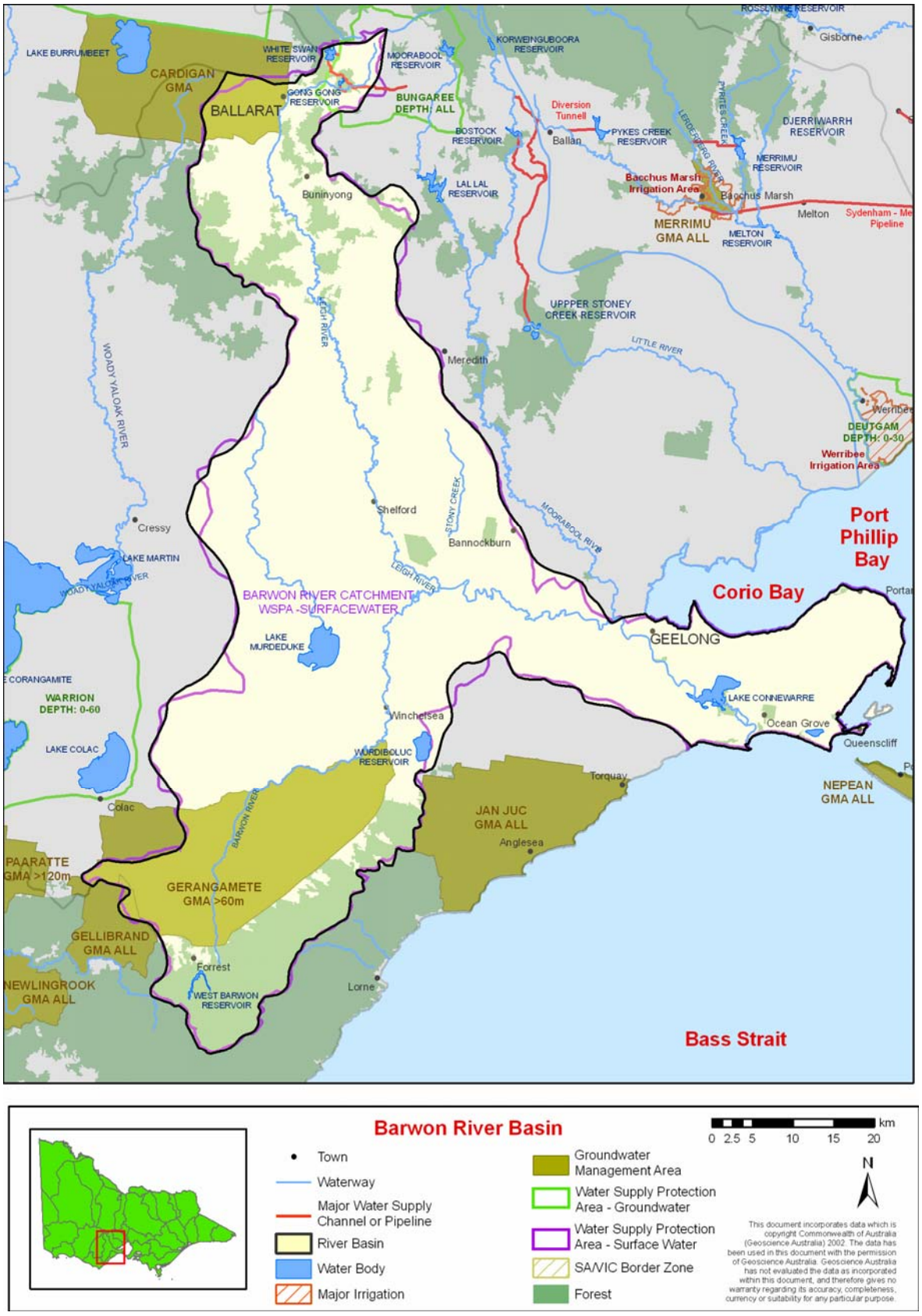
Table 28-2 shows the responsibilities of various authorities within the Barwon basin.

Table 28-2 Responsibilities for water resources management within the Barwon basin, 2005/06

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		
Barwon Water			Urban water supply to Greater Geelong	Owns and operates reservoirs and weirs in the West Barwon system Obligation to meet passing flow requirements
Central Highlands Water			Urban water supply to Greater Ballarat South Ballarat sewage treatment plant	Owns and operates reservoirs and weirs in the Ballarat supply system (White Swan Reservoir etc.) Obligation to meet passing flow requirements
Corangamite Catchment Authority				Waterway management for the whole of the Barwon basin

28.3 Location of water resources

Figure 28-1 Map of 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 shown in Table 28-3.

Barwon Water sources water from both the Barwon and Moorabool basins to supply Geelong, which is located in both basins.

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

Table 28-3 Summary of total water resources and water use in the Barwon basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	154,200	63,200
Groundwater(2)	Not available	Not available
Recycled water	28,960	2,630

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

28.5 Surface water resources

28.5.1 Water balance

A surface water balance for the Barwon basin is shown in Table 28-4. Central Highlands Water operates two major storages within the basin, namely White Swan Reservoir and Gong Gong Reservoir, whilst Barwon Water operates the West Barwon Dam.

Storages began 2005/06 with 54% of the total capacity in storage, however this volume had dropped to 31% by the end of the year. Small catchment dams in the Barwon basin have a capacity that is approximately equivalent to the on-stream storages in the basin.

Central Highlands Water transferred 2,300 ML from the Moorabool basin into the Barwon basin to supply water to Ballarat. Skipton, which forms part of the Ballarat water supply system and is located within the Hopkins basin, received a small proportion of this volume.

Table 28-4 Balance of surface water in the Barwon basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	18,700	15,200
Volume in storage at end of year	8,500	18,700
Change in storage	**-10,200**	**3,500**
Inflows		
Catchment inflow[1]	142,000	189,200
Inflows from the Moorabool River	1,800	21,300
Transfers from Moorabool basin to White Swan Reservoir	2,300	8,800
Return flow from irrigation	0	0
Treated wastewater discharged back to river	8,130	9,130
Sub-total	**154,200**	**228,400**
Usage		
Urban diversions	28,530	40,710
Licensed private diversions from unregulated streams	3,800	3,300
Small catchment dams	30,900	30,900
Sub-total	**63,200**	**74,900**
Losses		
Net evaporation losses from major storages	1,500	400
Evaporation from small catchment dams	12,500	12,400
In-stream infiltration to groundwater, flows to floodplain and evaporation[2]	6,200	11,900
Sub-total	**20,200**	**24,700**
Water passed at outlet of basin		
River outflows to the ocean	81,000	125,300

Notes:

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

(2) Losses estimated using loss functions from the Lower Barwon REALM.

28.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 28-5 below are based on the estimated average annual impact.

Table 28-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	10,400	5,200	Not available
Registered commercial and irrigation	30,600	25,700	Not available
Total	**41,000**	**30,900**	**43,400**

28.5.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements or diversion licences within the basin in 2005/06.

28.5.4 Volume diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 28-6. 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 2005/06.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

The bulk entitlement volumes within the Barwon basin refer to the total volume that can be extracted over any consecutive three-year period. The Yarrowee-White Swan bulk entitlement includes up to 10,500 ML extracted from the Upper West Moorabool system as specified in the Upper West Moorabool bulk entitlement in the Moorabool basin.

Table 28-6 Volume of water diverted under surface water entitlements in the Barwon basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)	Entitlement volume compliance?
Barwon Water					
Upper Barwon system	3	43,467	0	23,588	Yes
Central Highlands Water					
Yarrowee - White Swan system(2)	3	12,267	0	4,946	n/a
Total annual volume of bulk entitlements 2005/06		**55,733**	**0**	**28,534**	
Total annual volume of bulk entitlements 2004/05		**55,733**	**0**	**40,713**	
Licensed diversions from unregulated streams 2005/06		*4,199*		*3,800*	
Licensed diversions from unregulated streams 2004/05		*5,058*		*3,300*	

Notes:

(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2005, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2005/06 period. The actual maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

(2) This bulk entitlement overlaps with Central Highlands Water's Upper West Moorabool system bulk entitlement in the Moorabool basin.

28.6 Groundwater resources

A summary of licensed entitlements and use for groundwater management units 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 and Bungaree WSPA. The volumes described in the tables below are totals for the management areas and include the area that falls outside the Barwon basin. Groundwater allocation and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 28-7 Compliance with licensed groundwater volumes, Barwon basin 2005/06

Water supply protection area/ Groundwater management area[1]	GMA/WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Cardigan GMA (20%)[5]	All depths	3,967	3,759	10	253	263	Not available
Gellibrand GMA (8%)[6]	All depths	0	0	0	0	0	0
Gerangamete GMA (86%)	>60	8,000	8,000	2,000	0	2,000	0
Bungaree WSPA (24%)	All depths	5,401	5,401	2,700	0	2,700	2,610

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) Cardigan GMA was inadvertently omitted from the 2004/05 State Water Report.

(6) The PAV and allocations for the Gellibrand GMA are set at zero because studies indicate that any groundwater extractions will directly impact on streamflow in the Gellibrand River.

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, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Cardigan GMA[3]	481	962
Gellibrand GMA	0	0
Gerangamete GMA	5	10
Bungaree WSPA	252	504

Note:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in the Table 28-7.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

(3) Cardigan GMA was inadvertently omitted from the 2004/05 State Water Report.

Groundwater was used as part of the urban water supply for Geelong in 2005/06. The licensed entitlements and metered use for this supply is provided in Table 28-9.

Table 28-9 Urban groundwater usage

Town supplied	Licensed allocation (ML)	Metered use 2005/06	Metered use 2004/05
Greater Geelong area	20,000	1,998	0

28.7 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions are shown in Table 28-10.

No bans or restrictions were imposed on groundwater use in the Barwon basin during 2005/06.

Table 28-10 Seasonal allocations and restrictions on water use in Barwon basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	Ballarat and surrounds	Stage 2 applied for the entire year
	Ballarat and Geelong	Permanent water savings measures were introduced in February 2006 (Central Highlands Water) and May 2006 (Barwon Water)
Licensed diversions from unregulated streams	Barwon River – Zone A	Irrigation ban from January to April 2006
	Barwon River – Zone B	Stage 2 (25% reduction) from January to April 2006

28.8 Recycled water

Both Barwon Water and Central Highlands Water operate wastewater treatment plants within the Barwon basin (Table 28-11).

In 2005/06, some 9% of wastewater in the Barwon basin was recycled, mostly for agricultural purposes. An upgrade at the Barwon Water treatment plant at Black Rock has been commissioned with a view to providing 13,000 ML per annum of recycled water.

Table 28-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Bannockburn	27	27	100%	0	27	0	0	0	0
Black Rock	20,407	2,212	11%	0	1,418	0	794	0	18,989
Portarlington	322	322	100%	0	322	0	0	0	0
Winchelsea	30	30	100%	0	30	0	0	0	0
Ballarat North	2,044	0	0%	0	0	0	0	2,044	0
Ballarat South	6,127	40	1%	0	0	0	40	6,087	0
Total 2005/06	**28,955**	**2,630**	**9%**	**0**	**1,796**	**0**	**834**	**8,131**	**18,989**
Total 2004/05	**30,887**	**2,204**	**7%**	**0**	**1,253**	**0**	**951**	**9,133**	**19,550**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

28.9 Water for the environment

28.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Barwon basin EWR comprised the following components:

- passing flows released as a condition of consumptive bulk entitlements held by Barwon Water and Central Highlands Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

28.9.2 Compliance with passing flow requirements

Table 28-12 shows the passing flow requirements in the Barwon 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.

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)

	Passing flow rules	• During April to December inclusive:
		  • If storage volume is less than 40,000 ML, then minimum passing flow is 4 ML/day
		  • If storage volume is greater than 40,000 ML, then minimum passing flow is 5 ML/day
		• Storage volumes January 26,100 ML, February 22,900 ML, March 20,900 ML:
		  • If storage volume is less than above monthly volumes, then minimum passing flow is 4 ML/day
		  • If storage volume is greater than above monthly volumes, then minimum passing flow is 4 ML/day

Barwon Water reported that, overall, levels of compliance with minimum passing flow requirements were met with some minor non-compliance experienced infrequently at Pennyroyal Creek and Matthews Creek during 2005/06. Barwon Water reported that installation of additional automatically adjusting weir gates will improve the level of compliance in the future.

Central Highlands Water reported that it met all passing flow requirements under its bulk entitlements at all sites in the Barwon basin.

28.9.3 Streamflow management plans (SFMPs)

Technical studies and administrative processes are underway in preparation for the development of an SFMP for the Barwon River. The proposed area for the SFMP includes the main stem and tributaries of the Barwon River including the Leigh River, but excluding the Moorabool River.

28.9.4 Water leaving the basin

The amount of water flowing from the Barwon basin into Corio Bay and Bass Strait was 81,000 ML in 2005/06. This represents 57% of the total inflows into the basin, compared to 66% in 2004/05. This water comprises consumptive water that was not used under entitlements and the EWR (passing flows and any water above cap).

Important environmental assets depend on water from the EWR in the Barwon basin. The Bellarine Peninsula contains internationally significant wetlands listed under the Ramsar convention and relying on the freshwater inputs from the Barwon basin for their ecological functioning.

28.10 Barwon basin summary

Rainfall in the Barwon basin was substantially below average in 2005/06 and this was reflected in a substantial decline in the streamflows.

Despite the low rainfall and streamflows, Barwon Water was able to maintain supplies to Geelong without restriction in 2005/06 by depleting its reservoirs and drawing on groundwater from its Barwon Downs borefield (for the first time since 2001).

Areas supplied by Ballarat and surrounding towns in the Barwon basin were on Stage 2 restrictions during 2005/06.

The low streamflows resulted in restrictions and bans on diversions from the Barwon River being imposed in January 2006.

29 Corangamite basin

Table 29-1 Key features of the Corangamite basin, 2005/06

- Inflows were 22% of the long term average.
- Outfows to the Corangamite Lakes system fell from 245,300 ML in 2004/05 to 53,300 ML in 2005/06.

29.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall in the Corangamite basin ranged between 80% and 100% of the long term average. However, inflows were 22% of the long term average (316,000 ML) across the basin. Inflows reduced substantially compared with 2004/05, which were 83% of the long term average.

29.2 Responsibilities for management of water resources

Table 29-2 shows the responsibilities of various authorities within the Corangamite basin.

Table 29-2 Responsibilities for water resources management within the Corangamite basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Southern Rural Water		Groundwater and surface water licensed diversions		
Barwon Water			Urban water supply to Colac (supplied from the Otway Coast basin)	
Central Highlands Water			Urban water supply to Linton, Rokewood and Smythesdale (supplied from Ballarat system)	
Wannon Water			Urban water supply to Camperdown, Lismore and Derrinallum (supplied from the Otway Coast basin)	
Corangamite Catchment Management Authority				Waterway management for the whole of the Corangamite basin

29.3 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 29-3.

Transfers from the Otway Coast basin into the Corangamite basin to supply Colac, Camperdown, Lismore and Derrinallum are accounted for within the Otway Coast basin.

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

29.4 Location of water resources

Figure 29-1 Map of the Corangamite basin

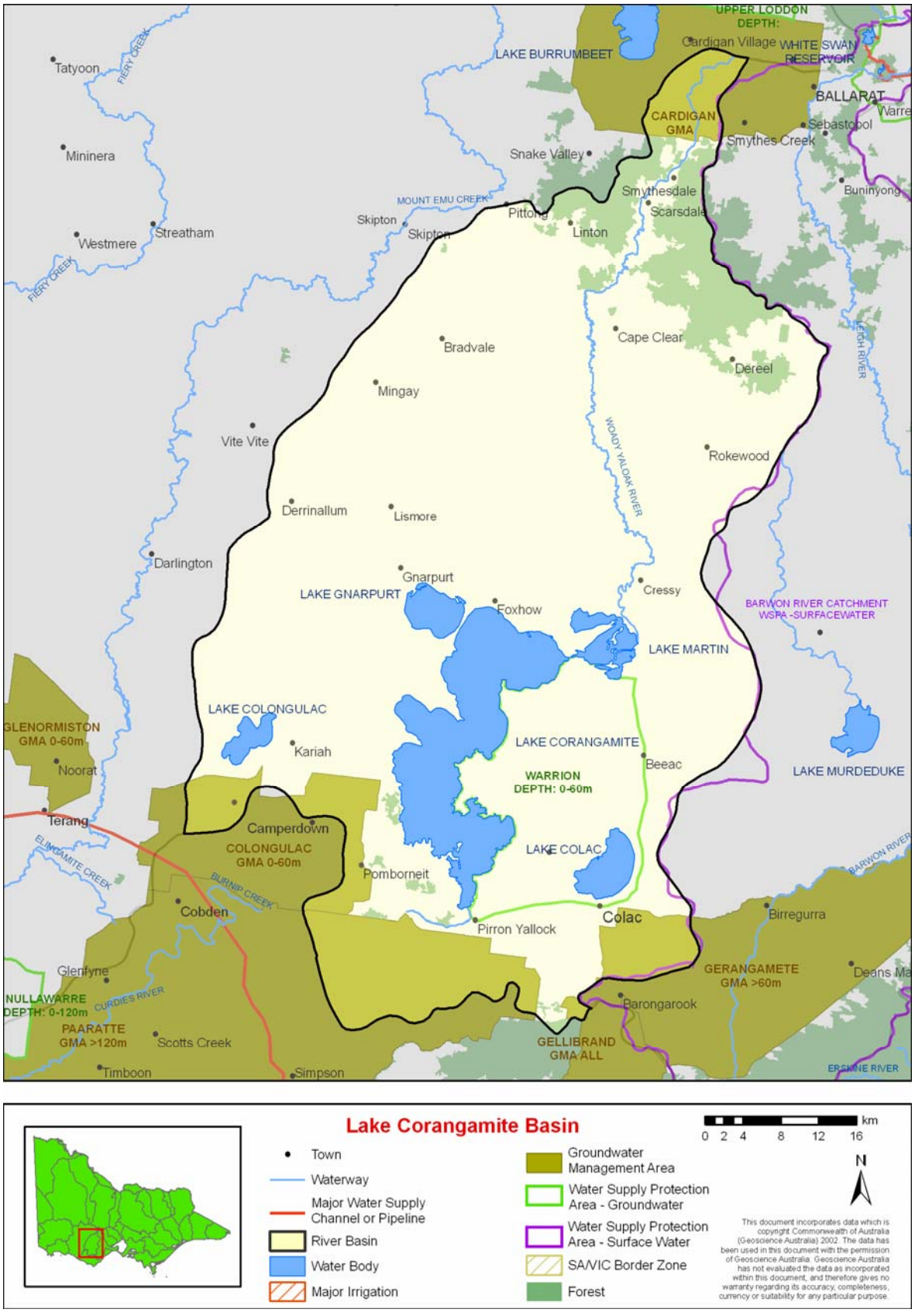


Table 29-3 Summary of total water resources and water use in the Corangamite basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	72,700	12,800
Groundwater(1)	Not available	Not available
Recycled water	2,140	310

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

29.5 Surface water resources

29.5.1 Water balance

A surface water balance for the Corangamite basin is shown in Table 29-4.

