Victorian Water Accounts 2006-2007

A statement of Victorian water resources

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Disclaimer

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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Lake Bellfield, The Grampians

Foreword

Low rainfall and severe drought conditions were major challenges for Victorians in 2006/07, changing the way we view and manage our limited water resources.

The eleventh consecutive year of drought in Victoria saw water storage levels and streamflows drop to seriously low levels in many basins.

Water businesses, in consultation with the Victorian Government, implemented their drought response plans and a range of contingency measures to ensure water continued to flow to meet basic human needs.

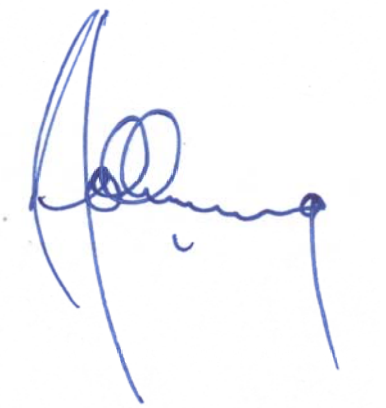
Victorians in urban areas cut their water use dramatically through a combination of water restrictions and conservation measures such as rainwater tanks and more efficient showerheads.

Increased use of groundwater and recycled water, and increased water trading activity were some of the short-term actions relied upon to ensure water was available in those areas that needed it most.

The drought continues to highlight the importance of annually recording and reporting on the availability and use of Victoria's water resources. It also underlines the importance of *The Next Stage of the Government's Water Plan,* announced in June 2007, which includes $4.9 billion in new infrastructure projects to secure water supplies for our future.

The *Victorian Water Accounts 2006-2007* is the fourth consecutive publication to provide a State-wide overview of Victoria's water resource availability and use at bulk supply level. It contributes to the body of knowledge and information available to Government and other parties involved in water resource management across Victoria.

I commend it as an important account of water availability, entitlement, use and related drought response measures for the 2006/07 year.



Tim Holding MP
Minister for Water

Alphabetical listing of Victoria's river basins

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Introduction

Overview of the Victorian Water Accounts 2006-2007

The *Victorian Water Accounts 2006-2007* documents the key water resource management issues for Victoria. The *Victorian Water Accounts 2006-2007* is the fourth in a series of reports[1] providing an overview of water availability and use across Victoria at bulk supply level and reflects the government's continuing commitment to accounting for and reporting on the state's water availability and use.

The Victorian Water Accounts was formerly known as the State Water Report.

As a signatory to the National Water Initiative, Victoria has obligations to implement water accounting systems and report on water entitlements, consumption, trade and environmental releases and initiatives. The *Victorian Water Accounts 2006-2007* is an important component of Victoria's obligations. The government's key policy directions included in Part 3 provide an insight into how it is responding to the main issues facing the water industry and water users in Victoria.

The *Victorian Water Accounts 2006-2007* examines the entire state's water allocation and use for the 2006/07 year at bulk supply level. It is a consolidation of information from all Victorian water businesses[2], catchment management authorities, the Department of Sustainability and Environment, the Essential Services Commission, the Murray Darling Basin Commission, Victorian Alpine Resort Management Boards, power generators and other major users.

The *Victorian Water Accounts 2006-2007* has three parts:

Part 1 provides the statewide overview. It summarises water availability including rainfall, streamflow and storage levels, the amount that was taken for consumptive purposes, and how the government manages water for the environment. This year's edition also includes a detailed discussion of the measures put in place to respond to drought.

Part 2 comprises the state water accounts for each of Victoria's 29 river basins. The accounts include quantitative data on water available and used, and concise commentary that provides the contextual background to the data. An introductory chapter describes the approach taken to compile the basin accounts, as well as key assumptions and any identified limitations of the data.

Part 3 outlines the key policy directions and challenges for water resource planning. In particular, it outlines the next stage of the *Our Water Our Future* action plan, Victoria's planning framework of regional sustainable water strategies, urban water supply initiatives, groundwater management challenges and water accounting and reporting directions.

Victorian Water Accounts and the drought

Victoria remains in the grip of its worst drought on record and 2006/07 was its harshest year to date.

The drought and its impacts are the key themes of the *Victorian Water Accounts 2006-2007*, which plays an important role in providing both the factual and contextual information required for an accurate assessment of the drought's effects on Victoria.

Drought impacts in 2006/07

There are a myriad of statistics that illustrate the severity of the drought. These include:

- Victoria's rainfall was lower than the long term average for the eleventh consecutive year.
- Melbourne experienced its lowest recorded rainfall over a 365-day period for the year leading up to 15 May 2007.
- Storage levels in 17 of the 19 river basins with major storages finished the year lower than they began. In aggregate, Victoria's major water storages held 2,438,000 ML less water as at 30 June 2007 compared with 30 June 2006 – a decline of 52%.
- Increases in storage levels, normal during the winter-spring period, did not occur in 2006/07. Aggregate storage levels declined every month until heavy rains late in the year resulted in a small increase.
- Basin inflows in 2006/07 were 26% of the long term average, with the majority of basins recording less than 20%. Only the Thomson and East Gippsland basins experienced an increase in streamflow compared with 2005/06.
- Inflows into the Murray basin in 2006/07 were 3,253,400 ML lower than 2005/06.

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[1] Previous reports are the *State Water Report 2003-2004*, *State Water Report 2004-2005* and *State Water Report 2005-2006*.

[2] Water businesses include water authorities, Melbourne Water Corporation and metropolitan retailers. The *Water (Governance) Act 2006* amended the *Water Act 1989* to establish water authorities as corporations from 1 July 2007.

- The volume of water diverted for consumptive purposes fell by 24%, or approximately 1,289,000 ML, due to more stringent urban water restrictions, lower seasonal allocations for irrigators and increased bans on diversions from unregulated streams.
- Groundwater use increased by 44% as surface water supplies became increasingly depleted. The volume of groundwater used to augment urban water supplies doubled in comparison with groundwater consumption in 2005/06.

Actions taken to address drought

Lower inflows and falling storage levels prompted government, water businesses and communities to implement a range of drought contingency measures, or to intensify programs already in place. Many urban customers throughout the state experienced water restrictions in 2005/06, some at the highest level of Stage 4. In 2006/07, the number of Victorian towns on restrictions more than doubled. By the end of the year, the number of towns on Stage 4 restrictions exceeded the number on any restrictions at the end of 2005/06.

Seasonal allocations were again low in regulated irrigation districts. Unlike prior years, however, no irrigation district received a 100% allocation. The Murray (95%), Broken (77%) and Thomson-Macalister (60%) districts were the only systems to receive more than a 40% allocation. Campaspe, Loddon and Wimmera irrigators received a zero allocation for the entire year.

In the irrigation districts, the water market played an important role by allowing irrigators to adjust their allocations.

The Minister for Water used his powers under the *Water Act 1989* to qualify rights to water in a number of basins. For example, the Minister established new diversion points and allocated additional water to priority urban, rural and power-generation customers. These qualifications ensured that water supplies for consumptive purposes, already at critical levels, did not further deteriorate.