Approximately 18% of the basin's total inflows were diverted for consumptive use, the majority being extracted by small catchment dams.

Urban water demands are supplied from sources located outside of the basin due to the better quality of water available in the Otway Coast basin. There are no major water storages (i.e. greater than 1,000 ML in size) for consumptive use located in the Corangamite basin.

Table 29-4 Balance of surface water in the Corangamite basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	0	0
Volume in storage at end of year	0	0
Change in storage	**0**	**0**
Inflows		
Catchment inflow(1)	71,000	263,000
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	1,730	1,880
Sub-total	**72,700**	**264,900**
Usage		
Urban diversions	0	0
Licensed private diversions from unregulated streams	500	700
Small catchment dams	12,300	12,300
Sub-total	**12,800**	**13,000**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams	6,600	6,600
In-stream infiltration to groundwater, flows to floodplain and evaporation(2)	0	0
Sub-total	**6,600**	**6,600**
Water passed at outlet of basin		
River outflows to the Corangamite Lakes	53,300	245,300

Notes:

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

(2) Losses estimated to be zero because data is not readily available.

29.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 29-5 below are based on the estimated average annual impact.

Table 29-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	8,100	4,000	Not available
Registered commercial and irrigation	9,900	8,300	Not available
Total	**18,000**	**12,300**	**18,900**

29.5.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements or diversion licences within the basin in 2005/06.

29.5.4 Volume diverted

The only surface water licences utilised in the Corangamite basin are licences on unregulated streams. In 2005/06, licensed volume totalled 964 ML and use was estimated to be 500 ML.

29.6 Groundwater resources

A summary of the licensed entitlements and use for groundwater management units 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, Gerangamete GMA and Paaratte GMA. The volumes described in the tables below are totals for the management areas and include the area that falls outside the Corangamite basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 29-6 Compliance with licensed groundwater volumes, Corangamite basin 2005/06

Water supply protection area/Groundwater management area[1]	GMA/ WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Colongulac GMA (35%)	≤60	14,271	3,577	0	1,073	1,073	1,260[6]
Cardigan GMA (20%)[7]	All depths	3,967	3,759	10	253	263	n/a
Gerangamete GMA (14%)	>60	0	8,000	2,000	0	2,000	0
Paaratte GMA (14%)	>120	4,606	3,192	0	958	958	1,276
Warrion WSPA (100%)[8]	All depths	14,214	14,214	3,650	0	3,650	4,276

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) In non-metered areas, Southern Rural Water has estimated use at 30% of licencsed entitlement.

(6) Use in the Colongulac GMA was incorrectly reported as 1,440 ML in the 2004/05 State Water Report.

(7) Cardigan GMA was inadvertently omitted from the 2004/05 State Water Report.

(8) Depth limit was incorrectedly stated in 2004/05 State Water Report and has been adjusted.

An estimate of domestic and stock groundwater use is provided in Table 29-7.

Table 29-7 Number of domestic and stock bores and estimated use, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Colongulac GMA	208	416
Cardigan GMA	481	962
Gerangamete GMA	5	10
Paaratte GMA	4	8
Warrion WSPA	461	922

Note:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in the Table 29-6.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

29.7 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions are shown in Table 29-8.

No bans or restrictions were imposed on groundwater use in the Corangamite basin during 2005/06.

Table 29-8 Seasonal allocations and restrictions on water use in Corangamite basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	Linton, Rokewood, Smythesdale	Stage 2 from July 2005 to June 2006 Permanent water savings measures were introduced in March 2006 (Wannon Water) and in May 2006 (Barwon Water)
Licensed diversions from unregulated streams	Lake Tooliorook	Irrigation ban in July 2005, and from January to June 2006

29.8 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 used for agricultural purposes.

Table 29-9 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Colac	1,729	27	2%	0	0	0	27	1,702	0
Camperdown	412	282	68%	0	282	0	0	0	130
Total 2005/06	**2,141**	**310**	**14%**	**0**	**282**	**0**	**27**	**1,702**	**130**
Total 2004/05	**2,446**	**563**	**23%**	**0**	**552**	**0**	**12**	**1,884**	**0**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

29.9 Water for the environment

29.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Corangamite basin EWR comprised the component of water in the basin not allocated for consumptive use, i.e. water above cap.

29.9.2 Compliance with passing flow requirements

There are currently no bulk entitlements in operation in the Corangamite basin.

29.9.3 Water leaving the basin

The amount of water flowing from the Corangamite basin into a series of inland lakes was 53,300 ML in 2005/06. This represents 75% of the total inflows into the basin, compared to 93% in 2004/05. This water comprises consumptive water that was not used under entitlements and the EWR (water above cap).

Important environmental assets are dependent on water from the EWR in the Corangamite basin. The Western District Lakes are internationally significant wetlands listed under the Ramsar convention and relying on the freshwater inputs from the Corangamite basin for their ecological functioning.

As noted above, freshwater flows to these lakes dropped significantly in 2005/06.

29.10 Corangamite basin summary

Inflows in the Corangamite basin fell to 22% of the long term averages in 2005/06. This had minimal impact on consumptive use, as usage is primarily restricted to small catchment dams. However, anecdotal evidence suggests some relatively significant negative environmental impacts becoming apparent in 2005/06 as a lack of freshwater flows reduced lake levels and increased salinity.

30 Otway Coast basin

Table 30-1 Key features of the Otway Coast basin, 2005/06

- Inflows in 2005/06 were 53% of the long term average and roughly half of those estimated in 2004/05 and 2003/04.
- 93% of the total inflows left the basin into Bass Strait.

30.1 Otway Coast basin seasonal overview for 2005/06

The Otway basin is one of the wettest basins in Victoria. Rainfall in the Otway Coast basin in 2005/06 was, however, below average (80-100%). Streamflows in the basin were 53% of the long term average (884,000 ML). Despite rainfall similar to that of the previous two years, 2005/06 inflows were significantly lower than those recorded in 2004/05 and 2003/04 which were of the order of 100-110% of the long term average.

30.2 Responsibilities for management of water resources

Table 30-2 shows the responsibilities of various authorities within the Otway Coast basin.

Table 30-2 Responsibilities for water resources management within the Otway Coast basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Southern Rural Water		Groundwater and surface water licensed diversions		
Wannon Water	Domestic and stock supply to farms to the west across parts of the Otway Coast, Corangamite, Hopkins and Portland Coast basins(1)		Urban water supply to towns in the west of the basin including Cobden, Timboon, Peterborough and Port Campbell(1)	Obligation to meet passing flow requirements
Barwon Water			Urban water supply to the majority of towns in the basin including Torquay, Anglesea, Lorne and Apollo Bay. Also transfers to Colac	West Gellibrand Reservoir Obligation to meet passing flow requirements
Corangamite Catchment Management Authority				Waterway management 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 Location of water resources

Figure 30-1 Map of 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 30-3.

There was a net transfer of water out of the Otway Coast basin. Barwon Water transferred 4,788 ML from the Otway Coast basin into the Corangamite basin to supply Colac and surrounds. Wannon Water transferred 10,342 ML from the Otway Coast basin to supply water to towns and farms in the Corangamite, Hopkins and Portland Coast basins. Barwon Water transferred water from the Barwon basin into the Otway Coast basin to supply 1,949 ML to the towns of Torquay and Anglesea. (This volume is included in the Barwon basin water balance).

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

Table 30-3 Summary of total water resources and water use in the Otway Coast basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	467,300	32,200
Groundwater(1)	Not available	Not available
Recycled water	1,360	360

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary as it is not possible to split groundwater use between the basins.

30.5 Surface water resources

30.5.1 Water balance

A surface water balance for the Otway Coast basin is shown in Table 30-4.

The only major storage in the basin is the West Gellibrand Reservoir which started the year close to full capacity, and finished the year at 54% of capacity.

Table 30-4 Balance of surface water in the Otway Coast basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	1,900	2,000
Volume in storage at end of year	1,000	1,900
Change in storage	**-900**	**-100**
Inflows		
Catchment inflow[1]	467,300	981,420
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	20	80
Sub-total	**467,300**	**981,500**
Usage		
Urban diversions	16,100	15,590
Licensed private diversions from unregulated streams	3,300	3,900
Small catchment dams	12,800	12,800
Sub-total	**32,200**	**32,300**
Losses		
Net evaporation losses from major storages	200	0
Evaporation from small catchment dams	3,400	3,400
In-stream infiltration to groundwater, flows to floodplain and evaporation[2]	0	0
Sub-total	**3,600**	**3,400**
Water passed at outlet of basin		
River outflows to the ocean	432,400	945,900

Notes:

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

(2) Assumed to be zero because data is not readily available.

30.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 30-5 below are based on the estimated average annual impact.

Table 30-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	10,700	5,400	Not available
Registered commercial and irrigation	8,800	7,400	Not available
Total	**19,500**	**12,800**	**16,200**

30.5.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements or diversion licences within the basin in 2005/06.

30.5.4 Volume diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 30-6. 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 2005/06.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 30-6 Volume of water diverted under surface water entitlements in the Otway Coast basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)	Entitlement volume compliance?
Barwon Water					
Aireys Inlet	1	317	0	226	Yes
Apollo Bay and Skenes Creek	1	365	0	313	Yes
Colac	1	5,400	0	4,788	Yes
Gellibrand	1	60	0	24	Yes
Lorne	1	510	0	408	Yes
Wannon Water					
Otway system	1	12,580	0	10,342	Yes
Total annual volume of bulk entitlements 2005/06		**19,232**	**0**	**16,101**	
Total annual volume of bulk entitlements 2004/05		**19,232**	**0**	**15,586**	
Licensed diversions from unregulated streams 2005/06		*6,298*		*3,300*	
Licensed diversions from unregulated streams 2004/05		*5,439*		*3,900*	

30.6 Groundwater resources

A summary of licensed entitlements and use for groundwater management units that overlap the Otway Coast basin, excluding domestic and stock use, is presented in Table 30-7.

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. The volumes described in the tables below are totals for the management areas and include the area that falls outside the Otway Coast basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 30-7 Compliance with licensed groundwater volumes, Otway Coast basin 2005/06

Water supply protection area/ Groundwater management area[1]	GMA/ WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Colongulac GMA (56%)	≤60	14,271	3,577	0	1,073	1,073	1,260
Gellibrand GMA (92%)[6]	All depths	0	0	0	0	0	0
Jan Juc GMA (100%)	All depths	6,804	4,000	0	1,200	1,200	1,400
Newlingrook GMA (100%)	All depths	74,970	1,968	0	590	590	689
Paaratte GMA (84%)	>120	4,606	3,192	0	958	958	1,117
Nullawarre WSPA (11%)[7]	≤250	22,238	22,238	10,500	0	10,500	9,490

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed allocations for WSPAs and the permissible consumptive volume for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) In non-metered areas, Southern Rural Water has estimated use at 30% of licensed entitlement.

(6) The permissible annual volume and allocations for the Gellibrand GMA are set at zero because studies indicate that any groundwater extractions will directly impact on streamflow in the Gellibrand River.

(7) Depth limit was incorrectedly stated in 2004/05 State Water Report and has been adjusted.

An estimate of domestic and stock groundwater use is provided in Table 30-8.

Table 30-8 Number of domestic and stock bores and estimated use, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Colongulac GMA	208	416
Gellibrand GMA	0	0
Jan Juc GMA	0	0
Newlingrook GMA	0	0
Paaratte GMA	4	8
Nullawarre WSPA	1,197	2,394

Notes:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in Table 30-7.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

In the Otway Coast basin, groundwater is used for urban water supply in the townships of Port Campbell, Timboon, Peterborough and Koroit as well as the areas around Carlisle and Curdie Vale. The licensed entitlements and metered use for these groundwater supplies is provided in Table 30-9.

Table 30-9 Urban groundwater usage

Town supplied	Licensed allocation (ML)	Metered use 2005/06	Metered use 2004/05
Otway system (Carlisle)	1,800	109	115
Otway system (Curdie Vale)	2,150	0	0
Port Campbell, Timboon and Peterborough	1,009	387	352

30.7 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions are shown in Table 30-10.

No bans or restrictions were imposed on groundwater use in the Otway Coast basin during 2005/06.

Table 30-10 Seasonal allocations and restrictions on water use in Otway Coast basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	Apollo Bay, Marengo, Skenes Creek	Stage 1 from November to December 2005, increasing to Stage 2 from January to June 2006 Permanent water savings measures applied from March 2006 (Wannon Water) and May 2006 (Barwon Water)
Licensed diversions from unregulated streams	Curdies River	Stage 3 (50% reduction) July 2005, and from January to April 2006
	Gellibrand River	Stage 1 (roster) in July 2005, Stage 3 from January to April 2006, back to Stage 2 (25% reduction) from May to June 2006
	Lake Purrumbete	Irrigation Ban January 2006 to May 2006

30.8 Recycled water

Wastewater treatment plants within the Otway Coast basin are operated by Barwon Water and Wannon Water. In 2005/06, 27% of the volume of treated wastewater was used within the Otway Coast basin (Table 30-11). This was a reduction from 33% in 2004/05 primarily due to the Timboon treatment plant which recycled a greater amount in 2004/05 because of a carryover from 2003/04.

Table 30-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Aireys Inlet	101	101	100%	0	101	0	0	0	0
Anglesea	259	96	37%	0	73	0	24	0	187
Apollo Bay	366	15	4%	0	0	0	15	0	367
Lorne	300	15	5%	0	0	0	15	0	300
Cobden	189	103	54%	0	103	0	0	0	87
Port Campbell	65	20	30%	0	20	0	0	0	45
Simpson	20	3	12%	0	3	0	0	18	0
Timboon	59	10	18%	0	10	0	0	0	48
Total 2005/06	**1,360**	**363**	**27%**	**0**	**309**	**0**	**54**	**18**	**1,033**
Total 2004/05	**1,447**	**472**	**33%**	**0**	**415**	**0**	**58**	**81**	**894**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

30.9 Water for the environment

30.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Otway Coast basin EWR comprised the following components:

- passing flows released as a condition of consumptive bulk entitlements held by Barwon Water and Wannon Water
- all other water in the basin not allocated for consumptive use.

30.9.2 Compliance with passing flow requirements

Table 30-12 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 30-12 Selected passing flow requirements 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
	Passing flow rules	• From December to February inclusive: natural flow • From March to November inclusive: the lesser of 0.5 ML/day or natural flow
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	Barham River diversion weir
	Passing flow rules	• The authority is not obliged to provide minimum passing flows
	Compliance point	Skenes Creek diversion weir
	Passing flow rules	• The lesser of 1.5 ML/day or natural flow • When flow is between 1.5 and 1.93 ML/day, the authority must pass 1.5 ML/day • When flow is greater than 1.93 ML/day, the authority must pass the entire flow, less 0.43 ML/day • Minimum passing flow is 1.5 ML/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
	Passing flow rules	• When flow is equal to or less than 12 ML/day, no passing flow is specified • When flow is between 12 and 22.5 ML/day, the authority must pass 12 ML/day • When flow is between 22.5 and 44.9 ML/day, the authority must pass 17.5 ML/day • When flow is between 44.9 and 54.9 ML/day, the authority must pass 20 ML/day • When flow is 54.9 ML/day or greater, the authority must pass 22.5 ML/day
	Compliance point	Gellibrand River - South Otway pump station
	Passing flow rules	• When flow is equal to or less than 12 ML/day, no passing flow is specified • When flow is between 12 and 22 ML/day, the authority must pass 12 ML/day • When flow is between 22 and 32.7 ML/day, the authority must pass 17 ML/day • When flow is between 32.7 and 41.2 ML/day, the authority must pass 19 ML/day • When flow is 41.2 ML/day or greater, the authority must pass 21.5 ML/day

Barwon Water and Wannon Water reported that all passing flow requirements under their bulk entitlements in the Otway Coast basin were met in 2005/06.

30.9.3 Streamflow management plans (SFMPs)

Technical studies and administrative processes are underway in preparation for the development of an SFMP for the Gellibrand River.

30.9.4 Water leaving the basin

The amount of water flowing from the Otway basin into Bass Strait was 432,400 ML in 2005/06. This represents 93% of the total inflows into the basin, compared to 96% in 2004/05. This water comprises consumptive water that was not used under entitlements and the EWR (passing flows and any water above cap).

30.10 Otway Coast basin summary

Otway Coast basin experienced some of the highest rainfall in the state during 2005/06, with between 600mm and 1,200mm of rain falling throughout the region. However, in 2005/06 rainfall was still less than average, continuing the trend witnessed in recent years.

Inflow to the basin was substantially higher than diversions, with only 7% of the 550,000 ML of inflows of diverted for consumptive use.

Water supplies in the basin experienced restrictions and falling storages despite the apparent abundance of water. This has occurred because the water supply systems have small offstream storages as they rely on good summer base flows in the rivers. They are therefore susceptible to water shortages in years of low summer river flows such as 2005/06.

Stage 1 restrictions prevailed for some of Barwon Water's coastal town customers during early summer as the population in the region increased during the holiday season. Restrictions increased to Stage 2 in January 2006 and remained at that level for the rest of 2005/06.

31 Hopkins basin

Table 31-1 Key features of the Hopkins basin, 2005/06

- Rainfall was 60-100% of long term average, with inflows 24% of long term average.
- Outflows to the ocean fell from 295,100 ML to 56,200 ML over the year.

31.1 Hopkins basin seasonal overview for 2005/06

In 2005/06, rainfall in the Hopkins basin ranged between 60% and 100% of the long term average. This was a decline from both 2004/05 (average rainfall) and 2003/04 (100-125% of average). Inflows reflected the low rainfall, with 2005/06 flows 24% of the long term average (635,000 ML) compared with 62% in 2004/05 and around 40% in 2003/04.

31.2 Responsibilities for management of water resources

Table 31-2 shows the responsibilities of various authorities within the Hopkins basin.