Other measures taken to secure supplies included increasing the use of groundwater (at times through emergency bores) and recycled water, augmenting both urban and rural water supplies. New and upgraded infrastructure included modifications to storages, pipelines and treatment plants. Where required, and usually as a last resort, water was carted from one town to another.

The drought also presented a challenge for the environment's allocation of water. Several qualifications of rights had the effect of reducing passing flow requirements or postponing releases of environmental water. The volume of water released under environmental entitlements (excluding the Barmah/Millewa Forest Environmental Allocation) reduced from 71,400 ML in 2005/06 to 46,400 ML in 2006/07.

Conclusion

Sustainable management of our water resources cannot be achieved without adequate monitoring, accounting and reporting. The *Victorian Water Accounts 2006-2007* provides public accountability for water availability, 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.ourwater.vic.gov.au/victorianwateraccounts.

Part 1
Overview of Victorian water resources 2006/07

Part 1 of the *Victorian Water Accounts 2006-2007* provides a statewide overview of Victoria's water resources during the year. It reports on the:

- quantity of water available in terms of rainfall, streamflow, reservoirs and aquifers
- quantity of water allocated for consumption from reservoirs, streams and aquifers under entitlements issued by government, as well as quantity used and quantity recycled
- actions taken by the government and water businesses to respond to drought, including water restrictions, qualifications of rights and bans
- water available to the environment.

1 Water availability

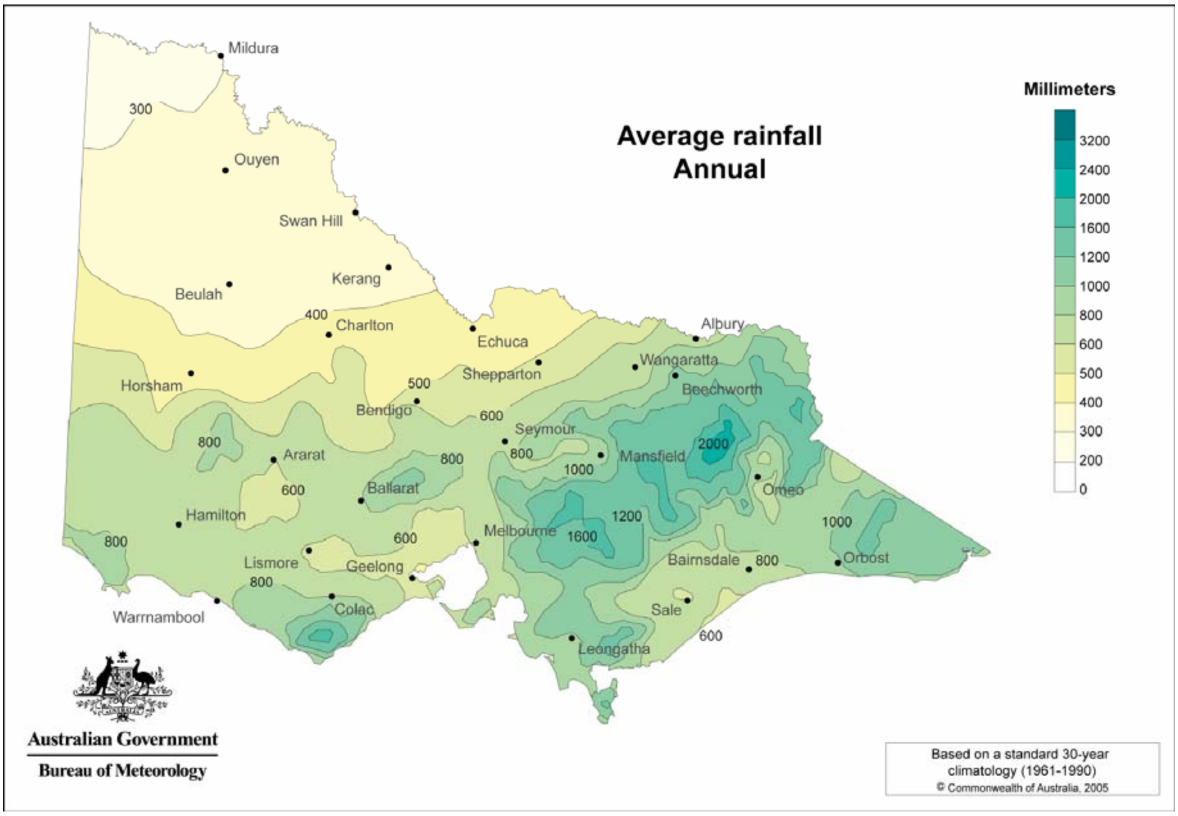
This chapter presents a description and analysis of surface water and groundwater in Victoria during 2006/07. It examines how much surface water was available in Victoria during the year compared with previous years and reports rainfall, streamflow and reservoir levels. The chapter also presents a high level synopsis of Victoria's groundwater resources during 2006/07, including groundwater levels, entitlement volumes and extractions.

1.1 Rainfall

Victoria's rainfall in an average year is shown in Figure 1-1. The average rainfall varies from less than 300 millimetres a year in the north-west of the state, up to approximately 2,000 millimetres a year in the alpine area of north-east Victoria.

Most of Victoria's rainfall cannot be diverted for consumptive uses. Of the rain and snow falling across the state, around 84% evaporates or is transpired by vegetation (evapotranspiration), around 15% becomes surface run-off and streamflow, and around 1% recharges groundwater aquifers.

Figure 1-1 Victorian average annual rainfall



Victoria's rainfall during 2006/07 is shown in Figure 1-2, and is compared to the long term average rainfall in Figure 1-3. Rainfall conditions were below average across most of the state in 2006/07. A small pocket in the south east area of the state was the only region to receive higher than average rainfall. The rainfall in this area of central and east Gippsland, which includes parts of the Latrobe, Thomson, Mitchell, Tambo and Snowy basins, was also well below average until 26 June, when between 140 and 250 millimetres fell in 72 hours, approximately a quarter of the average annual rainfall.

The majority of the state received between 60% and 80% of the long term average rainfall during 2006/07. Rainfall was particularly low (between 40% and 60% of average) in the north eastern part of the state and around Port Phillip Bay and Westernport.