Table 31-2 Responsibilities for water resources management within the Hopkins basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Southern Rural Water		Groundwater and surface water licensed diversions		
Wannon Water			Urban water supply to towns in the south of the basin including Warrnambool	
GWMWater			Urban water supply to towns in the north of the basin including Ararat	
Central Highlands Water			Urban water supply to towns in the north east of the basin including Beaufort and Skipton	Obligation to meet passing flow requirements
Glenelg Hopkins Catchment Management Authority				Waterway management in the whole of the Hopkins basin

31.3 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 31-3. Wannon Water transferred water from the Otway Coast basin into the Hopkins basin to supply urban demands, Central Highlands Water transferred water from the Barwon basin into the Hopkins basin to supply Skipton, and Grampians Wimmera Mallee Water transferred water from the Wimmera basin to supply the towns of Ararat, Moyston, Willaura, Lake Bolac and Wickliffe. An overview of the methodology used to derive the information presented in this chapter is set out in Chapter 5.

31.4 Location of water resources

Figure 31-1 Map of the Hopkins basin

Table 31-3 Summary of total water resources and water use in the Hopkins basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	154,900	68,600
Groundwater(1)	Not available	Not available
Recycled water	5,760	1,040

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

31.5 Surface water resources

31.5.1 Water balance

A water balance for the Hopkins basin is shown in Table 31-4. As indicated by the water balance, there are no major water storages (greater than 1,000 ML in size) for consumptive use in the basin.

Inflows to the Hopkins basin are estimated to be 154,600 ML in 2005/06. Approximately 44% of the 2005/06 total inflows were diverted for consumptive use, the majority of which comprised extractions from small catchment dams.

Although transfers occurred into the basin for the purposes of urban water supply, these did not affect streamflows and so are not accounted for in the water balance for the Hopkins basin.

Table 31-4 Balance of surface water in the Hopkins basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	0	0
Volume in storage at end of year	0	0
Change in storage	**0**	**0**
Inflows		
Catchment inflow(1)	154,900	395,100
Transfers from other basins(3)	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	30	210
Sub-total	**154,900**	**395,300**
Usage		
Urban diversions	470	340
Licensed private diversions from unregulated streams	3,500	5,400
Small catchment dams	64,600	64,600
Sub-total	**68,600**	**70,300**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams	30,100	29,900
In-stream infiltration to groundwater, flows to floodplain and evaporation(2)	0	0
Sub-total	**30,100**	**29,900**
Water passed at outlet of basin		
River outflows to the ocean	56,200	295,100

Notes:

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

(2) Assumed to be zero because data is not readily available.

(3) 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

31.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 31-5 below are based on the estimated average annual impact.

Table 31-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	30,900	15,500	Not available
Registered commercial and irrigation	58,400	49,100	Not available
Total	**89,300**	**64,600**	**94,700**

31.5.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements ordiversion licences within the basin in 2005/06.

31.5.4 Volume diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 31-6. 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 2005/06. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information. No water was extracted under the Skipton bulk entitlement as the demand was supplied from the Ballarat system.

Table 31-6 Volume of water diverted under surface water entitlements in the Hopkins basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)	Entitlement volume compliance?
Central Highlands Water					
Beaufort	1	419	0	232	Yes
Skipton	1	210	0	0	Yes
GWMWater					
Willaura, Moyston, Lake Bolac and Wickliffe[1]	n/a	n/a	n/a	235	n/a
Total annual volume of bulk entitlements 2005/06		**629**	**0**	**467**	
Total annual volume of bulk entitlements 2004/05		**n/a**	**0**	**342**	
Licensed diversions from unregulated streams 2005/06		*9,928*		*3,500*	
Licensed diversions from unregulated streams 2004/05		*9,956*		*5,400*	

Note:

(1) Bulk entitlements were not finalised at the end of reporting period.

31.6 Groundwater resources

A summary of the licensed entitlements and use for groundwater management units that overlap 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, Upper Loddon WSPA, Yangery WSPA, Cardigan GMA and Colongulac GMA. The volumes

described in tables below are totals for the management areas and include the area that falls outside the Hopkins basin.

Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Good quality groundwater of reasonable yields is found in the unincorporated areas around the Nullawarre and Yangery WSPAs, and use from these unincorporated areas may increase in the future.

Table 31-7 Compliance with licensed groundwater volumes, Hopkins basin 2005/06

Water supply protection area/ Groundwater management area[1]	GMA/ WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Cardigan GMA (60%)[6]	All depths	3,967	3,759	10	253	263	n/a
Colongulac GMA (9%)	≤60	14,271	3,577	0	1,073	1,073	1,260
Glenormiston GMA (100%)	≤60	5,042	2,512	0	753	753	879
Nullawarre WSPA (89%)[7]	≤250	22,238	22,238	10,500	0	10,500	9,490
Upper Loddon WSPA (25%)	All depths	12,991	12,991	2,380	0	2,380	6,210
Yangery WSPA (60%)	≤100	14,488	14,488	3,270	0	3,270	4,520

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) In non-metered areas, Southern Rural Water has estimated use at 30% of licensed entilement.

(6) Cardigan GMA was inadvertently omitted from the 2004/05 State Water Report.

(7) Depth limit was incorrectedly stated in 2004/05 State Water Report and has been adjusted.

n/a: Information not available.

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, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Cardigan GMA	481	962
Colongulac GMA	208	416
Glenormistom GMA	125	250
Nullawarre WSPA	1,197	2,394
Upper Loddon WSPA	198	396
Yangery WSPA	1,432	2,864

Notes:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in the Table 31-7.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

In the Hopkins basin groundwater is provided to the townships of Mortlake, Warrnambool, Koroit, Allansford, Caramut, Darlington and Glenthompson. The licensed entitlements and metered use for these groundwater supplies is provided in Table 31-9.

Table 31-9 Urban groundwater usage

Town supplied	Licensed allocation (ML)	Metered use 2005/06	Metered use 2004/05
Caramut	50	47	39
Darlington	10	2	2
Glenthompson/Nekeeya	140	63	0
Koroit	524	0	0
Mortlake	295	39	43
Warrnambool, Allansford and Koroit	750	397	341

31.7 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions are shown in Table 31-10. Stage 3 restrictions (of a five stage policy) continued in Ararat for the entire 2005/06 year after first being imposed in February 2003.

No bans or restrictions were imposed on groundwater use in the Hopkins basin during 2005/06.

Table 31-10 Seasonal allocations and restrictions on water use in Hopkins basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	Beaufort	Voluntary restrictions applied from July to December 2005
	Ararat	Stage 3 from July 2005 to June 2006
	Skipton	Stage 2 from July 2005 to June 2006
		Permanent water savings measures were applied from February 2006 (Central Highlands Water) and March 2006 (Wannon Water)
Licensed diversions from unregulated streams	Merri River (downstream of Wordford)	Stage 8 (domestic and stock) from January to April 2006, falling to Stage 1 (roster) in May 2006
	Merri River (upstream of Wordford)	Stage 1 in June 2006
	Mt Emu Creek	Stage 3 (50% reduction) from January to April 2006, falling to Stage 1 (roster) in May 2006
	Hopkins River	Stage 1 in May 2006
	Lake Cartcarrong	Irrigation ban from January to June 2006

31.8 Recycled water

Three separate water authorities operate wastewater treatment plants within the Hopkins basin. Wastewater from the largest treatment plant in the basin at Warrnambool is discharged to the ocean. Overall, the percent recycled remained at 2004/05 levels, with 18% of the total wastewater volume reused (Table 31-11).

Table 31-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Ararat	745	745	100%	62	671	0	11	0	0
Beaufort	100	0	0%	0	0	0	0	0	100
Cardigan Village[4]	21	0	0%	0	0	0	0	21	0
Mortlake	105	24	23%	0	24	0	0	0	80
Terang[5]	253	258	102%	0	258	0	0	0	-5
Warrnambool	4,516	0	0%	0	0	0	0	0	4,516
Willaura	24	16	67%	0	0	0	16	8	0
Total 2005/06	**5,763**	**1,043**	**18%**	**62**	**954**	**0**	**27**	**29**	**4,691**
Total 2004/05	**6,083**	**1,094**	**18%**	**101**	**993**	**0**	**0**	**213**	**4,755**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

(4) Cardigan Village treatment plant was inadvertently omitted from the 2004/05 State Water Report.

(5) Some water was carried over in storage from the previous year, resulting in a negative value in the Other column

31.9 Water for the environment

31.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Hopkins basin EWR comprised the following components:

- passing flows released as a condition of consumptive bulk entitlements held by Central Highlands Water and Goulburn Murray Water
- all other water in the basin not allocated for consumptive use.

31.9.2 Compliance with passing flow requirements

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 as it was judged to be of community interest.

Table 31-12 Selected passing flow requirements in the Hopkins basin

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
	Passing flow rules	• The lesser of 0.2 ML/day or natural inflow, except when there is insufficient supply to meet demand at Raglan

Central Highlands Water reported that it met all passing flow requirements under its bulk entitlements at all sites in the Hopkins basin.

31.9.3 Streamflow management plans (SFMPs)

Technical studies and administrative processes are underway in preparation for the development of an SFMP for the Merri River.

31.9.4 Water leaving the basin

The amount of water flowing from the Hopkins basin into Bass Strait was 56,200 ML in 2005/06. This represents 36% of the total inflows into the basin, compared to 75% in 2004/05. This water comprises consumptive water that was not used under entitlements and the EWR (passing flows and any water above cap).

31.10 Hopkins basin summary

Conditions in the Hopkins basin were significantly drier than the long term average. Rainfall was between 60% and 100% of average and has declined over the past two years.

The low rainfall contributed to a signficant fall in inflows compared with 2004/05, and 2005/06 inflows were 24% of the long term average. Lower inflows resulted in far less water flowing into the ocean with 56,200 ML leaving the basin (36% of inflows) compared with 295,100 ML in 2004/05 (75% of inflows).

Diversions remained similar to previous years, with small catchment dams by far the main source of diversions in the basin. Urban diversions accounted for less than 1% of the total water resource available as most urban supplies came from outside the basin.

32 Portland Coast basin

Table 32-1 Key features of the Portland Coast basin, 2005/06

- Inflows were 19% of the long term average.
- Outflows were 48,600 ML, down from 585,700 ML in 2004/05.

32.1 Portland Coast basin seasonal overview for 2005/06

In 2005/06, rainfall in the Portland Coast basin ranged between 80% and 100% of the long term average, broadly in line with 2004/05, but less than 2003/04 (100-125%). Despite this, inflows in the catchment were significantly less than the two previous years, especially 2004/05. Overall, inflows were 19% of the long term average (361,000 ML) in 2005/06, down from 168% in 2004/05 and 58% in 2003/04.

32.2 Responsibilities for management of water resources

Table 32-2 shows the responsibilities of various authorities within the Portland Coast basin.

Table 32-2 Responsibilities for water resources management within the Portland Coast basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Southern Rural Water		Groundwater and surface water licensed diversion		
Wannon Water			Water supply to Koroit(1), Port Fairy(2), Heywood(2) and Portland(2)	
Glenelg Hopkins Catchment Management Authority				Waterway management

Note:

(1) Supplied from the Otway Coast basin.

(2) Suppied from groundwater.

32.3 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 32-3.

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

32.4 Location of water resources

Figure 32-1 Map of the Portland Coast basin

Table 32-3 Summary of total water resources and water use in the Portland Coast basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	69,600	16,600
Groundwater[1]	Not available	Not available
Recycled water	2,130	260

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

32.5 Surface water resources

32.5.1 Water balance

A water balance for the Portland Coast basin is shown in Table 32-4. There are no major storages (greater than 1,000 ML in size) in the basin.

Approximately 24% of the total inflows were diverted for consumptive use, with the largest diversions estimated to be due to consumption and losses from small catchment dams. All towns serviced by Wannon Water in this basin are supplied by groundwater or from other river basins and hence urban surface water diversions are zero.

Table 32-4 Balance of surface water in the Portland Coast basin

Water account component	2005/06 (ML)	2004/05 (ML)
Major on-stream storage		
Volume in storage at start of year	0	0
Volume in storage at end of year	0	0
Change in storage	**0**	**0**
Inflows		
Catchment inflow[1]	69,600	607,200
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	40
Sub-total	**69,600**	**607,200**
Usage		
Urban diversions	0	0
Licensed private diversions from unregulated streams	400	800
Small catchment dams	16,200	16,200
Sub-total	**16,600**	**17,000**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams	4,400	4,500
In-stream infiltration to groundwater, flows to floodplain and evaporation[2]	0	0
Sub-total	**4,400**	**4,500**
Water passed at outlet of basin		
River outflows to the ocean	48,600	585,700

Notes:

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

(2) Assumed to be zero because data is not readily available.

32.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 32-5 below are based on the estimated average annual impact. Small catchment dams represent an estimated 98% of surface water usage in the basin.

Table 32-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	4,500	2,300	Not available
Registered commercial and irrigation	16,500	13,900	Not available
Total	**21,000**	**16,200**	**20,600**

32.5.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements, diversion licences or sales water within the basin in 2005/06.

32.5.4 Volume diverted

The only licences utilised in the Portland Coast basin are licences on unregulated streams. In 2005/06, licensed volume totalled 1,224 ML and use was estimated to be 400 ML.

32.6 Groundwater resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Portland Coast basin, excluding domestic and stock use, is presented in Table 32-6.

The Portland Coast basin contains all of the Heywood GMA as well as part of the Condah WSPA, Yangery WSPA and Portland GMA. The volumes described in tables below and are totals for the management areas and include the area that falls outside the Portland Coast basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

The Portland GMA comprises the deep, geothermal waters of the Dilwyn Formation aquifer. This aquifer is recharged in its northern parts where it is closer to the ground surface. The increasing area of plantation forests in the recharge zones of the Dilwyn aquifer of the Portland GMA has the potential to deplete recharge to the aquifer. The impact of these plantations is being considered in the management of the groundwater resource.

Table 32-6 Compliance with licensed groundwater volumes, Portland Coast basin 2005/06

Water supply protection area/ Groundwater management area[1]	GMA/ WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Heywood GMA (100%)	≤70	21,763	6,474	0	1,942	1,942	2,255
Portland GMA (72%)	>200	20,683	2,340	0	702	702	576
Condah WSPA (53%)	70-200	7,568	7,568	2,710	0	2,710	3,270
Yangery WSPA (40%)	≤100	14,488	14,488	3,270	0	3,270	4,520

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) In non-metered areas, Southern Rural Water has estimated use at 30% of licensed entitlement.

An estimate of domestic and stock groundwater use is provided in Table 32-7.

Table 32-7 Number of domestic and stock bores and estimated use, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Heywood GMA	1,735	3,470
Portland GMA	63	126
Condah WSPA	58	116
Yangery WSPA	1,432	2,864

Note:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in the Table 32-6.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

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 is provided in Table 32-8.

Table 32-8 Urban groundwater usage

Town supplied	Licensed allocation (ML)	Metered use 2005/06	Metered use 2004/05
Heywood	333	247	212
Port Fairy	1,026	727	790
Portland	6,222	2,258	1,989

32.7 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions are shown in Table 32-9.

No bans or restrictions were imposed on groundwater use in the Portland Coast basin during 2005/06.

Table 32-9 Seasonal allocations and restrictions on water use in Portland Coast basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	No restrictions	No restrictions Permanent water savings measures introduced March 2006
Licensed diversions from unregulated streams	Darlots Creek	Stage 2 (25% reduction) in July 2005, from May to June 2006
	Condah Drain	Stage 2 in July 2005, from January to June 2006
	Eumarella River	Stage 1 (roster) July 2005, irrigation ban from January to April 2006
	Surry River	Irrigation ban in July 2005, from January to April 2006
	Moyne River	Irrigation ban in July 2005, from January to June 2006
	Fitzroy River	Irrigation ban January to June 2006

32.8 Recycled water

Within the Portland Coast basin the wastewater treatment systems are operated by Wannon Water. In 2005/06, 12% of the total wastewater produced in the basin was reused, including 100% from the Heywood treatment plant for wood lot irrigation. All wastewater from the Portland and Port Fairy treatment plants is discharged to the ocean (Table 32-10).

Table 32-10 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Heywood	256	256	100%	0	256	0	0	0	0
Port Fairy[4]	822	0	0%	0	0	0	0	0	822
Portland[4]	1,054	0	0%	0	0	0	0	0	1,054
Total 2005/06	**2,132**	**256**	**12%**	**0**	**256**	**0**	**0**	**0**	**1,876**
Total 2004/05	**2,364**	**257**	**11%**	**0**	**257**	**0**	**0**	**42**	**2,065**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

(4) In the State Water Report 2004/05, volumes of wastewater for Port Fairy and Portland were inadvertently transposed. Portland treatment plant should have been 1,258 ML and Port Fairy 807 ML.

32.9 Water for the environment

32.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Portland Coast basin EWR comprised of water in the basin not otherwise allocated for consumptive use i.e water above cap.

32.9.2 Compliance with passing flow requirements

There are currently no bulk entitlements in operation in the Portland Coast basin.

32.9.3 Water leaving the basin

The amount of water flowing from the Portland Coast basin into Bass Strait was 48,600 ML in 2005/06. This represents 70% of the total inflows into the basin, compared to 96% in 2004/05. This water comprises consumptive water that was not used under entitlements and the EWR (water above cap).

32.10 Portland Coast basin

The Portland Coast basin experienced the largest decline in streamflow of any Victorian basin in 2005/06 compared with 2004/05. The basin's 2005/06 streamflows were 19% of the long term average, compared with 168% of the long term average recorded in 2004/05.

The low streamflows led to irrigation bans on a number of unregulated streams for most of the second half of the year. Urban customers, who receive most of their water from groundwater, did not experience any restrictions on use until permanent water savings measures were announced in March 2006.

33 Glenelg basin

Table 33-1 Key features of the Glenelg basin, 2005/06

- Rainfall was 60-100% of long term average, with inflows falling to 15% of long term average.
- Storages began the year at 7% of capacity and ended the year at 3% of capacity.

33.1 Glenelg basin seasonal overview for 2005/06

During 2004/05, rainfall in the Glenelg basin was 60-100% of the long term average. Streamflows across the basin were again much lower than average with the recorded runoff being 15% of the long term average (964,000 ML) compared to 18% of the long term average in 2004/05.

33.2 Responsibilities for management of water resources

Table 33-2 shows the responsibilities of various authorities within the Glenelg basin.

Table 33-2 Responsibilities for water resources management within the Glenelg basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
Southern Rural Water		Groundwater and surface water licensed diversions for the entire basin except the Glenelg River above the bridge on Casterton-Harrow Road		
GWMWater		Groundwater and surface water licensed diversions for the Glenelg River above the bridge on Casterton-Harrow Road	Urban water supply to Harrow	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			Urban water supply to towns in the basin with the exception of Harrow	Reservoirs in the Hamilton supply systems Obligation to meet passing flow requirements
Minister for the Environment				Obligation to meet passing flow requirements
Glenelg-Hopkins Catchment Management Authority				Waterway management in the whole of the Glenelg basin

33.3 Location of water resources

Figure 33-1 Map of 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 33-3.