Figure 1-2 Victorian rainfall in 2006/07 (millimetres)

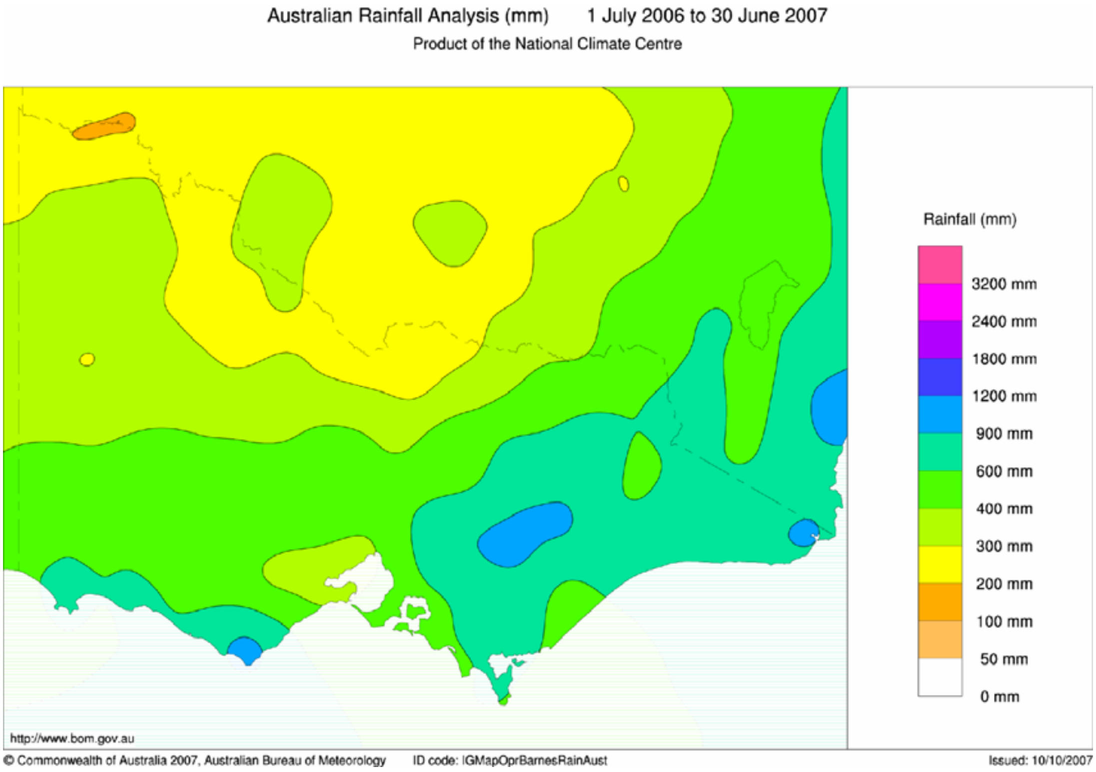


Figure 1-3 Victorian rainfall in 2006/07 relative to average rainfall

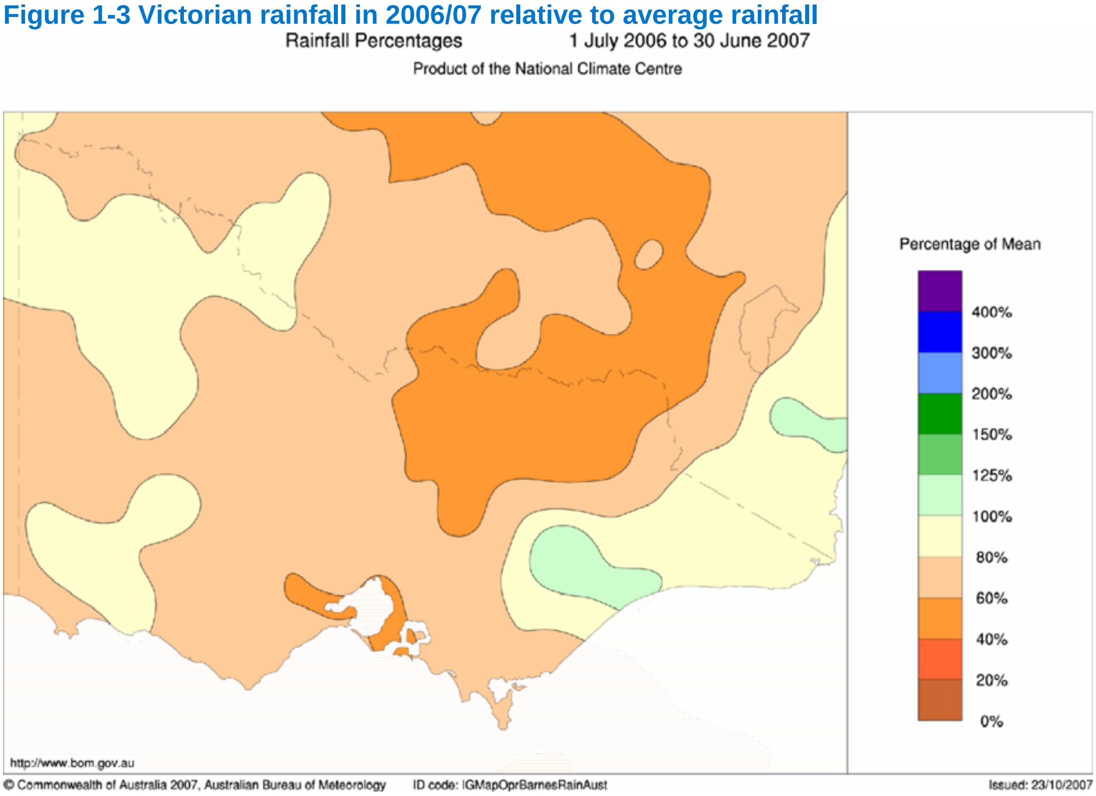
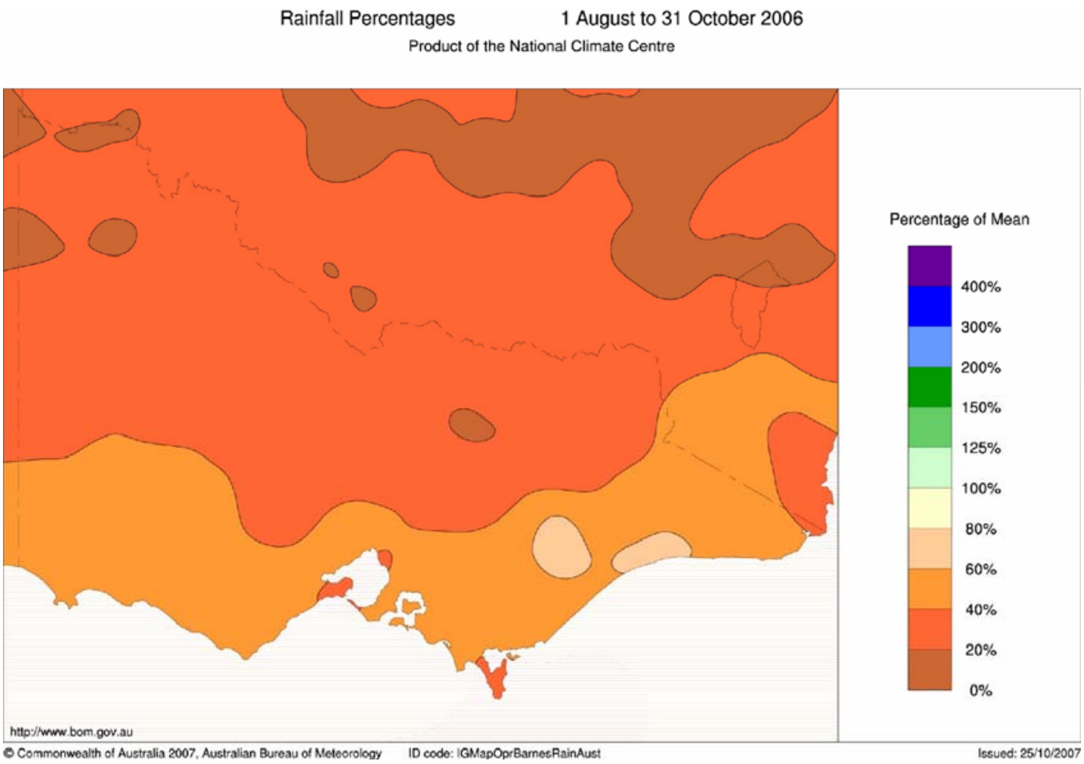


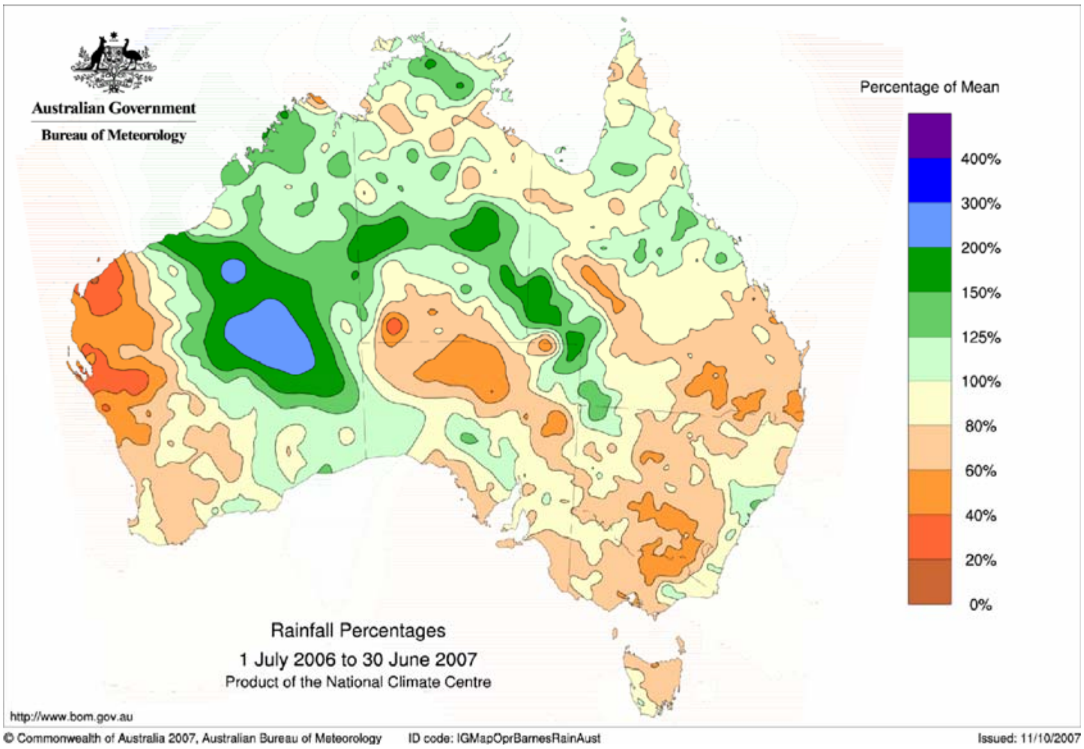
Figure 1-4 shows the particularly low rainfall from August to October 2006. Apart from a few pockets, the southern part of Victoria experienced rainfall of 40% to 60% of the long term average, while in the northern part of the state rainfall was 20% to 40% of the average. Generally the winter-spring period receives the highest rainfall of the year. However, as Figure 1-4 demonstrates, rainfall during this period was well below the long term average. The 365-day period leading up to 15 May 2007 was Melbourne's driest 365-day period on record, receiving 316.4 millimetres of rain, less than half the average rainfall. The previous 365-day record of 318.0 millimetres was set in 1967/68, although 2002/03 was almost as dry, recording 320.2 millimetres.

Figure 1-4 Victorian rainfall from 1 August to 31 October 2006 relative to average rainfall



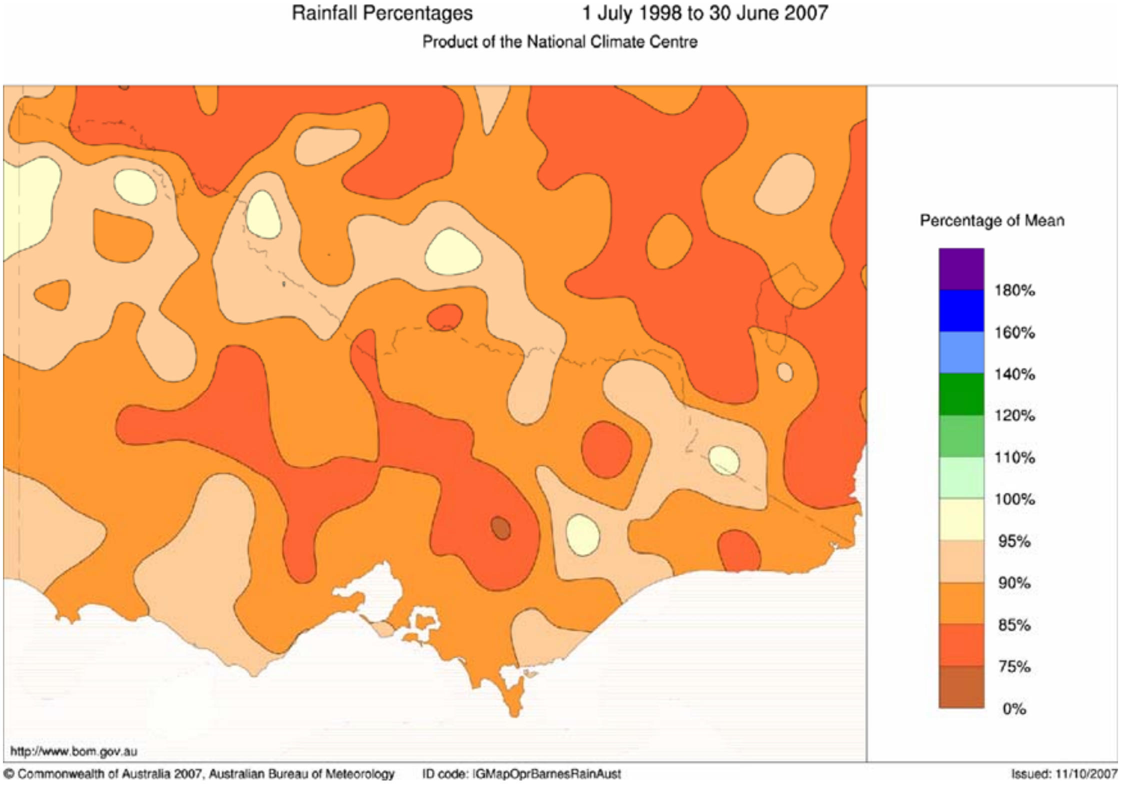
The pattern of generally below average rainfall in many parts of Victoria for 2006/07 is consistent with that experienced in most of south-eastern Australia over the period. As a national context for Victoria's conditions, rainfall patterns in most of New South Wales were similar to Victoria, although rainfall deficiencies in central New South Wales and southern Queensland (areas that are part of the Murray-Darling basin system) were even more severe. In contrast, much of western and northern Australia experienced rainfall above long term averages (Figure 1-5).