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

Table 33-3 Summary of total water resources and water use in the Glenelg basin, 2005/06

Water source	Total water resource (ML)	Total use (ML)
Surface water	140,700	64,000
Groundwater(1)	Not available	Not available
Recycled water	1,280	1,270

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

33.5 Surface water resources

33.5.1 Water balance

A water balance for the Glenelg basin is shown in Table 33-4. The largest use of water in 2005/06 was for small catchment dams. Approximately 72% of the basin inflows were diverted or lost during the year.

There are four major storages within the basin, dominated by the Rocklands Reservoir, which accounts for 97% of the total capacity of Glenelg basin storages. During 2005/06 the volume of water held within Rocklands Reservoir decreased from 5% of capacity at the start of the year to 2% at the end of the year.

Table 33-4 Balance of surface water in the Glenelg basin

Water account component	2005/06 (ML)	2004/05 [1] (ML)
Major on-stream storage		
Volume in storage at start of year [1]	23,900	53,400
Volume in storage at end of year	11,300	23,300
Change in storage	**-12,600**	**-30,100**
Inflows		
Catchment inflow [2]	140,700	177,200
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	10	0
Sub-total	**140,700**	**177,200**
Usage		
Urban diversions	1,490	1,990
Diversions to the Wimmera Mallee Water System	5,800	32,500
Licensed private diversions from unregulated streams	1,200	800
Small catchment dams	55,500	55,500
Sub-total	**64,000**	**90,800**
Losses		
Net evaporation losses from major storages	9,200	13,000
Evaporation from small catchment dams	24,600	24,600
In-stream infiltration to groundwater, flows to floodplain and evaporation [3]	4,100	9,500
Sub-total	**37,900**	**47,100**
Water passed at outlet of basin		
River outflows to the ocean	51,400	69,400

Notes:

(1) For the Glenelg basin in 2004/05, the reporting year for storage volumes is from 1 November 2004 to 31 October 2005. As a result, the volume in storage at the start of the 2005/06 year is as at 31 October 2005. Reporting arrangements for 2005/06 were brought in line with other basins and the volume in storage at the end of the 2005/06 year is as at 30 June 2006.

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

(3) Estimated from loss functions in the Glenelg River REALM model.

33.5.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available, and the values provided in Table 33-5 below are based on the estimated average annual impact.

Table 33-5 Small catchment dam information, 2005/06

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)	27,100	13,600	Not available
Registered commercial and irrigation	49,900	41,900	Not available
Total	**77,000**	**55,500**	**80,100**

33.5.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements, diversion licences or sales water within the basin in 2005/06.

33.5.4 Volume diverted

The volume of water diverted under each water authority's bulk 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 2005/06.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Although no water was diverted under the Glenthompson bulk entitlement due to lack of runoff, Wannon Water purchased 63 ML from GWMWater's Willaura groundwater supply to service Glenthompson. The amount diverted for the Coleraine bulk entitlement is not directly measured and was estimated based on the volume of water supplied to the towns.

Diversions under GWMWater's Wimmera and Glenelg River entitlement totalled 57,326 ML in 2005/06. Glenelg River diversions under the Minister for Environment's Wimmera and Glenelg Rivers entitlement totalled 4,291 ML

Table 33-6 Volume of water diverted under surface water entitlements in the Glenelg basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML) (1)	Entitlement volume compliance?
Wannon Water					
Coleraine, Casterton, Sandford	1	855	0	152	Yes
Dunkeld	1	170	0	0	Yes
Glenthompson	1	94	0	0	Yes
Hamilton	1	3,435	0	1,253	Yes
Wimmera and Glenelg Rivers	1	465	0	87	Yes
GWMWater					
Wimmera and Glenelg Rivers - Wimmera Mallee Water	5	149,211	0	57,326	Yes
Minister for the Environment					
Wimmera and Glenelg Rivers(2)	5	40,563	0	4,291	Yes
Total annual volume of bulk entitlements 2005/06		**194,793**	**0**	**63,109**	
Total annual volume of bulk entitlements 2004/05		**197,307**	**0**	**76,822**	
Licensed diversions from unregulated streams 2005/06		*1,222*		*900*	
Licensed diversions from unregulated streams 2004/05		*1,166*		*800*	

Notes:

(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2005, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2005/06 period. The actual maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

(2) The bulk entitlement held by the Minister for the Environment is reported under both the Glenelg and Wimmera basins, with the volume released for each system shown separately. The 4,291 ML in Table 33-6 was released prior to the Minister postponing further environmental flows in August 2006.

33.6 Groundwater resources

A summary of the licensed entitlements and use for groundwater management units 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. The volumes described in tables below are totals for the management areas and include the area that falls outside the Glenelg basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 33-7 Compliance with licensed groundwater volumes, Glenelg basin 2005/06

Water supply protection area/ Groundwater management area[1]	GMA/ WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Portland GMA (27%)	>200	20,683	2,340	0	702	702	576
Condah WSPA (47%)	70-200	7,568	7,568	2,710	0	2,710	3,270
Glenelg WSPA (66%)	All depths	32,777	32,777	7,570	0	7,570	19,950

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) In non-metered areas, Southern Rural Water has estimated use at 30% of licensed entitlement.

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, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Portland GMA	63	126
Condah WSPA	58	116
Glenelg WSPA	Not available	Not available

Note:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in the Table 33-7.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

Groundwater is used as an urban water supply for the townships of Penshurst, Macarthur, Merino, Casterton and Dartmoor. The licensed entitlements and metered use for these groundwater supplies is provided in Table 33-9.

Table 33-9 Urban groundwater usage

Town supplied	Licensed allocation (ML)	Metered use 2005/06	Metered use 2004/05
Casterton	1,000	371	403
Dartmoor	170	16	19
Harrow(1)	29	45	54
Macarthur	80	28	11
Merino	100	0	51
Penshurst	250	141	148
Hamilton (emergency bores)	120	136	0

Note:

(1) Harrow was reported in the Millicent Coast basin in 2004/05.

33.7 Seasonal allocations and restrictions on water use, diversions and extractions

Restrictions applying to urban customers and licensed diversions are shown in Table 33-10.

No bans or restrictions were imposed on groundwater use in the Glenelg basin during 2005/06.

Table 33-10 Seasonal allocations and restrictions on water use in Glenelg basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	Harrow	Stage 2 from July 2005 to June 2006
	Balmoral	Stage 1 in July 2005, increasing to Stage 2 from April 2006 to June 2006
	Cavendish, Dunkeld, Hamilton, Tarrington	Stage 1 in January 2006, increasing to Stage 2 from April to June 2006
	Glenthompson	Stage 1 in November 2005, increasing to Stage 2 from April to June 2006
Licensed diversions from unregulated streams	Glenelg River, Grange Burn Creek	Irrigation ban July in 2005, and from January to April 2006
	Wannon River	Irrigation ban in July 2005
	Crawford River	Irrigation ban from January to April 2006

33.8 Recycled water

Wannon Water operates four wastewater treatment plants in the Glenelg basin. Almost all wastewater is recycled, mainly for irrigation purposes.

Table 33-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Casterton	194	193	100%	0	193	0	0	0	1
Coleraine	73	72	99%	0	72	0	0	0	1
Dunkeld	43	43	100%	0	43	0	0	0	0
Hamilton	973	966	99%	0	927	39	0	6	1
Total 2005/06	**1,282**	**1,274**	**99%**	**0**	**1,235**	**39**	**0**	**6**	**2**
Total 2004/05	**1,230**	**1,230**	**100%**	**0**	**1,230**	**0**	**0**	**0**	**0**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

33.9 Water for the environment

33.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Glenelg basin EWR comprised the following components:

- the Wimmera and Glenelg Rivers – Flora and Fauna entitlement
- passing flows released as a condition of consumptive bulk entitlements held by Wannon Water, Goulburn Murray Water
- all other water in the basin not allocated for consumptive use.

33.9.2 Entitlements for the environment

A Flora and Fauna bulk environmental entitlement order for the Glenelg and Wimmera Rivers was in operation in the Glenelg basin in 2005/06.

The Inter Catchment Advisory Group (ICAG) determines the share of environmental allocations between the two catchments. The full entitlement for the Wimmera Glenelg system is 40,563 ML. Due to continued dry conditions, the 2005/06 environmental allocation to the total Wimmera Glenelg system was 8,689 ML which included an additional allocation of 50 ML in compensation flows for the Glenelg River.

In 2005/06, 3,909 ML of environmental flow releases were made in the Glenelg basin into the upper reaches of the Glenelg River, downstream of Rocklands Reservoir to address salinity and instream sedimentation issues.

The environment was also allocated 382 ML or 20% of the development reserve, as per the agreed management of this entitlement during dry conditions.

33.9.3 Compliance with passing flow requirements

Table 33-12 shows the passing flow requirements in the Glenelg 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 33-12 Selected passing flow requirements 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
	Passing flow rules	• The lesser of 0.4 ML/day or natural flow
	Compliance point	Headworks Creek
	Passing flow rules	• The lesser of 0.4 ML/day or natural flow
	Compliance point	Gap Creek
	Passing flow rules	• The lesser of 0.4 ML/day or natural flow
	Compliance point	Chimney Pot Creek
	Passing flow rules	• The authority is not obliged to provide minimum passing flows
	Compliance point	No 1 Creek
	Passing flow rules	• The lesser of 0.4 ML/day or natural flow
	Compliance point	No 2 Creek
	Passing flow rules	• The authority is not obliged to provide minimum passing flows
	Compliance point	No 3 Creek
	Passing flow rules	• The lesser of 0.4 ML/day or natural flow

Wannon Water reported that its predecessor had made no provision to meet passing flow requirements in the Hamilton system and it is investigating how future compliance will be achieved.

33.9.4 Water leaving the basin

The amount of water flowing from the Glenelg basin into Bass Strait was 51,400 ML in 2005/06. This represents 37% of the total inflows into the basin, compared to 39% in 2004/05. This water comprises consumptive water that was not used under entitlements and the EWR (environmental entitlement, passing flows, and any water above cap).

33.10 Glenelg basin summary

The Glenelg basin again experienced very low inflows in 2005/06 and most storages were close to empty at the end of the year. This includes Rocklands and Moora Moora Reservoirs, which both provide supplies to the Wimmera basin. Levels in these storages reflect the limited availability of water in the Wimmera Mallee system.

Streamflows in the lower part of the basin were limited, and irrigation bans were applied in the Glenelg River. Outflow to the ocean was 51,400 ML in 2005/06.

34 Millicent Coast basin

34.1 Rainfall and inflows in 2005/06

In 2005/06, rainfall across the Millicent Coast basin ranged between 80% and 100% of the long term average. Total rainfall was similar in magnitude over the previous two years. No reliable inflow data exists for the Millicent Coast basin.

34.2 Responsibilities for management of water resources

Table 34-1 shows the responsibilities of various authorities within the Millicent Coast basin.

Table 34-1 Responsibilities for water resources management within the Millicent Coast basin, 2005/06

Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management, waterway management, environmental obligations
GWMWater		Groundwater(1) and surface water licensed diversions within the Millicent Coast basin	Urban water supply to the Mllicent Coast basin, including Kaniva and Edenhope	
Southern Rural Water		Groundwater in the Glenelg WSPA		
Wimmera Catchment Management Authority				Waterway management in the whole of the Millicent Coast basin

Note:

(1) Groundwater management is undertaken jointly by South Australia and Victoria under the Border agreement.

34.3 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 streams in 2005/06.

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

Table 34-2 Summary of total water resources and water use in the Millicent Coast basin, 2005/06

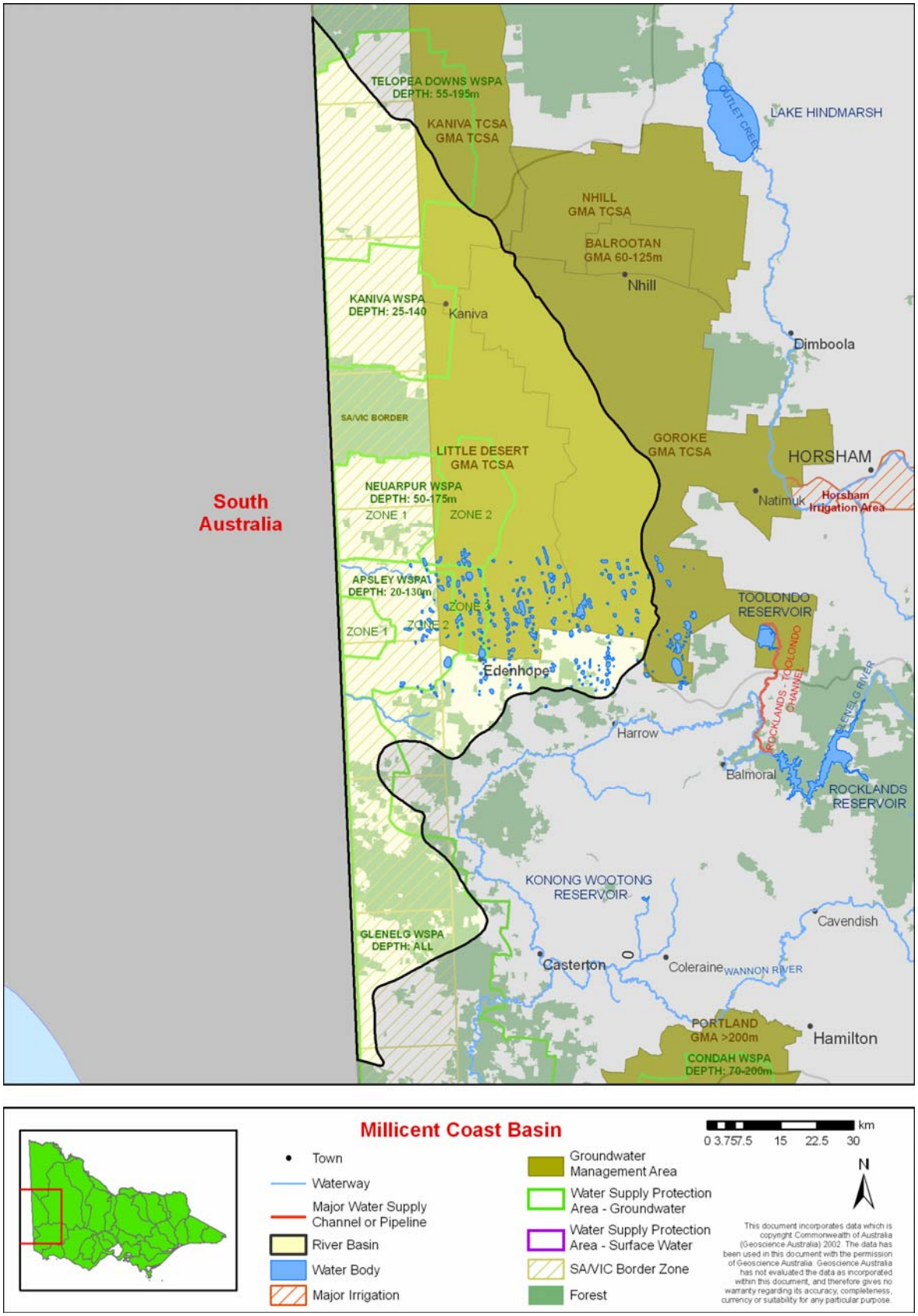
Water source	Total water resource (ML)	Total use (ML)
Surface water	100	100
Groundwater(1)	Not available	Not available
Recycled water	60	60

Note:

(1) The total groundwater resource and use is provided only where all GMAs and WSPAs have more than 90% of their surface areas within the river basin boundary.

34.4 Location of water resources

Figure 34-1 Map of the Millicent Coast basin



34.5 Surface water resources

34.5.1 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 gauging within the Millicent Coast basin in Victoria, an estimate of 2005/06 inflows could not reliably be made, and has notionally been set to the volume of diversions which is estimated to be approximately 150 ML. This is considered to be an underestimate of the total surface water resource.

Currently limited information is available for surface water availability and use, therefore a water balance has not been included for the Millicent Coast basin.

34.5.2 Small catchment dams

No information regarding small catchment dams is readily available within the Millicent Coast basin.

34.5.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements, diversion licences or sales water within the basin in 2005/06.

34.5.4 Volume diverted

A bulk entitlement for the water supply to towns in the Millicent Coast basin was not completed by the start of 2005/06 and values are not reported against this bulk entitlement.

Licensed diversions from unregulated streams are estimated based on full use of domestic and stock water entitlements, and the application of a simple evaporation-irrigation demand relationship for the use of irrigation water entitlements.

Table 34-3 Volume of water diverted under surface water entitlements in the Millicent Coast basin

Bulk entitlement	Bulk entitlement period (years)	Average bulk entitlement over period (ML/year)	Net temporary transfer 2005/06 (ML)	Volume diverted 2005/06 (ML)	Entitlement volume compliance?
GWMWater					
Edenhope	n/a	n/a	0	0	n/a
Total annual volume of bulk entitlements 2005/06		**n/a**	**0**	**0**	
Total annual volume of bulk entitlements 2004/05		**n/a**	**0**	**150**	
Licensed diversions from unregulated streams 2005/06		*100*		*100*	
Licensed diversions from unregulated streams 2004/05		*85*		*85*	

34.6 Groundwater resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Millicent Coast basin, excluding domestic and stock use, is shown in Table 34-4.

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 GMA and Goroke GMA. The volumes described in tables below are totals for the management areas and include the area that falls outside the Millicent Coast basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

Table 34-4 Compliance with licensed groundwater volumes, Millicent Coast basin 2005/06

Water supply protection area/ Groundwater management area[1]	GMA/ WSPA depth limits[2] (m)	Allocation limit[3] (ML/year)	Licensed entitlement allocated[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2005/06	Total licensed groundwater use (ML) 2004/05
Goroke GMA (37%)	Tertiary confined sand aquifer	2,200	0	0	0	0	0
Kaniva TCSA GMA (17%)	Tertiary confined sand aquifer	1,100	0	0	0	0	0
Little Desert GMA (100%)	Tertiary confined sand aquifer	1,100	0	0	0	0	0
Apsley WSPA (100%)[6]	All depths	4,285	4,285	1,770	350	2,120	1,360
Glenelg WSPA (30%)	All depths	32,777	32,777	7,570	0	7,570	19,950
Kaniva WSPA (100%)	25-140	3,673	3,673	2,360	0	2,360	2,250
Neuarpur WSPA (100%)	50-175	24,696	24,696	15,600	0	15,600	19,250
Telopea Downs WSPA (61%)	All depths	7,482	7,482	4,120	0	4,120	3,830

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses. Those GMAs/WSPAs with <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) The allocation limit represents the sum of licensed entitlements for WSPAs and the permissible consumptive volume (PCV) for GMAs.