Figure 1-5 Australian rainfall, percentage of average, 1 July 2006 to 30 June 2007



The very dry conditions experienced in Victoria in 2006/07 occurred after a decade of lower than average rainfall and inflows. Figure 1-6 depicts the average annual rainfall in Victoria for the 2006/07 year as a percentage of the long term average. It shows that, on average, rainfall over the past 10 years in most parts of the state has been 75% to 95% of the long term average, with the greater portion lying between 85% and 90% of the average. Melbourne's catchment areas have experienced rainfall between 75% and 90% of the average.

Figure 1-6 Average annual rainfall percentage 10 years ending June 2007



Data from the Bureau of Meteorology indicates that evaporation was above historical long term averages for the majority of the state in 2006/07.

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 subsurface geology, permeability and moisture levels of the soil, vegetation cover, and the pattern of individual rainfall events.

The streamflow data presented in Table 1-1 is taken from the water balance for each basin in Part 2 of this report. The table includes a comparison with streamflow in 2006/07 and average streamflow over the long term.

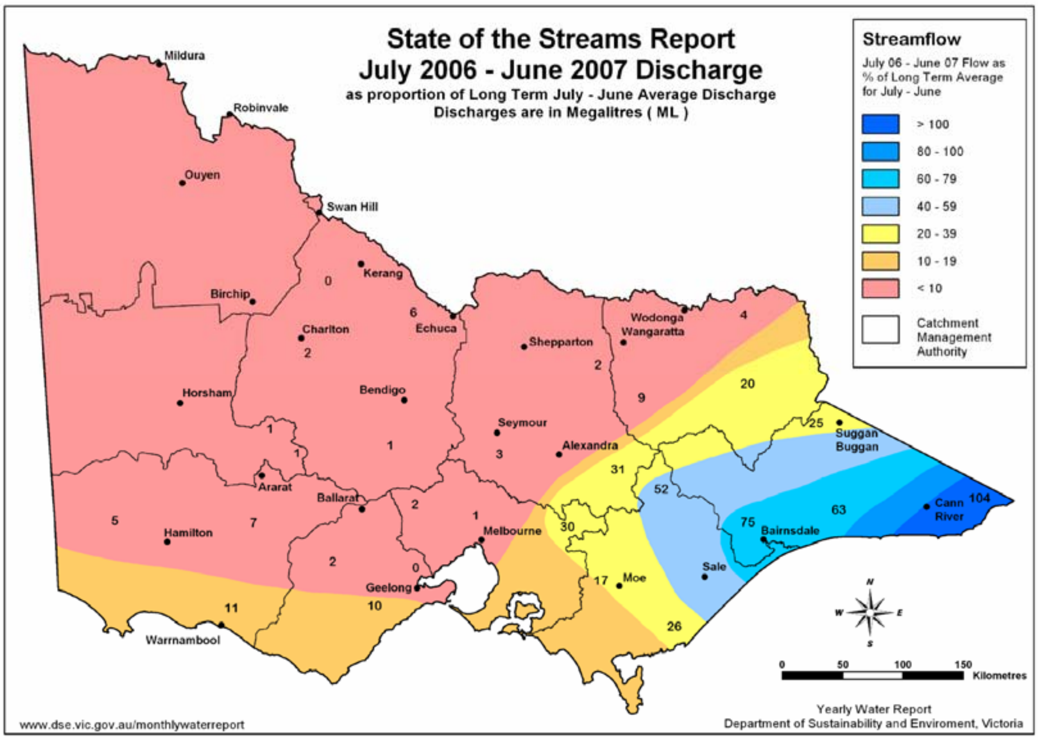
Table 1-1 shows that despite rainfall of between 60% and 100% of the long term average across the majority of the state, streamflows were significantly lower than average. Only the Snowy and East Gippsland basins recorded streamflows of more than 50% of the long term average. Many areas of the state experienced record low flows. Out of Victoria's 29 river basins, 15 experienced inflows of less than 20% of the long term average, including the River Murray at 16%. Overall, the state's inflows were 26% of the long term average.

In 2006/07, only the Thomson and East Gippsland basins recorded higher inflows than 2005/06. In the Thomson's case, this occurred because of a major flood in the Macalister River in late June 2007. Basins experiencing significant reductions in streamflow included the Ovens (87% reduction in streamflow compared with 2005/06), Corangamite (84%), Murray (74%), Kiewa (74%), Broken (72%) and South Gippsland (70%) basins.

Figure 1-7 shows Victorian streamflows in 2006/07 as a percentage of the long term average flow. The figure demonstrates a distinct pattern of severe conditions across most of Victoria. A large part of the state experienced flows less than 10% of the long term average. Moving eastward the streamflows increase, with only a small area in the far eastern tip of the state experiencing flows above average. Streamflows were considerably lower than in 2005/06 when western Victoria was the only area of the state with streamflows less than 10% of the long term average. The heavy rainfall in the Gippsland region in the last three days of the year resulted in severe flooding that not only increased streamflows in 2006/07, but will impact 2007/08 streamflows as the resulting high flows extended into July 2007.

Figure 1-8 depicts the 10 year average streamflows in Victoria as a percentage of the long term average and demonstrates a similar, if not as pronounced, pattern as Figure 1-7. The lowest flows were observed in the western third of the state and the flows generally increased moving east.

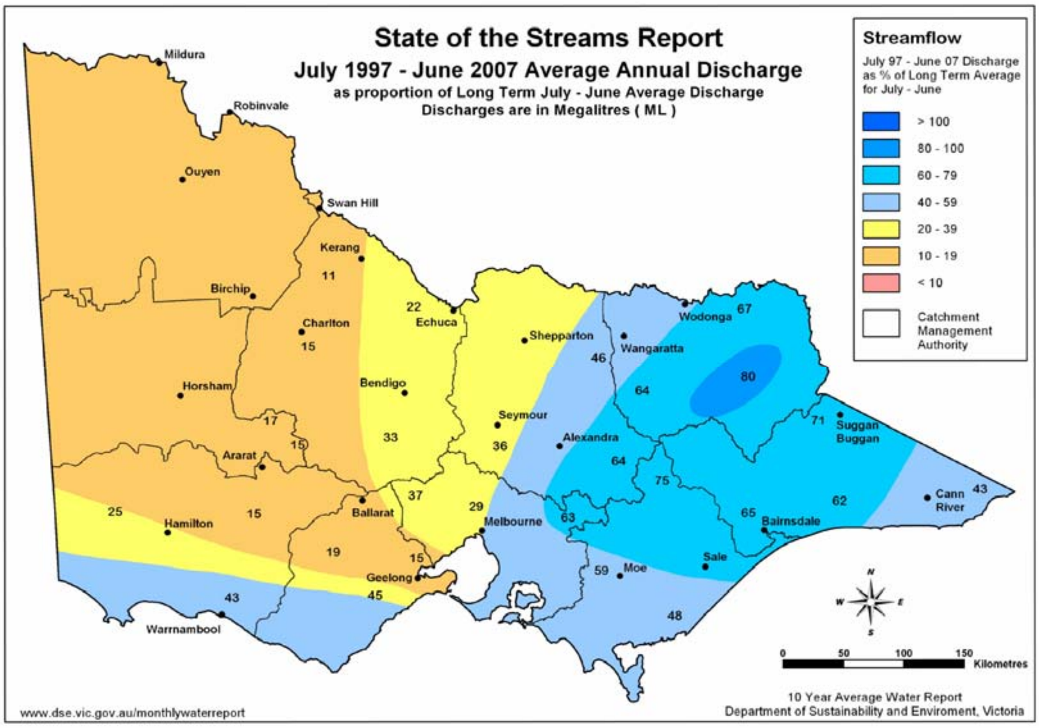
Figure 1-7 Streamflow in 2006/07 expressed as a percentage of long term average flow(1)



Note:

(1) Figure 1-7 shows an isoline representation of 2006/07 streamflow as a percentage of long term average streamflow (inclusive of 2006/07), based on data from 28 selected streamflow gauges distributed across Victoria. The percentages are not directly comparable to the total river basin flows listed in Table 1-1 because some gauges are located downstream of major storages, and the period of streamflow record differs for each site.

Figure 1-8 Streamflow July 1997 to June 2007 expressed as a percentage of long term average flow(1)



Note:

(1) Figure 1-8 shows an isoline representation of 1997/98 to 2006/07 streamflow as a percentage of long term average streamflow (inclusive of 2006/07), based on data from 28 selected streamflow gauges distributed across Victoria. The percentages are not directly comparable to the total river basin flows listed in Table 1-1 because some gauges are located downstream of major storages, and the period of streamflow record differs for each site.

Table 1-1 Streamflow compared with long term average

Basin	Average annual streamflow (ML) [1]	2006/07 streamflow		2005/06 streamflow	
		(ML) [2]	(% of average) [2]	(ML) [2]	(% of average) [2]
Murray	7,000,000	1,140,900	16%	4,394,300	63%
Kiewa	679,000	169,800	25%	651,600	96%
Ovens	1,692,000	190,400	11%	1,417,100	84%
Broken	326,000	71,700	22%	259,200	80%
Goulburn	3,366,000	777,700	23%	1,953,500	58%
Campaspe	305,000	34,500	11%	80,900	27%
Loddon	415,000	39,900	10%	124,000	30%
Avoca	136,200	16,500	12%	24,500	18%
Mallee	0	0	Not applicable	0	Not applicable
Wimmera	316,400	43,700	14%	109,600	35%
East Gippsland	1,122,000	788,600	70%	508,600	45%
Snowy [3]	1,447,300	780,800	54%	1,078,300	75%
Tambo	570,000	115,600	20%	167,500	29%
Mitchell	1,355,000	353,800	26%	675,700	50%
Thomson	1,414,000	665,200	47%	489,000	35%
Latrobe (4)	875,000	306,500	35%	520,200	59%
South Gippsland	1,157,000	191,100	17%	632,600	55%
Bunyip	541,000	265,900	49%	484,800	90%
Yarra [4]	1,054,000	388,200	37%	582,600	55%
Maribyrnong [4]	113,000	19,600	17%	30,400	27%
Werribee [4]	102,000	15,400	15%	19,200	19%
Moorabool [4]	97,000	25,100	26%	47,900	49%
Barwon [4]	360,000	83,400	23%	142,000	39%
Corangamite	316,000	11,700	4%	71,000	22%
Otway Coast	884,000	297,000	34%	467,300	53%
Hopkins	635,000	82,100	13%	154,900	24%
Portland Coast	361,000	57,100	16%	69,600	19%
Glenelg	964,000	140,200	15%	140,400	15%
Millicent Coast [5]	0	0	Not applicable	0	Not applicable
Total	**27,602,900**	**7,072,400**	**26%**	**15,296,700**	**55%**

Notes:

(1) Data is average 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, where estimates are based on model outputs. The average for all other catchments is based on the average annual flow calculations of the Sustainable Diversion Limits project (Department of Natural Resources and Environment, 2002) 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) Volumes shown for Snowy basin exclude catchment inflows from NSW (i.e. above Burnt Hut Crossing).

(4) Average annual streamflow volumes obtained from the Central Region Sustainable Water Strategy (Department of Sustainability and Environment, 2006).

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

As Table 1-2 makes clear, streamflow in 2006/07 declined substantially from prior years.

Table 1-2 Streamflow compared with long term average

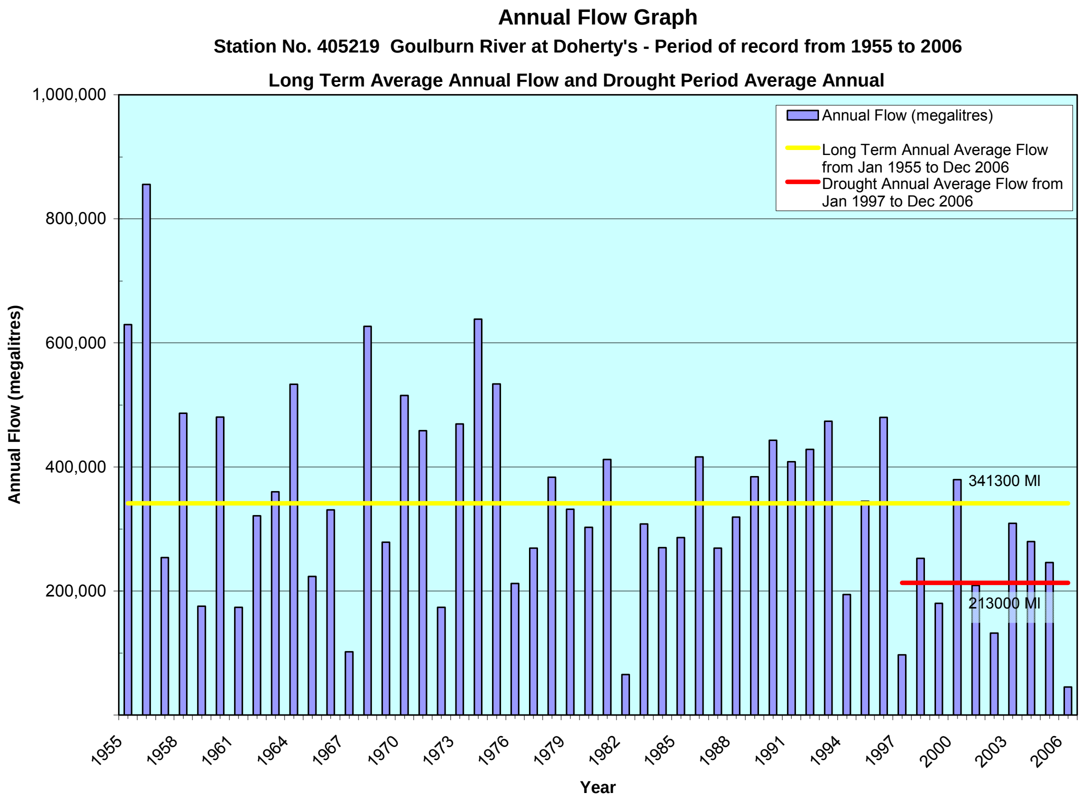
Year	Streamflow (ML)	% of average
2003/04	16,848,300	62%
2004/05	17,015,900	62%
2005/06	15,296,700	55%
2006/07	7,072,400	26%