(4) Allocated volume includes domestic and stock usage in those cases where it is part of a licensed allocation.

(5) In non-metered areas, estimated use has been provided by Southern Rural Water (30% of licensed entitlement) and GWMWater (based on the proportion of bores that are unmetered).

(6) Depth limit was incorrectedly stated in 2004/05 State Water Report and has been adjusted.

An estimate of domestic and stock groundwater use is provided in Table 34-5.

Table 34-5 Number of domestic and stock bores and estimated use, 2005/06

Water supply protection area/ Groundwater management area	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Goroke GMA	0	0
Kaniva GMA	0	0
Little Desert GMA	0	0
Apsley WSPA	134	268
Glenelg WSPA	Not available	Not available
Kaniva WSPA	112	224
Neuarpur WSPA	297	594
Telopea Downs WSPA	97	194

Note:

(1) There are a number of licensed groundwater allocations that also incorporate domestic and stock use. The estimated use for these bores is included in the licensed allocation in Table 34-4.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965.

In the Millicent Coast basin groundwater is used as an urban water supply for the townships of Apsley, Kaniva, Lillimur, Goroke, Leeor (Serviceton), Mirampiram (Miram) and Harrow, and as an emergency supply for Edenhope. The licensed entitlements and metered use for these groundwater supplies is provided in Table 34-6.

Table 34-6 Urban groundwater usage

Town supplied	Licensed allocation (ML)	Metered use 2005/06	Metered use 2004/05
Goroke	86	74	79
Kaniva	600	216	160
Lillimur	32	23	24
Boikerbert (Apsley)	40	40	37
Edenhope (emergency bores)	150	107	150
Mirampiram (Miram)	7	3	3
Leeor (Serviceton)	25	12	11

34.7 Seasonal allocations and restrictions on water use, diversions and extractions

Edenhope experienced Stage 1 restrictions for the entire year (Table 34-7).

No bans or restrictions were imposed on groundwater use in the Millicent Coast basin during 2005/06.

Table 34-7 Seasonal allocations and restrictions on water use in Millicent Coast basin, 2005/06

Type of restriction	Area	Nature of restriction
Urban	Edenhope	Stage 1 from July 2005 to June 2006

34.8 Recycled water

GWMWater operates wastewater treatment plants in three towns within the Millicent Coast basin. All wastewater from Edenhope was reused for a variety of purposes, including pasture improvement and watering recreational facilities and parks. Wastewater produced at Kaniva and Serviceton treatment plants was evaporated on-site.

Table 34-8 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% Recycled	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean / Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Edenhope	62	62	100%	62	0	0	0	0	0
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 2005/06	**62**	**62**	**100%**	**62**	**0**	**0**	**0**	**0**	**0**
Total 2004/05	**188**	**188**	**100%**	**188**	**0**	**0**	**0**	**0**	**0**

Notes:

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

(2) Water that is reused in wastewater treatment processes, e.g. backflushing of filters.

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

34.9 Water for the environment

34.9.1 Environmental Water Reserve (EWR)

In 2005/06 the Millicent Coast basin EWR comprised all water in the basin not allocated for consumptive use:

34.9.2 Water leaving the basin

As there are no stream gauges within the Millicent Coast basin in Victoria, an estimate of the volume of water leaving the basin was not made. Any surface water that forms flows on to become an available resource to South Australia.

Part 3
Directions for Victorian water resource management and reporting

Part 3 examines the key directions and policy influences shaping the government's management of water resources in Victoria.

It points to some key action areas for the government that will impact on subsequent editions of the State Water Report and, in doing so, will inform future State Water Reports.

The *Our Water Our Future* action plan provides the framework for the major initiatives being implemented by the Victorian Government to ensure a sustainable future for Victoria's water resources. The establishment of the environment's formal right to water in legislation under the *Water (Resource Management) Act 2005* is now firmly in place with the creation of the Environmental Water Reserve and its important impact on Victoria's water sharing arrangements.

Prolonged drought coupled with clearly detectable trends towards climate change are issues that are now well known to Victorians. Both will have ongoing ramifications for the way we manage our limited water resources. Fundamental changes in water management practices as reflected in the development of Regional Sustainable Water Strategies, continued expansion of water markets and the launch of the Water Register, as well as examination of alternative water supply sources including groundwater, are key steps for ensuring sustainable water resource planning.

The importance of improved monitoring, reporting and accounting to strengthen the body of information available to water resource planners and decision makers are all important concerns identified and being progressed by the Victorian Government.

35 Challenges for water resource management in Victoria

Drought continued to characterise the 2005/06 period, as has been the case for the last ten years. Over this time, rainfall and streamflows across all of Victoria have been well below average.

Historically, Victoria's water management arrangements have been designed to cope with drought by storing water in reservoirs in wet years and relying on this supply in dry times. The prolonged dry conditions of the past ten years resulted in very low storage levels in reservoirs at the end of 2005/06.

The cumulative reduction in storage levels and ongoing rainfall deficiencies during this period indicate that the typical cycle of drought and rain may have been exacerbated and distorted by climate change. As a result, new water resource and drought management planning activities were initiated to ensure the sustainable management of resources over the 2005/06 period and into the future, along with new investments to secure long-term water supplies for the State.

35.1 The next stage of the *Our Water Our Future* water plan

Building on the 2004 *Our Water Our Future* plan for sustainable water management in Victoria, the government released the second phase of the strategy in June 2007.

Around $4.9 billion will be spent on major infrastructure projects to boost Victoria's water supplies. Over the next five years the government will:

- build Australia's largest desalination plant
- modernise irrigation systems in Victoria's food bowl to capture lost water
- expand Victoria's water grid – the network of rivers, channels and pipes linking our major water systems
- provide more water for regional centres including Geelong, Westernport, South Gippsland and Hamilton
- upgrade Melbourne's Eastern Treatment Plant to provide more high grade recycled water
- support new and existing water conservation programs for Victorian homes and industry.

Along with Victorians' continued efforts to save water, these projects will secure water supplies for Victoria's growing economy and population.

The full details of the next stage of the *Our Water Our Future* water plan are available on www.ourwater.vic.gov.au

35.2 Regional Sustainable Water Strategies

Regional Sustainable Water Strategies are a key action from the Victorian Government's *Our Water Our Future* action plan. As such, they form a key plank in Victoria's new planning framework for determining large scale, long term changes in water use. Once the strategies are implemented, the annual water accounts included in future State Water Reports will track the allocation and report on the annual review of Regional Sustainable Water Strategies. The State Water Report will also highlight discrepancies between supply and demand forecasts identified in Regional Sustainable Water Strategies and actual occurrences. Five Regional Sustainable Water

Strategies will be developed across Victoria: Central Region, Wimmera and Glenelg Region, Northern Victoria, Gippsland Region and South-West Region.

The Central Region Sustainable Water Strategy (CRSWS) was developed, and after community input over six months and a review by an independent panel, was finalised in late 2006. The development of the Northern Region Sustainable Water Strategy will be initiated in 2007. The other three strategies will be progressively completed in the future.

35.2.1 Aim of each Regional Sustainable Water Strategy

The Regional Sustainable Water Strategies consider all aspects of water resource management in each region of Victoria over the next 50 years. They look at all sources of water, including rivers, reservoirs and aquifers, as well as recycled water, stormwater and seawater. They identify a range of water resource management issues and opportunities, and implement actions to maintain and improve the condition of rivers and provide safe, reliable water supplies for all users.

35.2.2 Central Region Sustainable Water Strategy

The CRSWS is a plan to secure water supplies for homes, business, industry, agriculture and the environment for the next 50 years.

It is responsive to changing water needs and includes actions to ensure Victoria has sufficient supplies in the event that the low inflows to reservoirs experienced over the last 10 years continue. It has clear objectives, and is the result of over two years planning and consultation with community, industry, key stakeholders and government agencies.

The plan takes an integrated approach to water resource planning. It considers all water sources including rivers, reservoirs, aquifers, as well as recycled water, stormwater and seawater.

The Central Region stretches in an arc around Melbourne and covers Geelong, Ballarat, the Macedon district and West Gippsland. It includes the Barwon, Moorabool, Werribee, Maribyrnong, Yarra, Bunyip, Thomson and Latrobe basins. Particular objectives of the CRSWS include to:

- ensure reliable and safe water supplies for all uses into the future
- understand the implications of the record low rainfall and inflows to reservoirs experienced over the past 10 years
- protect and where necessary improve the health of rivers, aquifers and estuaries
- protect the indigenous and other heritage values associated with the region's rivers and catchment areas
- maximise overall community benefits and ensure that no generation or group incurs unwarranted extra costs or receives inequitable benefits
- support high value water use by industry and agriculture with the least adverse impact
- make the best use of water resources locally and throughout the region
- further develop an appreciation of the value of water and a conservation culture in the community
- aim to be greenhouse gas emission neutral.

35.2.3 Implementation of the Central Region Sustainable Water Strategy

A key objective of the CRSWS is planning and delivering on-ground improvements in the way Victorians use water, and setting up monitoring and reporting regimes to track progress. Many organisations contribute to water management and provide water-related services in the Central Region, and will have a part to play in implementing the CRSWS. Actions identified in the CRSWS fall into two categories:

- policy regulations, performance obligations and targets determined by the Victorian Government and enforced by its regulatory agencies such as EPA Victoria
- projects, services and targets delivered by water authorities and catchment management authorities.

Key actions currently being undertaken include:

- the Goldfields Superpipe, a new pipe linking the Goulburn system directly with Bendigo and Ballarat. This project is expected to be completed by August 2008 to provide long term water security for these cities
- investigation of major augmentation options for Melbourne
- investigation of major augmentation options for Geelong
- Westernport Water accelerating the augmentation of the bore at Corinella aquifer.

35.2.4 Annual review

The CRSWS outlined that an annual review of water availability and demand compared to forecasts would be undertaken. If the reviews show that inflows have consistently returned to more average conditions over the medium to long term, the volumes of water required may require amendment.

The review will include an evaluation of progress in meeting water conservation targets. River flows and progress in meeting environmental targets will also be monitored.

The outcomes of the annual review of water availability and demand (including the need for any change to targets or the timing of actions) will be publicly available before the end of the calendar year.

35.2.5 Northern Region Sustainable Water Strategy

In 2007, the Department of Sustainability and Environment will commence work on the Northern Region Sustainable Water Strategy (NRSWS) in collaboration with catchment management authorities, local government, water authorities, other stakeholders and the community. The NRSWS will be focused on the River Murray and its tributaries, from Wodonga in the east to Shepparton, Bendigo and Mildura in the west. It includes the Ovens, Broken, Goulburn, Campaspe and Murray basins.

During the development of this strategy, the government will release a discussion paper for public comment. This will represent the first formal opportunity for community members to have input into the development of the NRSWS.

35.3 Managing urban supplies

Urban water authorities are responsible for the development of water supply and demand strategies for their customers and contribute to the development of Regional Sustainable Water Strategies. Both of these strategies aim to ensure security of water supplies for the long term (to 2055) by forecasting supply and demand and identifying appropriate augmentation or demand management initiatives to ensure a sustainable supply at times of low water availability.

Water authorities are required to have drought response plans in place to manage limited supplies. During 2006 the majority of Victoria's urban water authorities adopted the standardised water restriction system contained in the Uniform Drought Response Guidelines. Under this system, each water authority's drought response plan identifies appropriate trigger levels for enacting the four stages of water restrictions.

Uniform Drought Response Guidelines were adopted by Melbourne's water retailers through their Uniform Drought Response Plans in July 2006. The majority of regional water authorities adopted

the guidelines through by-laws in mid to late 2006. Although South Gippsland Water and East Gippsland Water had four stages of water restrictions, they did not formally adopt the Uniform Drought Response Guidelines during the reporting period. Copies of the guidelines can be sourced from relevant Victorian water authorities.

Drought response plans also require the identification of contingency measures to temporarily boost water supplies or ration water use beyond Stage 4 in the event that a drought is more severe than envisaged and Stage 4 restrictions are not adequate.

35.3.1 Permanent water saving measures

In accordance with Action 5.4 of the *Our Water Our Future* action plan, all water authorities were required to introduce permanent water saving measures. The measures were to be developed at the local level and suitable for local conditions, requiring a minimum level of 'water wise' behaviour by consumers.

Melbourne introduced permanent water saving measures on 1 March 2005 with penalties applicable for failing to comply. The five key permanent water saving measures are:

- Use manual watering systems only between 8pm and 10am.
- Use automatic watering systems only between 10pm and 10am.
- Fit hoses with trigger nozzles.
- No hosing paved areas.
- Apply to fill a new pool.

March 2006 figures showed record amounts of water had been saved since the introduction of the permanent water saving rules in 2005. In Melbourne, water consumption was 22% lower than the city's water usage in the 1990s with less water used per person in 2005 than in any other year since the metropolitan water authorities started keeping detailed records in 1995.

The majority of Victoria's regional urban water authorities adopted permanent water saving measures in 2005 and early 2006. North East Water and Lower Murray Water did not adopt permanent water saving measures during the reporting period.

35.3.2 Non-residential consumption

In October 2006, the Victorian Government amended legislation requiring water authorities to report on their major non-residential water users. Passed as part of the Governance Bill, changes were made to the *Water Industry Act* and *Water Act*. The legislation requires that the water authority report annually:

- the number of consumers who fall above a threshold
- whether or not customers participate in water conservation programs
- the names of those customers consuming above a threshold.

Currently government policy has set the threshold at 50ML per annum. (This does not include water for farm use or irrigation). The top 200 users in Melbourne fall above the threshold.

The CRSWS required water authorities to broaden Melbourne's Pathways to Sustainability program to all customers with consumption greater than 10 ML per annum. It was subsequently mandated that all customers across the state with consumption greater than 10 ML (approximately 2,300 additional customers) will be required to develop a water management action plan. It is forecast that in Melbourne new water savings initiated by customers with consumption greater than 10 ML (i.e. 1,500 customers including the top 200) will contribute approximately 5 GL to the forecast saving by Melbourne's non-residential sector of an additional 13 GL by 2015. This program has since been accelerated.

35.4 Bushfires, water quality and water yield

The ongoing dry conditions of the 2005/06 period was a contributing factor in a number of severe bushfires, compounding the impact of the 2002/03 fires on the Victorian landscape and on short and long term water yield.

The 2002/03 bushfires burnt more than a million hectares of forest and grazing land. Run-off from areas burnt in these fires, and from the 2005/06 bushfires, carried high ash and sediment loads into a number of streams.

Research has found that observed water quality impacts from bushfires can vary between different streams, ranging from no measurable impact through to a 1,500 fold increase in total suspended solids concentrations (Sheridan et. al., 2004, *Preliminary analysis of pre-and post-bushfire water quality data from hydrologic stations in Eastern Victoria (Interim Report),* Department of Sustainability and Environment). Early indications of immediate effects after a bushfire (i.e. up to 12 months after the event) are that high flows can result in poor water quality for long periods as these events can remobilise sediment and absorbed nutrients in the stream channel. During periods of low flow between rainfall events, water quality has improved gradually as ground vegetation recovered. Delivery of sediment and nutrients to lower catchment water impoundments is likely to be substantially lower due to in-channel storage.

In 2005/06, the Department of Sustainability and Environment continued to work with water authorities in fire-affected areas. They developed a number of drought contingency plans to respond to the potential water quality problems caused by run-off from burnt areas in north east Victoria and Gippsland. The drought contingency plans range from water treatment to using groundwater for supply augmentation and water carting.

Under the *Our Water Our Future* action plan, the Victorian Government introduced legislation requiring reviews to be conducted every 15 years of water resource availability. These reviews need to take into account the effects of climate change and bushfires and make recommendations on strategies to ensure water supplies are protected using best practices at the given time. The first review is scheduled for commencement in 2017.

In addition, an important part of the planning and contingency measures implemented in relation to the 2005/06 fires was the identification and use of alternative water supply points such as emergency groundwater standpipes to supplement the surface water used to fight fires.

35.5 Groundwater management in Victoria

In the past, groundwater has not received the same degree of attention as other sources of water as it is generally unseen and often poorly understood. Some 366,000 ML of groundwater was extracted from Victoria's aquifers in 2005/06 and used for a variety of purposes including town water supply, rural domestic consumption, stock watering, irrigation and industry.

Although many groundwater levels in Victorian aquifers show a trend downwards because of increased use and the prolonged dry conditions, of the 70 managed groundwater areas in Victoria only six are seen to be under significant stress. They are Neuarpur, Glenelg, Yarram, Sale, Upper Loddon and Condah. All have been declared as water supply protection areas, thereby ensuring that no more licences can be issued. Management plans have been developed or are under development to ensure that allocations are managed to sustainable levels.

35.5.1 Sustainable management of groundwater

The Victorian Government, through *Our Water Our Future*, has made the commitment of bringing all the state's water resources under a sustainable water allocation regime. For groundwater, this means ensuring that all extraction falls within limits defined by the 'sustainable yield' of the aquifer. The sustainable yield is the renewable part of the groundwater resource, identified after

making allowance for acceptable impacts on users, the surface environment and the resource itself.

Permissable consumptive volumes (PCVs) for groundwater were declared for 25 aquifers in the Central Region on the basis of estimates of sustainable yield.

Recent groundwater management plans have also included seasonal allocation rules which require the allocations to be restricted if groundwater levels fall below specified trigger levels. The trigger levels are set taking into account surface-groundwater interactions, the protection of water quality, as well as operational issues such as bore interference.

Continued monitoring of water levels and groundwater use over the long term is an essential part of the management approach. The information gathered may lead to a review of a particular system's PCV.

Monitoring the condition, levels and use of groundwater resources is fundamental to ensuring they are managed properly as this provides decision makers with key information. Intensive groundwater management requires accurate data from groundwater monitoring bores and the metering of groundwater use. This information is modelled and analysed to gain an understanding of the resource and needs to be supplemented by continuous observation of trends.

Key emerging issues with respect to the management of groundwater in Victoria include:

- **Drought**. With the current urban supply situation, the need to find groundwater to augment urban supplies has increased. Any new allocations will need to balance short term needs with the need to minimise long term impacts of such allocations.
- **Domestic and stock versus licensed extractions**. With increasing pressures on groundwater extraction, any improvement to the groundwater allocation process needs to take into account the importance of groundwater to both domestic and stock and licensed users.
- **Cost recovery and pricing**. The increased level of management now required for sustainable groundwater management is now being reflected by increasing prices for groundwater across the state. Further price increases are likely to be necessary in subsequent pricing rounds as the need for increased management efforts continues.
- **Improved metering and compliance**. Active monitoring and improved management of compliance with groundwater licence conditions needs to occur across the water industry as groundwater resources are used more heavily. For example, any unauthorised use of the Deutgam aquifer could have a long term impact on its health.
- **Improving trading systems**. The groundwater allocation and trading system in Victoria is under-developed, and new trading and accounting rules need to be created for groundwater to promote water efficient practices.
- **Groundwater-surface water interaction**. There is a continued need to invest in better understanding the role of groundwater in Victoria's water cycle. In particular, an improved understanding of aquifer shape and behaviour is needed, especially in areas of groundwater-surface water interaction and where there are groundwater dependant ecosystems.

Over the next twelve months, the Department of Sustainability and Environment will continue to improve the groundwater allocation framework in Victoria to streamline existing processes and ensure allocation and resource management are efficient and responsive to immediate pressures. A more responsive approach will ensure those groundwater areas requiring more active management and intervention receive due attention. Similarly, the issues of over-allocation and over-use, more vigorous metering and proactive enforcement will also be addressed.

36 Securing the environmental health of water resources

36.1 Importance of environmental flows

As a water resource management document, the State Water Report covers the water resource elements of environmental water. However, it should be noted that rivers have naturally variable flow regimes, reflecting the rainfall and run-off within their catchments. The total annual streamflow volumes, as reported in Part 1 and Part 2 of this report, are not in themselves indicators of river health. Seasonal flow regimes are critical.

Detail of the importance of flow regimes in sustaining streams, rivers and groundwater, and their dependent ecosystems has been outlined in a number of documents, including Chapter 35 of the *State Water Report 2004-05* and Chapter 2 of the *Central Region Sustainable Water Strategy, Action to 2055*.

36.2 Environmental Water Reserve

The Environmental Water Reserve (EWR) is the legal term used for the share of water set aside for the environment as environmental flows.

The government established the EWR to provide a higher degree of legal protection and recognition for the environment's share of water resources. It is also recognised that the EWR in some river systems needs to be enhanced to provide for the long term health of the river and its floodplain.

Catchment management authorities have responsibility for the operational management of the EWR. Melbourne Water manages the EWR in the Port Phillip and Westernport region.

The EWR is required by the *Water Act 1989* to be managed in accordance with the EWR objective specified in the Act, and as such it:

- aims to achieve ecological objectives for the protection and/or restoration of priority river, wetland and aquifer assets
- is undertaken as one key component of an integrated program of river, wetland and aquifer restoration aimed at achieving ecological objectives
- aims to achieve the most effective use of environmental water, achieving the greatest level of environmental benefits possible and minimising as far as possible any adverse impacts on water users
- engages communities, particularly where these are likely to be affected by the water management regime.

Environmental operating strategies are prepared by the EWR managers for the operational management of environmental entitlements held in storage. The catchment management authorities are required to report to the Minister for the Environment on the allocation and use of the environment's water currently held under bulk entitlements.

Reporting on the allocation and use of the various components of the environment's water will be further developed as management systems for the EWR are established.

In 2005 the Department of Sustainability and Environment commissioned the eWater Cooperative Research Centre to initiate an ecological monitoring program to assess the ecological outcomes of the use of environmental water in a number of regulated rivers across the state where there has been a government commitment to increase environmental flows. Known as the Victorian Environmental Flows Monitoring and Assessment Program (VEFMAP), this project is investigating the effects of improved environmental flow regimes that have occurred as a result of major water recovery projects. Its work is focusing on the following priority rivers:

- Broken River
- Goulburn River
- Campaspe River
- Loddon River
- Thomson River
- Macalister River
- Wimmera River
- Glenelg River.

The data will allow EWR managers to test hypotheses about the relationships between flow and a number of ecological parameters to ensure effective adaptive management of the EWR. It is also important to demonstrate to the broader community the environmental water is being well managed and is achieving the environmental benefits as set by the community.

Amendments to the Water Act in 2005 created the EWR where it is formally defined as water set aside for the environment through:

- Environmental entitlements: The legislation provides for volumes of water in regulated river systems to be granted to the environment. Environmental entitlements are held by the Minister for the Environment. The existing bulk entitlements held by the Minister are equivalent to environmental entitlements and it is expected they will be amended so as to afford them the same legal status as environmental entitlements. Because they exist in regulated water supply systems, which provide opportunities for discretionary releases of water, environmental entitlements can be managed with considerable flexibility to meet environmental objectives.
- Consumptive entitlement holders meeting the obligations attached to their water entitlements: This is flow that a consumptive entitlement holder must allow to pass before they can take any water; it is also flow that is in excess of entitlements. This component of the EWR does not include water set aside for future consumptive purposes in a river basin, but which is not yet allocated (e.g. unallocated water within permissible consumptive volumes for groundwater; or unallocated water identified in regulated systems under the statewide sustainable diversions rules).
- Operation of a management plan: e.g. a streamflow management plan.
- Operation of other legislation, e.g. the *Murray Darling Basin Act 1993* and the *Groundwater (Border Agreement) Act 1985*.

Environmental entitlements already exist in the Wimmera/Glenelg river system (41 GL), Thomson River (10 GL), Loddon River (2 GL), River Murray (27.6 GL), and the Snowy River (21.5 GL). The status and annual allocation for the environmental entitlements that existed in 2005/06 are reported in the basin water accounts and summarised in Chapter 4.

New or expanded environmental entitlements are proposed and committed for the following systems: the River Murray, Goulburn, Broken, Loddon, Wimmera, Glenelg, Macalister, Thomson, Latrobe, Werribee, Maribyrnong, Barwon, Moorabool and Tarago rivers.

Stormwater, recycled water and irrigation drainage flows may also contribute to the environmental wellbeing of a river or stream, but are not currently included in the EWR.

36.3 Completion of the Environmental Water Reserve

A number of actions are required by government to fully establish the EWR:

- completion of all consumptive bulk entitlements across the state. The largest of these are the bulk entitlements for Melbourne Water to take from the Tarago River. A small number of small town water supplies also require bulk entitlements to formalise their water supply entitlements, as well as the Newlyn Reservoir/Hepburns lagoon system in the upper part of the Loddon basin
- in unregulated streams, the statutory recognition of the statewide sustainable diversion limits as PCVs
- for groundwater management units, the proclamation of permissible consumptive volumes.

36.4 Enhancing the Environmental Water Reserve

The government's *Our Water Our Future* action plan outlined key projects for enhancing the EWR including:

- Unbundling water entitlements: This irrigation reform initiative will improve the security of irrigation water entitlements and enhance the water market. The agreed implementation package for irrigation areas in northern Victoria includes the transfer of 20% of the new irrigation sales entitlements to the environment. The project will deliver a total of 145,000 ML a year towards Victoria's share of the water required for the Living Murray project. This water will be transferred into environmental entitlements for use in improving environmental flows in the River Murray as well as the Goulburn, Broken, Campaspe and Loddon rivers. The *Water (Resource Management) Act 2005* was passed in the spring session of Parliament 2005 to enable the unbundling of water entitlements. On 1 July 2007, some 120,000 ML of lower reliability entitlement will be transferred to the environment. The supply of this water will depend on the annual allocation for lower reliability entitlements.
- Snowy River: The Victorian Government, together with the Commonwealth and New South Wales Governments, have committed to increase the river's flow below Jindabyne Dam from approximately 1% to 21% of its natural flow. This requires 212,000 ML of water to be recovered by water savings projects in New South Wales and Victoria. An allocation of 10,200 ML for the Snowy River was available in 2004/2005, which was created through water savings projects in Normanville, Woorinen and Goulburn-Murray irrigation districts that were completed during 2003/2004. This volume was carried over for use in 2005/06 (see Chapter 4). Other water savings projects initiated in Victoria include the decommissioning of Lake Mokoan, and the channel reconfiguration project in the Goulburn-Murray Irrigation District.
- River Murray: The Living Murray initiative, from the Murray Darling Basin Ministerial Council, aims to improve the ecological health of the River Murray, initially focussing on six priority

sites. Under the First Step Decision by the Council, 500,000 ML will be returned to the River Murray for the environment. (This includes 145,000 ML for the environment from the unbundling water entitlements project). Physical structures such as regulators and channels to deliver and manage the environmental water at the priority sites will be developed under a $150 million works program. Four of the six sites are wholly or partly within Victoria: Barmah/Millewa, Gunbower-Pericoota/Koondrook, Hattah Lakes and Chowilla-Lindsay/Wallpolla.

- Thomson/Macalister: An additional 5,000 ML of water for environmental flows in the Macalister River will become available by December 2007. This is the second instalment of the *Our Water Our Future* action plan's proposed total transfer of 25,000 ML of additional water for environmental flows in the Thomson and Macalister rivers. The first instalment of 10,000 ML was provided to the Thomson in 2005 as an environmental bulk entitlement. The water for the Macalister will be provided through improving the efficiency of water delivery infrastructure in part of the Macalister Irrigation District. This project is expected to initially save an estimated 5,000 ML for the environment, with more savings expected to follow as efficiency improvements are extended to other parts of the district.
- Wimmera-Glenelg: The Wimmera-Mallee pipeline project will significantly change the balance between consumptive and environmental use in the basin with the environment's average share of total annual flows increasing from the current 20% to an estimated 60%. Further additions to the Wimmera/Glenelg environmental bulk entitlement are expected as this project proceeds.

Through the Central Region Sustainable Water Strategy (CRSWS) the government committed to increase the EWR of rivers in the Central Region by a total of 66,000 ML by 2015. This water will be provided through a range of measures including the allocation of unallocated water, voluntary licence buy-back schemes, water savings through conservation and efficiency projects and the transfer of entitlements. The increased EWR for each of the rivers in the Central Region is:

- Yarra River: an additional 20,000 ML per year
- Moorabool River: an additional 3,000 ML per year
- Barwon River: an additional 4,700 ML per year
- Werribee River: an additional 6,000 ML per year
- Maribyrnong River: an additional 3,000 ML per year
- Tarago/Bunyip rivers: an additional 3,000 ML per year
- Latrobe River: an additional 10,000 ML per year
- Thomson/Macalister rivers: an additional 15,000 ML per year. (This is a reconfirmation of the original government commitment made through *Our Water Our Future*)
- Gellibrand: an interim EWR to be confirmed as part of a Victorian Government decision on the possible development of the Newlingrook groundwater resource, including possible surface water interactions.

Further information regarding these projects can be found in the Victorian Government's *Our Water Our Future* action plan, the Victorian Government's CRSWS, or by visiting the Department of Sustainability and Environment's website at www.dse.vic.gov.au.

36.5 Managing the Environmental Water Reserve during drought

The current drought conditions are severely affecting rivers and wetlands. When drought occurs naturally, native fauna retreats to key refuges and populations decrease, wetlands dry out and plants start to die off. When the drought breaks, the refuges provide the basic stock for river recovery. However, the severity and duration of the current drought on the environment has been greatly increased by the combined effect of water extraction and river regulation.

In addition, the ability to recover from drought has been compromised further by other factors eg barriers along the river and/or deteriorating water quality as a result of catchment management practices. This means active management is required to ensure that key refuges are protected through the drought to provide some recovery capacity.

To cope with prolonged periods of low flows and to ensure that long term management objectives for rivers outlined in Regional River Health Strategies are met, catchment management authorities are developing drought response plans for priority rivers. These plans will develop contingencies to prevent catastrophic events and critical loss of species, and enable future recovery. They include:

- emergency management of the EWR
- complementary river restoration activities
- identifying opportunities in the management of water for consumptive purposes during drought to also provide environmental benefits.

37 Water accounting and reporting

Key actions in the Victorian Government's *Our Water Our Future* action plan that contribute to improving the accuracy, accountability and accessibility of water resource information are:

- **State Water Report**. An annual overview of water allocation and use, including the basin accounts. It relies on the development of water accounting rules.
- **Water Register**. Development of a public register of water rights and licences, including information on bulk entitlements in Victoria.
- **Metering program**. All new licences for commercial and irrigation use are required to be metered and funding incentives are provided to install meters on existing significant un-metered water extractions.

In addition, and also consistent with the Australian Government's National Water Initiative, Victoria is continuing to develop its water resource accounting framework. This includes:

- retail accounting to account for the consumptive use of water, for which the accounting concepts will be applied for irrigation use through the Victorian Water Register. Further work is required on an expanded retail accounting framework which includes urban water consumption (including the accounting for large non-residential use) and links to water resource accounting at the wholesale level
- wholesale resource (bulk) water accounting which primarily accounts for the overall volume of the resource at a basin scale. The conceptual basis for this is being developed through the annual basin accounts in the State Water Report
- whole-of-water-cycle accounting which accounts for water through the various stages of the water cycle, in particular through the terrestrial stage.

A fundamental requirement of water accounting is that it must align with the water allocation frameworks. The Victorian water allocation framework defines water for consumptive and environmental purposes. Consumptive use entitlements are currently issued through bulk entitlements, water rights and water licences, as outlined in Part 1, Chapter 2 Water for consumptive use. The Environmental Water Reserve provides a legal foundation for water to be set aside to maintain environmental values of rivers and streams. This water is defined through a range of mechanisms outlined in Part 1, Chapter 4 Water for the environment. The mechanisms include rules and conditions on consumptive use entitlements.

The development of water accounting concepts has progressed to varying degrees for different elements of the water allocation framework. This is evidenced in the issues outlined in the following sections, in particular those relating to basin accounts, accounting for groundwater and the Environmental Water Reserve.

37.1 Water accounting in the State Water Report 2005/06

Water accounting has historically been based on water authorities' customer accounting and water supply operating systems that focus on measuring consumption and billing customers.

It has also included seasonal assessments of water resources to determine allocations for irrigators in the large regulated water supply systems. Generally speaking, water accounts have been kept for individual entities and aggregated to larger groupings to allow analysis on a wider scale.

The 2005/06 basin accounts included in Part 2 of this report are an example of annual water resource accounting at the river basin and aquifer scale. These are at an early stage of development and it is expected that the scope of water accounts in future State Water Reports will be broadened to include a more complete record of transactions associated with holding and transferring bulk water and environmental flows.

The basin water accounts in the State Water Report present data on diversions and extractions rather than use, and for this reason surface water diversions are reported in the basin where the water is extracted, not where it is ultimately used. The majority of diversions are used for consumptive purposes, although in some cases there are some non-consumptive uses such as environmental flows.

A number of initiatives are underway at a national level to improve water accounting (see Section 37.7). At a Victorian level the Water Register for northern Victorian regulated systems will become operational in July 2007 (see Section 37.4).

Once implemented, the Water Register will ease the collection of data, simplify the compilation and improve the accuracy of the state water accounts.

Furthermore, the framework underpinning the water accounting in State Water Report will be more stringently defined during 2007. A chart of accounts will be developed, and accounting rules implemented in order to improve the accuracy and consistency of the basin water accounts. Work will also be undertaken to better link the water resource accounting information shown in the basin water accounts with urban water use information such as that presented in Figure 2-1 in Chapter 2 of this report.

37.2 Accounting for groundwater

While including groundwater as part of a wholesale water account appears at first glance to be an obvious way to produce combined surface water/groundwater accounts, groundwater poses a number of challenges for water accounting:

- If an aquifer underlies more than one surface water basin, an accounting system that tries to deal with groundwater within the boundaries of river basins will present great difficulties.
- Groundwater and surface water can be connected, flowing into each other. If double counting of some water is to be avoided, the connections must be identified and understood.
- Groundwater management areas and water supply protection areas in Victoria are currently managed using extraction rates and groundwater levels, not volumes in aquifers because estimates of volumes in aquifers are very unreliable

At this stage it is useful to regard water in an aquifer as a retail delivery system account at the same level as a surface water distribution system, and quantify such items as inflows from recharge, water feeding into rivers and other groundwater systems, and water extracted by retail customers. However, of these items, only the extractions can be readily calculated and these are reported in the basin accounts.

Estimating the other items is a technical exercise involving modelling and high levels of uncertainty. Therefore at this stage there is limited benefit in pursuing full groundwater accounts of this type except as a knowledge gathering exercise to better understand surface water/groundwater interconnections. The Victorian approach of managing groundwater by extraction rates and water level means that the risks of double counting and of the extraction impacting on surface water and groundwater-dependant ecosystems can effectively be managed.

37.3 Accounting for environmental water

The *Water (Resources Management) Act 2005* has conferred on the environment a legal share of the water in rivers and aquifers by establishing the Environmental Water Reserve (EWR). This water is defined through a range of mechanisms outlined in Part 1, Chapter 4 Water for the environment including: environmental entitlements, passing flow obligations on consumptive bulk entitlements, streamflow management plans, and in some instances above cap water. While these mechanisms cover the surface water component of the EWR, the groundwater components require further work to define.

These mechanisms through which the EWR is defined cover two components of water: storage elements and in-stream elements.

As with water accounting more broadly, water accounting for environmental water is a developing discipline. The approach developed for Victoria's environmental water accounting will need to ensure that the use of storage elements and in-stream elements are accounted for separately and explicitly.

37.3.1 Storage elements of the EWR

Extractive entitlements to discrete volumes of water can be used at the discretion of the environmental manager for, say, watering a wetland. They are usually held in regulated water systems.

Environmental entitlements will appear in the Victorian Water Register and, as Victoria's water accounting framework is further developed, it is anticipated that they will appear in the various retail water accounts.

37.3.2 In-stream elements of the EWR

The in-stream elements of the EWR include flows maintained by a water authority as an obligation or rule of a bulk entitlement or licence, and above-cap water. They include passing flows below storages on regulated systems and diversion restrictions in unregulated rivers.

The timing of flows in this component is determined by rules in bulk entitlements, rules in streamflow management plans, conditions on licences and flows in river systems (for example, increased flows in response to rain when a storage spills). The accounting for this component needs to demonstrate compliance with volumetric, temporal and spatial aspects of the rules.

The further development of EWR accounting concepts will assist in identifying which rules (in particular the temporal and spatial components) can be accounted and reported though water accounting systems and which will need to be reported through different processes in order to assess compliance.

It is worth noting, however, that temporal factors will need to be reported through non-accounting mechanisms. This is due to the need to recognise characteristics of flow, as well as volumes in water reporting.

37.4 Victorian Water Register

At present rural water authorities manage and maintain individual registers of water entitlements. The water authorities process and approve transfers of water entitlements and allocations and record the changes in their registers.

These registers are kept using different systems and to different standards but generally include information such as the name of the landowner, the description of the land, the volume and type of entitlement (e.g. water right or Section 51 licence) and other information such as drainage diversions.

On 1 July 2007 the water registers currently being operated by Goulburn-Murray Water, Lower Murray Water, and the First Mildura Water Trust will be replaced by a single web-based State Water Register. On 1 July 2008 the registers operated by Southern Rural Water and Melbourne Water will be replaced by the state register.