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 depict flows across a selection of waterways for the calendar year to the end of 2006. They demonstrate that the 2006 flows were significantly lower than the average of the last 10 years. They also show that average flows since 1997 have been significantly lower than the long term average flows. Water shortages resulting from these low flows have been felt by rural and urban communities and the environment. Note that 2006/07 streamflows in Table 1-1 are for the period from 1 July 2006 to 30 June 2007, whereas the volumes shown in Figures 1-9 to 1-15 are for a calendar year. These are the same figures included in the State Water Report 2005/2006 because compilation of data for the 2006/07 Report took place before the end of the 2007 calendar year.

Figure 1-9 Annual (calendar year) streamflow at Goulburn River



Annual flows in the Goulburn River over the past ten years have been 62% of the long term average flow and the 2006 flow was substantially lower than the past ten year average. The severe water shortage was reflected by the Goulburn irrigation allocation of 29% in April 2007 and numerous towns being placed on Stage 4 restrictions across the Goulburn basin.

Over the past ten years, annual flows in the Loddon River have been 33% of the long term average, with 2006 the lowest for more than 60 years. In 2006/07 inflows to storages in the Loddon basin were significantly reduced and storage levels were 5% of capacity by year end, a reduction from 9% at the end of 2005/06.

Figure 1-10 Annual streamflow at Loddon River

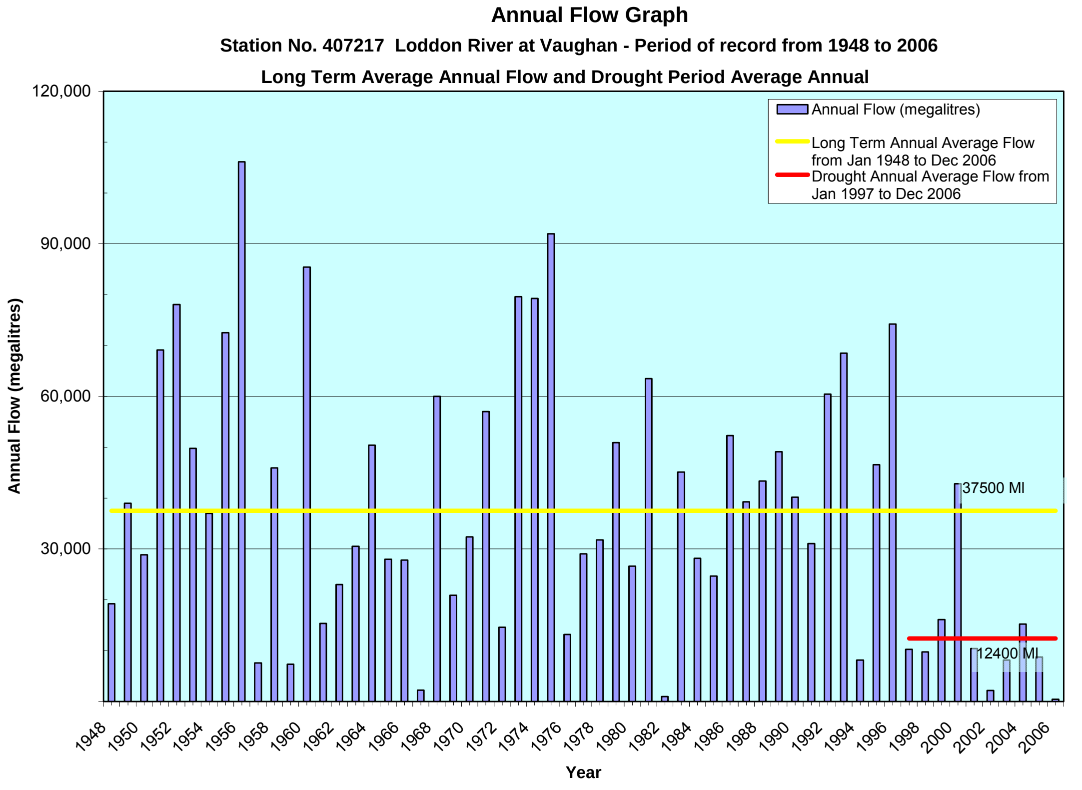
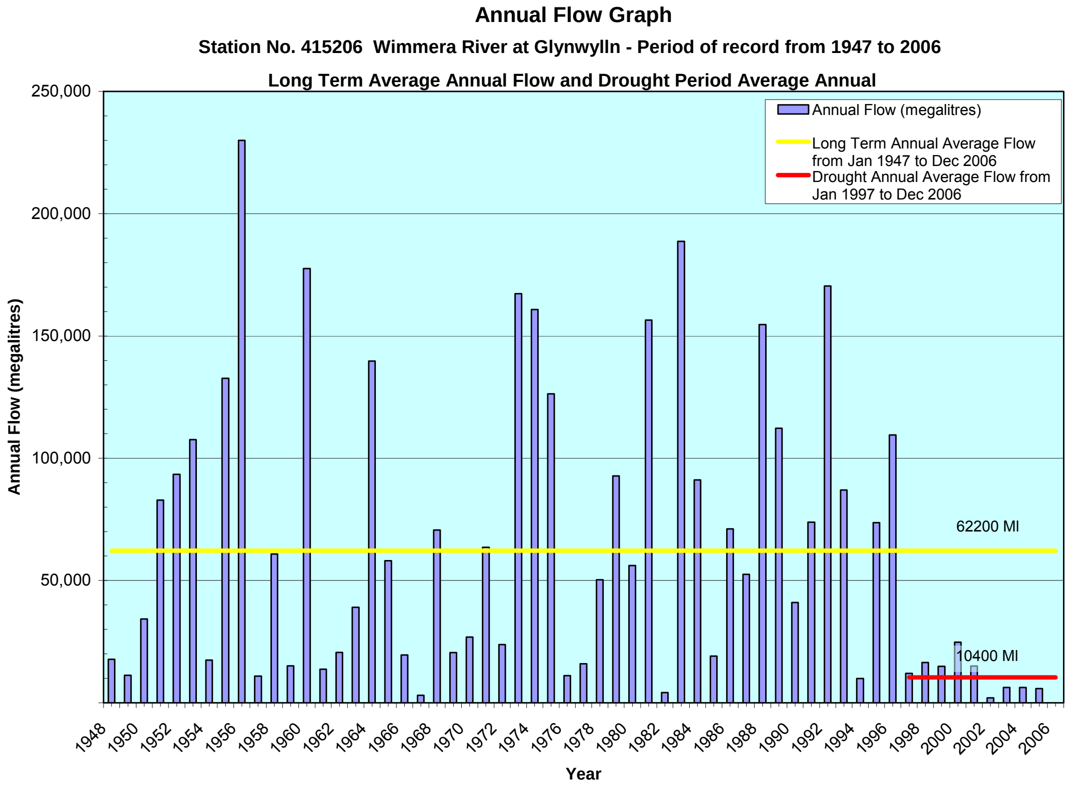
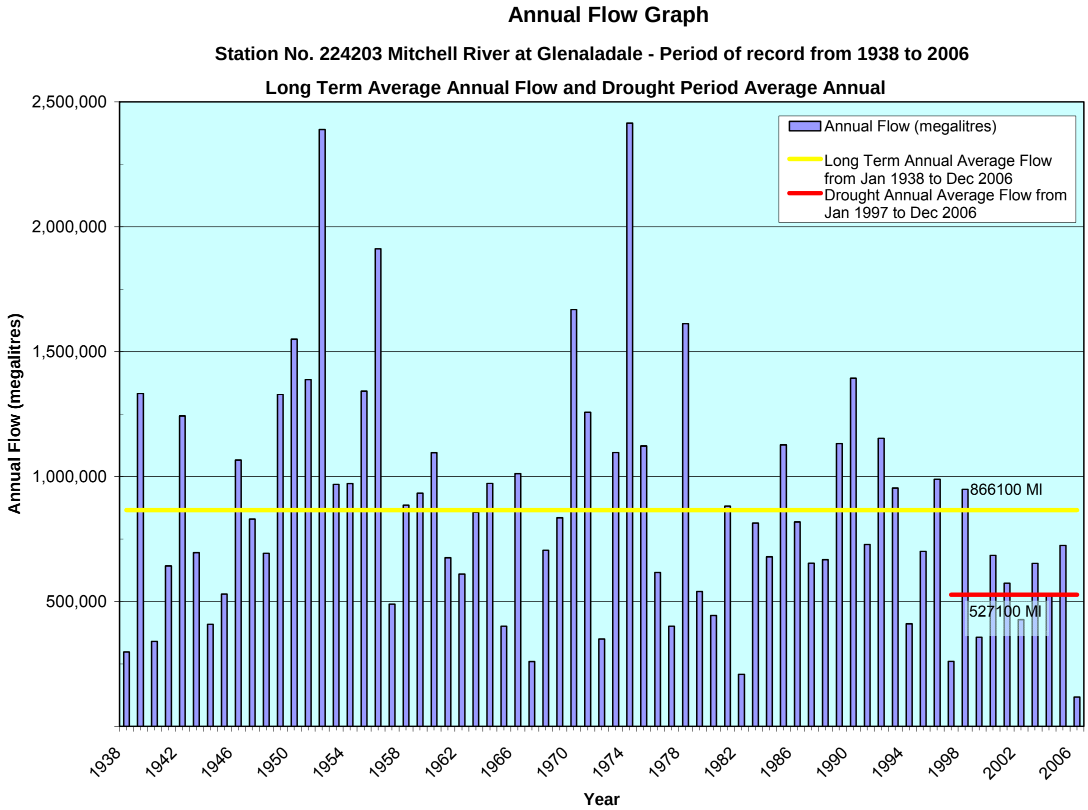