The Water Register will have five key operational aspects:

- a public register of water shares (unbundled entitlements) and interests over these entitlements (i.e. mortgages can now be recorded against water shares and these are recorded in the water register)
- a public register of water use licences and works licences
- a workflow process system for assessing and approving applications, and their subsequent recording in the register
- a system to make annual allocations to holders of water shares to account for allocation and usage
- reporting functionality including public on-line access to report on water trade prices, and water share, water use licence, and works licence records.

The Water Register accounting module will enable water shares, allocation, water use and transfers of water shares and allocation to be recorded, analysed and reported. This will include information regarding owner, delivery system, trading zone, reliability, tenure, source and water authority.

The Water Register will be underpinned by a rigorous accounting framework that is based on commonly accepted financial accounting principles of double entry accounting, chart-of-accounts, natural accounts, basic internal control practices of separation of responsibilities, and audit trails. The accounting framework adopted is the basis of retail water accounting.

The Victorian Water Register will:

- improve information on water authorities' compliance with their bulk entitlement volumes and enable the bulk entitlements to be updated and reconciled for trade
- enable reporting to individuals on their annual allocation and use
- enable annual reconciliation and reporting of water accounts at the retail system level.

Once implemented, the Water Register will ease the collection of data, simplify the compilation and improve the accuracy of the state water accounts.

37.5 State metering program

Accurate water accounts rely on accurate and complete data on the volumes of water extracted from rivers and aquifers. The *Our Water Our Future* action plan recognised that the metering of water extractions needed to be improved for resource monitoring and compliance purposes. The Victorian Government committed to meter all new surface water and groundwater licences for commercial and irrigation use, and to provide funds towards the installation of meters on existing unmetered water extractions of significant size.

The Victorian Government subsequently introduced the following metering thresholds, which apply unless a lesser volume is specified in a water management plan:

- 10 ML and greater to take and use surface water from unregulated systems
- 20 ML and greater to take and use groundwater.

Installation of meters will not be compulsory for licences below these thresholds.

The Victorian Government metering program contributes $400 to the cost of metering each site. The program commenced in 2005 and in the order of 1,300 meters were installed to June 2007.

As this project progresses, the accuracy of the figures reported in future State Water Reports on volumes of water extracted from groundwater aquifers and from unregulated streams will be significantly improved. It will add a greater level of confidence in the water resource information presented in future reports and will also assist water managers and water users to better understand water usage patterns and help them comply with their entitlement and licensed volumes.

37.6 Water consumption reporting

Victoria uses a range of tools to achieve sustainable urban water management. These include public education, incentives, regulation, planning provisions, technical change, pricing and investments. The availability of information on urban water consumption for the 2005/06 period varies across the state which limits the ability to evaluate the utility and effectiveness of such tools.

Over the next few years, Victoria will continue to seek improvements to the way water consumption information is collected, reported and analysed. It is expected that these developments will lead to improved water consumption reporting in the State Water Report and add to the body of knowledge available to water resource managers for future modeling, planning and investment.

A working group of the Council for the Australian Federation (CAF) is currently assessing the need for a national system for reporting urban water consumption, with particular focus on large users. The recommendations arising from this review will be considered by CAF once they are complete.

37.7 National water accounting policy

Water accounting is a formative discipline and its importance has been acknowledged through the National Water Initiative. The State, Territory and Commonwealth Governments have convened a water accounting development committee and established a three year workplan to develop national water accounting standards. The committee will oversee the development of a range of products to lead towards a national accounting model, including outputs such as:

- the information requirements of users of water accounting information
- a conceptual framework for water accounting
- a range of water accounting standards and guidelines for water market accounting, water resource accounting and environmental water accounting
- a national common chart of water accounts
- a series of pilot projects to aid development of the model
- recommending reporting requirements, obligations and assurance mechanisms for water accounting.

At this stage, development of the framework is still in its initial conceptual stage and is focusing on identifying relevant issues and information gaps.

The first practical element of the National Water Initiative in relation to water accounting will be delivered through the Australian Water Resources 2005 initiative expected to be released in mid 2007. The Australian Water Resources 2005 project covers water availability, use and quality to varying extents across Australia. The project envisages a water accounting framework that covers the whole of the terrestrial phase of the water cycle in a way that can be aggregated to a national level. The considerable challenge in applying these broad concepts will no doubt progress thinking on water accounting at both the national and state level.

Victoria's public reporting on water accounting is arguably the most developed in Australia. As work progresses in developing national water accounting standards, these developments will find their way into the state water accounts, however given the many complexities in water resource management, there will continue to be many challenges in producing meaningful national accounts.

37.8 Water Account Australia

The Australian Bureau of Statistics (ABS) prepares information on the supply and use of water in the Australian economy in a report entitled Water Account Australia (ABS catalogue no. 4610). Water Account Australia is currently produced every four years - the most recent version is for 2004/05. It is compiled using methods proposed in a 2003 United Nations document *System of Integrated Environmental and Economic Accounting* (SEEA). This system focuses on water that is in 'the economy' – water in systems that extract water for production and consumptive purposes – as distinct from water 'in the environment'. As a result, for

example, the ABS information provides information on water consumption across different industry types. It does not account for water for the environment and does not readily align with the Victorian Water Allocation Framework.

Information sources for *Water Account Australia 2004-05* include general survey information collected by the ABS, as well as a specific 2004/05 water supply survey. It also includes information provided by state agencies including the Department of Sustainability and Environment.

Because the state water accounts have a stronger focus on whole-of-system water reporting (including environmental water use) information presented in Water Account Australia and the state water accounts are not necessarily comparable. However, *Water Account Australia 2004-05* does incorporate data collected through the State Water Report process and hence in some cases the same base data has been used. It is expected that as water accounting develops greater alignment between the state water accounts and Water Account Australia will occur.

37.9 National metering standards

Under clause 88 of the National Water Initiative, states, territories and the Commonwealth have agreed to develop a national meter specification and national meter standards specifying the installation of meters. Clause 88 relates to meters for rural/agricultural water use including domestic and stock and industrial and does not apply to urban reticulated supply (which is already covered by existing standards).

Over time, this initiative is likely to involve the replacement of a significant number of meters that do not meet the standard. In turn this will improve the accuracy of information in the State Water Report.

Victoria is working with the Commonwealth and the states to progress this work.

38 Future State Water Reports

The scope and direction of the annual State Water Report is grounded in the policy direction detailed in the Victorian Government's *Our Water Our Future* action plan. As various elements of the action plan are implemented, the content of the State Water Report will evolve.

The reports will continue to provide publicly accessible accounts of the state's water resources that support the government's commitment to open, transparent and sustainable management. They also contribute to the government's commitments under the National Water Initiative in the area of water accounting and reporting.

Access to the accounts will continue to improve as web-based mechanisms that facilitate the public's ability to access and utilise data are enhanced. The commencement of the Victorian Water Register on 1 July 2007 will be a significant boost in this area.

As the EWR is progressively implemented, the reporting of the water resource elements in the State Water Report will be expanded. In the future, the definition of the EWR in each basin will incorporate groundwater.

Improvements to methodology will continue with each report. The classification of recycling data and improved reporting on entitlement compliance are two areas where processes and reporting will be enhanced. Developments in the emerging discipline of water accounting at both the state and national level will also add to the rigour of the basin accounts.

Urban water consumption continues to be an area of both policy action and public interest. Future reports will build on bulk water accounting concepts for urban use and will provide expanded information.

Appendix A

Groundwater entitlement and use

Groundwater management unit[1]	Allocation limit as of 30/06/06 (ML)	Licensed volumes (as of 30/06/2006)							Domestic/stock		Total use (licensed + D&S)
		Licensed entitlements (ML)	No. of licences	No. of metered bores	Estimated: metering program complete %	Metered volume (ML)	Estimated non- metered Use (ML)[2]	Method used to estimate non-metered use	No. of bores[3]	Estimated use (ML)[4]	
GWMWater											
WSPA (approved plan)											
Murrayville WSPA	10,883	9,634	33	33	100%	2,870	0		280	560	3,430
Neuarpur WSPA	24,696	24,696	50	104	100%	15,600	0		297	594	16,194
WSPA (draft plan)											
Apsley WSPA	4,285	4,285	20	11	80%	1,770	350	Metering program %	134	268	2,388
Kaniva WSPA	3,673	3,673	14	20	100%	2,360	0		112	224	2,584
Telopea Downs WSPA	7,482	7,482	10	12	100%	4,120	0		97	194	4,314
GMA											
Balrootan (Nhill) GMA	980	1,522	13	13	50%	690	690		51	102	1,482
Goroke GMA	2,200	0	0	0	0%	0	0		0	0	0
Kaniva GMA	1,100	0	0	0	100%	0	0		0	0	0
Little Desert GMA	1,100	0	0	0	0%	0	0		0	0	0
Nhill GMA	1,200	0	0	0	0%	0	0		0	0	0
Unincorporated areas											
GWMWater		5,909	32	n/a		0	2,068	35% of entitlement	314	628	2,696
Southern Rural Water											
WSPA (approved plan)											
Nullawarre WSPA	22,238	22,238	206	158	100%	10,500	0		1,197	2,394	12,894
Yangery WSPA	14,488	14,488	165	161	100%	3,270	0		1,432	2,864	6,134
Koo-Wee-Rup WSPA	13,854	13,854	391	326	100%	3,460	0		600	1,200	4,660
WSPA (draft plan)											
Bungaree WSPA	5,401	5,401	95	117	100%	2,700	0		252	504	3,204
Condah WSPA	7,568	7,568	39	45	100%	2,710	0		58	116	2,826
Denison WSPA	13,733	13,733	125	101	100%	6,680	0		297	594	7,274

Groundwater management unit[1]	Allocation limit as of 30/06/06 (ML)	Licensed volumes (as of 30/06/2006)							Domestic/stock		Total use (licensed + D&S)
		Licensed entitlements (ML)	No. of licences	No. of metered bores	Estimated: metering program complete %	Metered volume (ML)	Estimated non- metered Use (ML)[2]	Method used to estimate non-metered use	No. of bores[3]	Estimated use (ML)[4]	
Deutgam WSPA	5,234	5,234	159	205	100%	2,660	0		257	514	3,174
Glenelg WSPA	32,777	32,777	79	77	100%	7,570	0		0	0	7,570
Sale WSPA	21,519	21,519	104	77	100%	10,450	0		919	1,838	12,288
Wandin Yallock WSPA	3,037	3,037	184	206	100%	590	0		163	326	916
Warrion WSPA	14,214	14,214	131	131	100%	3,650	0		461	922	4,572
Wy Yung WSPA	7,521	7,521	61	55	100%	1,110	0		116	232	1,342
Yarram WSPA	25,457	25,457	84	70	100%	11,070	0		970	1,940	13,010
GMA											
Cardigan GMA	3,967	3,759	18	2	50%	10	253	CHW entitlement	481	962	1,225
Colongulac GMA	14,271	3,577	41	16	100%	0	1,073	30% of entitlement	208	416	1,489
Corinella GMA	2,550	164	13	2	100%	0	49	30% of entitlement	157	314	363
Cut Paw Paw GMA	3,650	533	6	3	100%	0	160	30% of entitlement	2	4	164
Frankston GMA	3,200	1,034	25	15	100%	0	310	30% of entitlement	199	398	708
Gellibrand GMA	0	0	0	0	0%	0	0		0	0	0
Gerangamete GMA[5]	8,000	8,000	1	0	0%	2,000	0		5	10	2,010
Giffard GMA	3,000	5,705	14	18	100%	3,260	0		171	342	3,602
Glenormistom GMA	5,042	2,512	35	9	100%	0	753	30% of entitlement	125	250	1,003
Heywood GMA	21,763	6,474	94	31	100%	0	1,942	30% of entitlement	1,735	3,470	5,412
Jan Juc GMA	6,804	4,000	1	0	0%	0	1,200	30% of entitlement	0	0	1,200
Lancefield GMA	1,485	1,373	15	16	100%	400	0	0	76	152	552
Leongatha GMA	6,500	1,471	31	6	100%	0	441	30% of entitlement	114	228	669
Merrimu GMA	452	452	15	9	100%	120	0	0	13	26	146
Moe GMA	8,193	3,299	81	13	100%	0	990	30% of entitlement	197	394	1,384
Moorabbin GMA	4,305	2,202	30	25	100%	0	661	30% of entitlement	238	476	1,137
Nepean GMA	5,000	6,049	65	44	100%	0	1,815	30% of entitlement	1,162	349	2,163
Newlingrook GMA	74,970	1,968	5	2	0%	0	590	30% of entitlement	0	0	590
Orbost GMA	1,200	1,200	3	4	100%	350	0		0	0	350
Paaratte GMA	4,606	3,192	5	0	0%	0	958	30% of entitlement	4	8	966

Groundwater management unit[1]	Allocation limit as of 30/06/06 (ML)	Licensed volumes (as of 30/06/2006)							Domestic/stock		Total use (licensed + D&S)
		Licensed entitlements (ML)	No. of licences	No. of metered bores	Estimated: metering program complete %	Metered volume (ML)	Estimated non- metered Use (ML)[2]	Method used to estimate non-metered use	No. of bores[3]	Estimated use (ML)[4]	
Portland GMA	20,683	2,340	8	1	0%	0	702	30% of entitlement	63	126	828
Rosedale GMA	9,000	13,102	49	37	100%	10,860	0		1	2	10,862
Stratford GMA	31,553	31,553	7	4	100%	17,690	0		410	820	18,510
Tarwin GMA	1,300	41	3	0	0%	0	12	30% of entitlement	806	242	254
Wa De Lock Zone GMA	11,500	26,865	242	107	100%	0	8,059	30% of entitlement	482	964	9,023
Unincorporated areas											
Southern Rural Water		64,712	1,191	0		0	19,414	30% of entitlement	0	0	19,414
Gouburn-Murray Water											
WSPA (approved plan)											
Campaspe Deep Lead WSPA	46,069	46,251	109	105	96%	23,110	344	Operational knowledge of system	188	376	23,830
Shepparton WSPA	244,226	224,226	1,373	789	60%	62,750	0		1,373	2,746	65,496
Spring Hill WSPA	4,957	4,947	56	51	91%	1,850	0		64	128	1,978
Katunga WSPA	59,770	42,487	183	121	66%	21,610	0		593	1,186	22,796
WSPA (draft plan)											
Mid Loddon WSPA	37,200	37,200	120	83	69%	15,830	0		124	248	16,078
Upper Loddon WSPA	12,991	12,991	177	60	33%	2,380	0		198	396	2,776
GMA											
Alexandra GMA	900	1,821	20	0	0%	0	686	Operational knowledge of system	52	104	790
Barnawartha GMA	2,100	595	10	0	0%	0	194	Operational knowledge of system	28	56	250
Ellesmere GMA	1,900	2,616	15	7	47%	1,040	400	Previous readings	27	54	1,494
Goorambat GMA	4,888	1,651	13	0	0%	790	0		17	34	824
Kialla GMA	4,770	2,332	13	0	0%	0	1,062	Operational knowledge of system	23	46	1,108
Kinglake GMA	3,830	2,012	87	0	0%	0	966	From summary sheets	342	684	1,650
Mullindolingong Zone 1 GMA	6,980	1,285	58	0	0%	0	514	40% of entitlement	77	154	668

Groundwater management unit[1]	Allocation limit as of 30/06/06 (ML)	Licensed volumes (as of 30/06/2006)							Domestic/stock		Total use (licensed + D&S)
		Licensed entitlements (ML)	No. of licences	No. of metered bores	Estimated: metering program complete %	Metered volume (ML)	Estimated non- metered Use (ML)[2]	Method used to estimate non-metered use	No. of bores[3]	Estimated use (ML)[4]	
Murmungee GMA	16,710	12,012	191	0	0%	0	4,717	40% of entitlement	1,285	2,570	7,287
Nagambie GMA	5,650	6,476	39	24	61%	1,340	0	0	78	156	1,496
Unincorporated areas											
Goulburn Murray Water		41,179	871	2,393		0	14,413	35% of entitlement	3,193	6,386	20,799
Total	**950,574**	**879,898**	**7,328**	**5,919**		**259,220**	**65,786**		**22,318**	**41,290**	**366,297**

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 35% of entitlement, as per the *2004/05 State Water Report*.

(3) The numbers of domestic and stock bores represent bores registered in the state database records as being drilled since 1965.

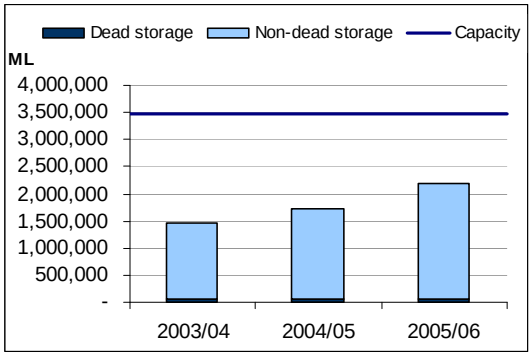
(4) Domestic and stock use is estimated as 2 ML/bore except in the Tarwin and Nepean GMAs (0.3 ML/bore) which is a more accurate estimate for these two GMAs.

(5) Barwon Water's groundwater licence allows extraction of a maximum of 20,000 ML every one year, 80,000 ML over a consecutive 10 year period and 400,000 ML over a 100 year period from the Gerangamete GMA.

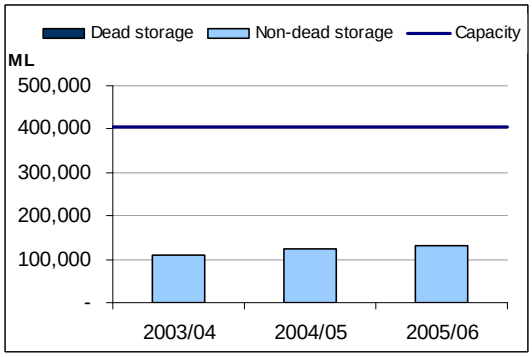
Appendix B

Storage volume by basin

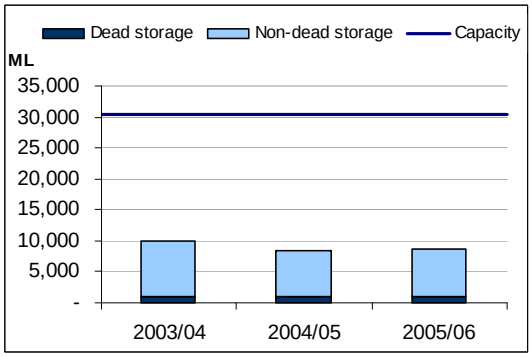
Murray basin



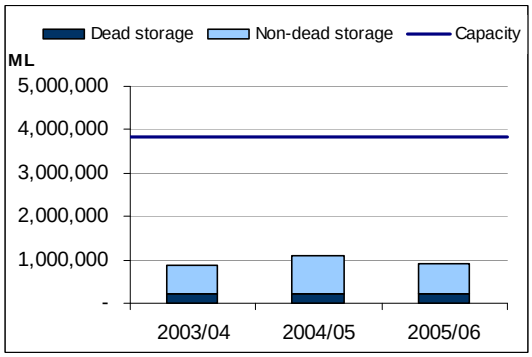
Broken basin



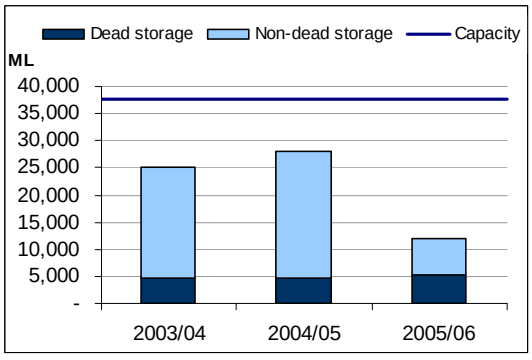
Kiewa basin



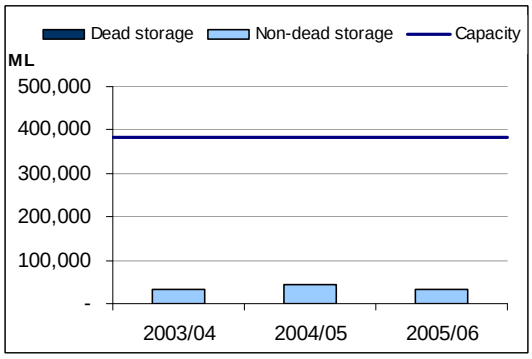
Goulburn basin



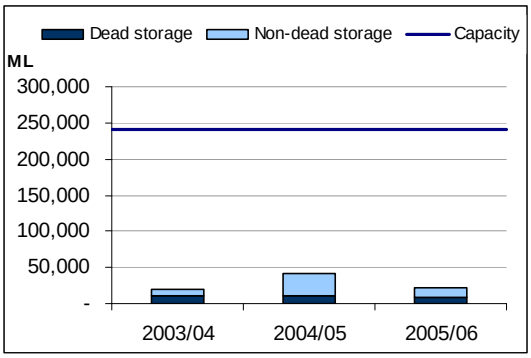
Ovens basin



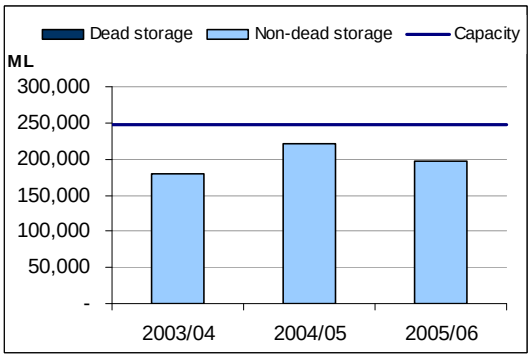
Campaspe basin



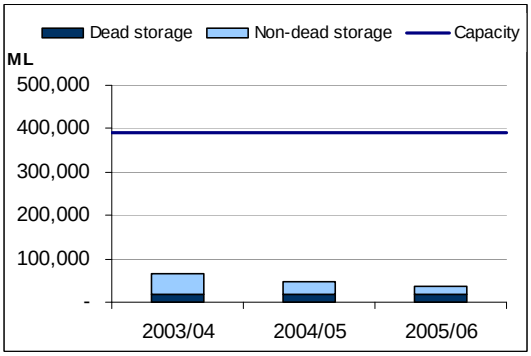
Loddon basin



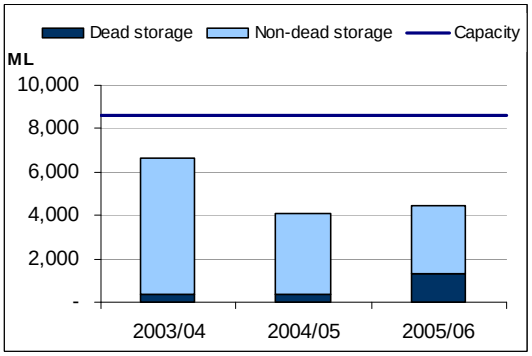
Latrobe basin



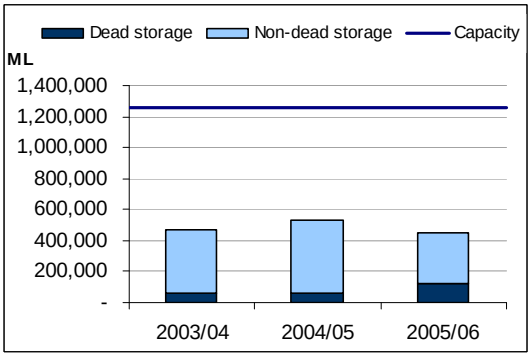
Wimmera basin



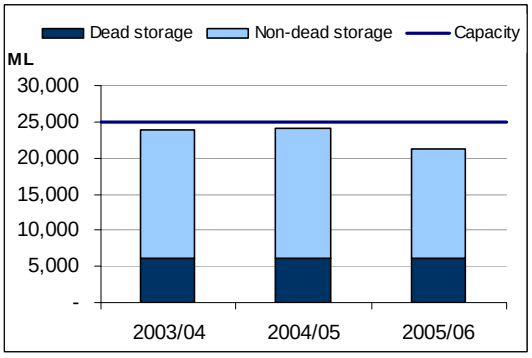
South Gippsland basin



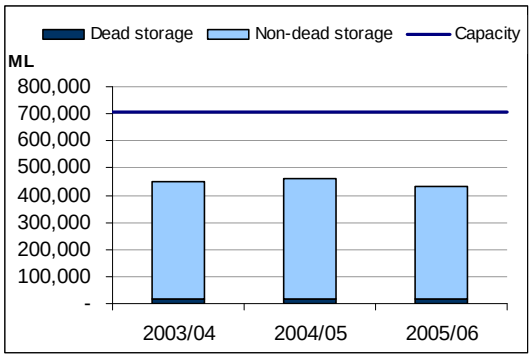
Thomson basin



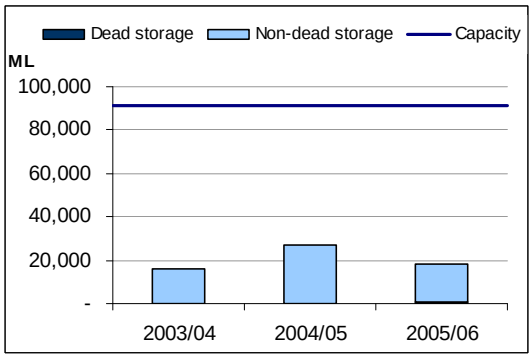
Bunyip basin



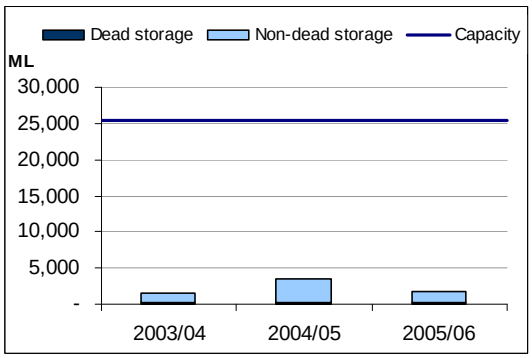
Yarra basin



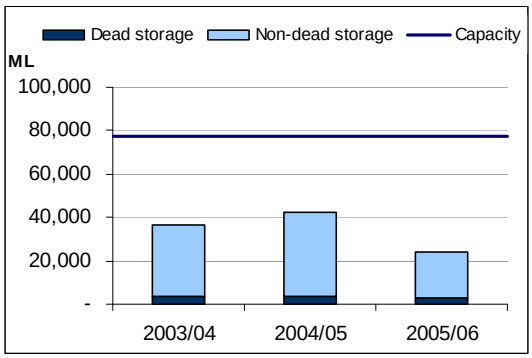
Moorabool basin



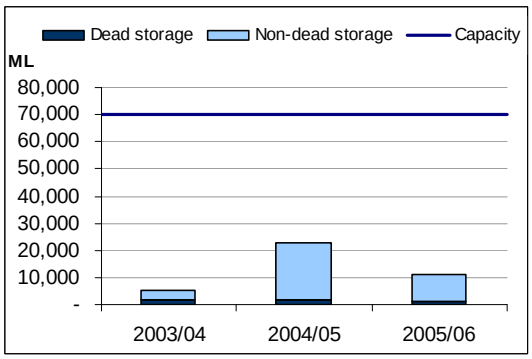
Maribyrnong basin



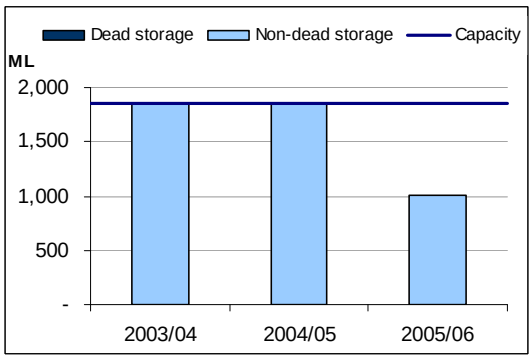
Barwon basin



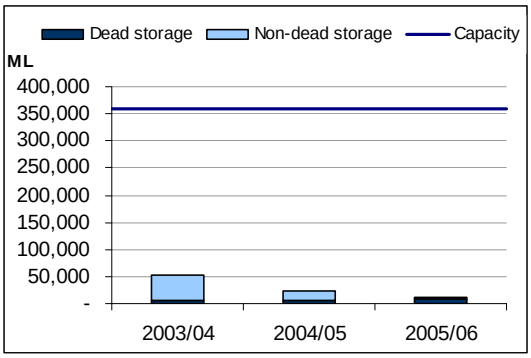
Werribee basin



Otway Coast basin



Glenelg basin



This appendix contains a visual representation of the volume held in storage as at 30 June 2006 in each of the basins. These charts represent all major on-stream and off-stream storages in the basin and therefore do not always correspond with volumes reported in the water balances in each basin account.

Appendix C

On-stream storages used in basin water balances

Basin	Reservoir	Data provider
East Gippsland	None	n/a
Snowy	None	n/a
Tambo	None	n/a
Mitchell	None	n/a
Thomson	Lake Glenmaggie	Southern Rural Water
	Thomson Reservoir (total of SRW+MW shares)	Melbourne Water
Latrobe	Blue Rock (total)	Southern Rural Water
	Lake Narracan	Southern Rural Water
	Moondarra Reservoir	Gippsland Water
South Gippsland	Lance Creek Reservoir	South Gippsland Water
	Hyland Reservoir	South Gippsland Water
	Western Reservoir	South Gippsland Water
	Candowie Reservoir	Westernport Water
Bunyip	Tarago Reservoir	Melbourne Water
Yarra	Upper Yarra Reservoir	Melbourne Water
	O'Shannassy Reservoir	Melbourne Water
	Maroondah Reservoir	Melbourne Water
	Yan Yean Reservoir	Melbourne Water
Maribyrnong	Rosslynne Reservoir (total)	Southern Rural Water
Werribee	Melton Reservoir	Southern Rural Water
	Merrimu Reservoir (total)	Southern Rural Water
	Pykes Creek Reservoir	Southern Rural Water
	Djerriwarrh Reservoir	Western Water
Moorabool	Korweinguboora Reservoir	Barwon Water
	Bostock Reservoir	Barwon Water
	Lal Lal Reservoir (total CHW + BW)	Central Highlands Water
	Wilsons Reservoir	Central Highlands Water
	Moorabool Reservoir	Central Highlands Water
Barwon	West Barwon Dam	Barwon Water
	White Swan Reservoir	Central Highlands Water
	Gong Gong Reservoir	Central Highlands Water
Corangamite	None	n/a
Otway Coast	West Gellibrand Reservoir	Barwon Water
Hopkins	None	n/a
Portland Coast	None	n/a
Glenelg	Rocklands Reservoir	Grampians Wimmera Mallee Water
	Moora Moora Reservoir	Grampians Wimmera Mallee Water
	Konongwootong Reservoir	Wannon Water - Hamilton
	Hayes Reservoir	Wannon Water - Hamilton
Millicent Coast	None	n/a
Murray	Lake Victoria (Victoria's share only)	Murray-Darling Basin Commission
	Menindee Lakes (Victoria's share only)	Murray-Darling Basin Commission
	Lake Hume (Victoria's share)	Goulburn-Murray Water

Basin	Reservoir	Data provider
	Lake Dartmouth (Victoria's share)	Goulburn-Murray Water
	Lake Cullulerаine	Lower Murray Water
Kiewa	Rocky Valley	Southern Hydro
	Lake Guy	Southern Hydro
Ovens	Lake William Hovell	Goulburn-Murray Water
	Lake Buffalo	Goulburn-Murray Water
Broken	Lake Mokoan	Goulburn-Murray Water
	Lake Nillacootie	Goulburn-Murray Water
	Loombah-McCall Say	North East Water
Goulburn	Lake Eildon	Goulburn-Murray Water
	Goulburn Weir	Goulburn-Murray Water
	Sunday Creek Reservoir	Goulburn Valley Water
Campaspe	Upper Coliban Reservoir	Coliban Water
	Lauriston Reservoir	Coliban Water
	Malmsbury Reservoir	Coliban Water
	Lake Eppalock	Goulburn-Murray Water
Loddon	Newlyn Reservoir	Goulburn-Murray Water
	Tullaroop Reservoir	Goulburn-Murray Water
	Cairn Curran Reservoir	Goulburn-Murray Water
	Laanecoorie Reservoir	Goulburn-Murray Water
	Hepburn Lagoon	Goulburn-Murray Water
Avoca	None	n/a
Mallee	None	n/a
Wimmera	Taylors Lake	Grampians Wimmera Mallee Water
	Lake Lonsdale	Grampians Wimmera Mallee Water
	Wartook Reservoir	Grampians Wimmera Mallee Water
	Lake Bellfield	Grampians Wimmera Mallee Water
	Fyans Lake	Grampians Wimmera Mallee Water

Note:
n/a: not applicable.

Abbreviations

AWRC	Australian Water Resources Council
BE	Bulk Entitlement
BOM	Bureau of Meteorology
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CMA	Catchment management authority
D&S	Domestic and stock
DSE	Department of Sustainability and Environment
EC	Electrical conductivity
ESC	Essential Services Commission
EWR	Environmental Water Reserve
FMIT	First Mildura Irrigation Trust
GL	Gigalitre
GMA	Groundwater management area
GMU	Groundwater management unit
ISC	Index of Stream Condition
MDBC	Murray Darling Basin Committee
ML	Megalitre
NTU	Nephelometric turbidity unit
PAV	Permissible annual volume
PCV	Permissible consumptive volume
REALM	Resource Allocation Model
SDL	Sustainable diversion limit
SFMP	Streamflow management plan
SWR	State Water Report
TCSA	Tertiary confined sand aquifer
UA	Unincorporated area
WSPA	Water supply protection area

Glossary of terms

Above cap water: Any water in a basin in excess of water authorities' 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.

Baseflows: The component of streamflow supplied by groundwater discharge.

Basin (river basin): The area of land which a river and its tributaries drain. In the State Water Report river basins are consistent with those defined by the Australian Water Resource Council (AWRC). The exception is the Murray basin which, for the purposes of this report, includes the Upper Murray basin as defined by AWRC and areas in Victoria supplied from the 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*. The 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 the 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 specific timeframe.

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* which include 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 a section 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, as in 'Murray-Darling Drainage Division', 'South-East Coast Drainage Division', etc. Australia has been divided up into 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 the 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 are dependent on the environmental condition of the system.

Evapotranspiration: The process of water being transpired by vegetation.

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 the Department of Sustainability and Environment, the project provided a measure of how much current flow conditions of a stream differs from the flow conditions if no water was 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: All subsurface water, generally occurring in an aquifer.

Groundwater allocation 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.

Irrigation district: An area declared under the *Water Act 1989* supplied with water by channels and pipelines used mainly for irrigation purposes.

Irrigation return flows: Water that is returned to a water course subsequent to being used in an irrigation area (e.g. 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 x 25 kilometres.

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.

NTU: Nephelometric turbidity units, which is a measure of the turbidity of water.

Nutrient: Generally refers to nitrogen and phosphorous in water.

Order (ordering of water): The advance notification given by individual entitlement holders to the storage operator to enable the storage operator to regulate water flows so that all entitlement holders' needs can be met at the agreed 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 of the level of compliance with these requirements.

Permissible annual volume (PAV): The total amount of water that can be taken in a groundwater management area under a Ministerial declaration. The *Water (Resource Management) Act 2005* has replaced this term with a new term: permissible consumptive volume.

Permissible consumptive volume (PCV): See 'permissible annual volume'.

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.

Ramsar Convention: An international treaty that aims to conserve wetlands which have been listed for their international significance and ensure they are managed wisely, signed in Ramsar, Iran, in 1971.

REALM model: A computer-based water supply system model used by the Department of Sustainability and Environment to aid the allocation of Victoria's water resources. Its name is an abbreviation of REsource ALlocation Model.

Recycled water: Water derived from sewerage systems or industry processes which is treated to a standard that is 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 sea or lake or marsh or another river.

River basin: The land which a river and its tributaries drain. See also 'basin'.

Run-off: The volume of water that enters streams and lakes from rainfall.

Sales water: Lower-reliability water offered to irrigators on a seasonal basis, in proportion to their base rights, after provision has been made to meet the base rights in the following year.

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 the water authority and expressed as a percentage of the irrigator's water right or licensed volume. Sometimes shortened to 'allocation'.

Sedimentation: Process where 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*), but for which registration has not yet been completed.

Spill: An uncontrolled flow of water past a reservoir or a weir.

Stormwater: 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 water supply protection area 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.

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 groundwater management area or a water supply protection area.

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 state water accounts is reported as the volume of water diverted from a stream or groundwater bore. It is not reflective of 'use' on a farm or in a town.

Wastewater: For the purposes of this document, wastewater refers to the volume of sewage that enters a treatment plant.

Water authorities: Authorities established under the *Water Act 1989* that have responsibilities to supply water for urban, irrigation, domestic, stock and commercial use in irrigation districts and water districts. Some authorities also have delegated responsibilities for controlling the diversion of water from waterways, passing flows and the extraction of groundwater.

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 authority or person. The government has passed legislation enabling all water rights and licences to be converted into water shares. The first conversions will be in place in July 2007. For more information, refer to the *Our Water Our Future* action plan.

Water supply protection area: 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.