Figure 1-11 Annual streamflow at Wimmera River



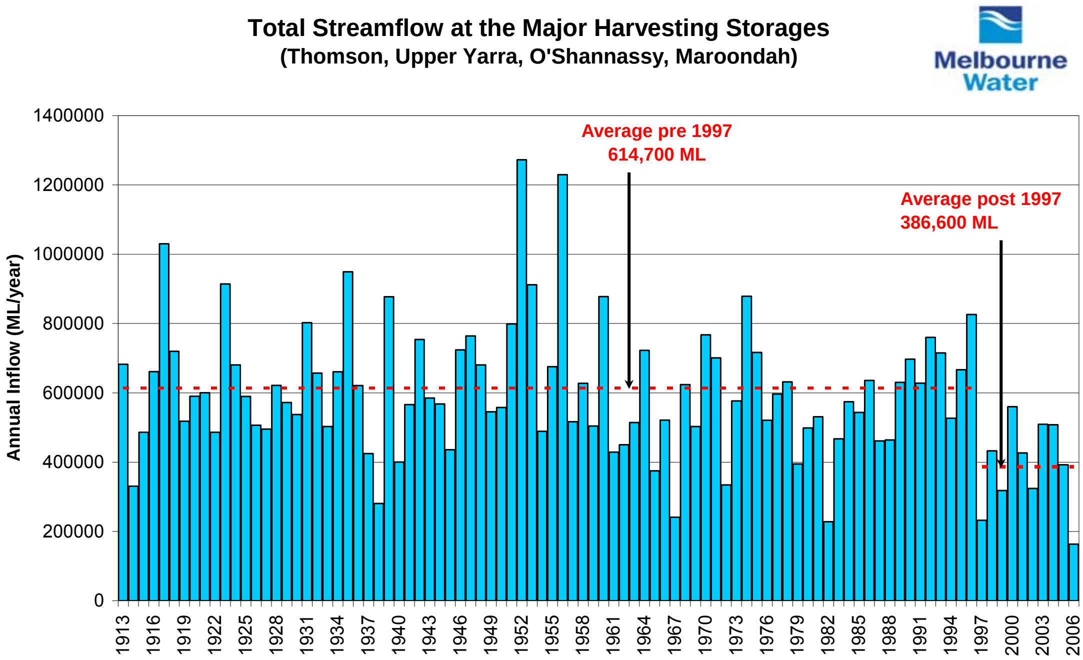
The Wimmera River has experienced a severe decrease in annual flows over the past ten years. The ten year average annual flow to 2006 represents 17% of the long term average flow. Major storages in the Wimmera basin continued to remain at historically low levels, and ended the year at 9% of capacity, a slight reduction from 10% at the end of 2005/06. Due to the seriousness of the regional water supply situation, with storages low, 2006/07 inflows were half of what was recorded in 2005/06 and 18% of the long term average, there was only enough water to supply towns from the winter channel run. GWMWater trucked water to fill tanks on farms for essential domestic and stock supply. Irrigation customers did not receive any allocation in 2006/07 and the Wimmera and Glenelg Rivers' environmental entitlement received a small allocation, which was retained in storage for emergency response purposes.

Figure 1-12 Annual streamflow at Mitchell River



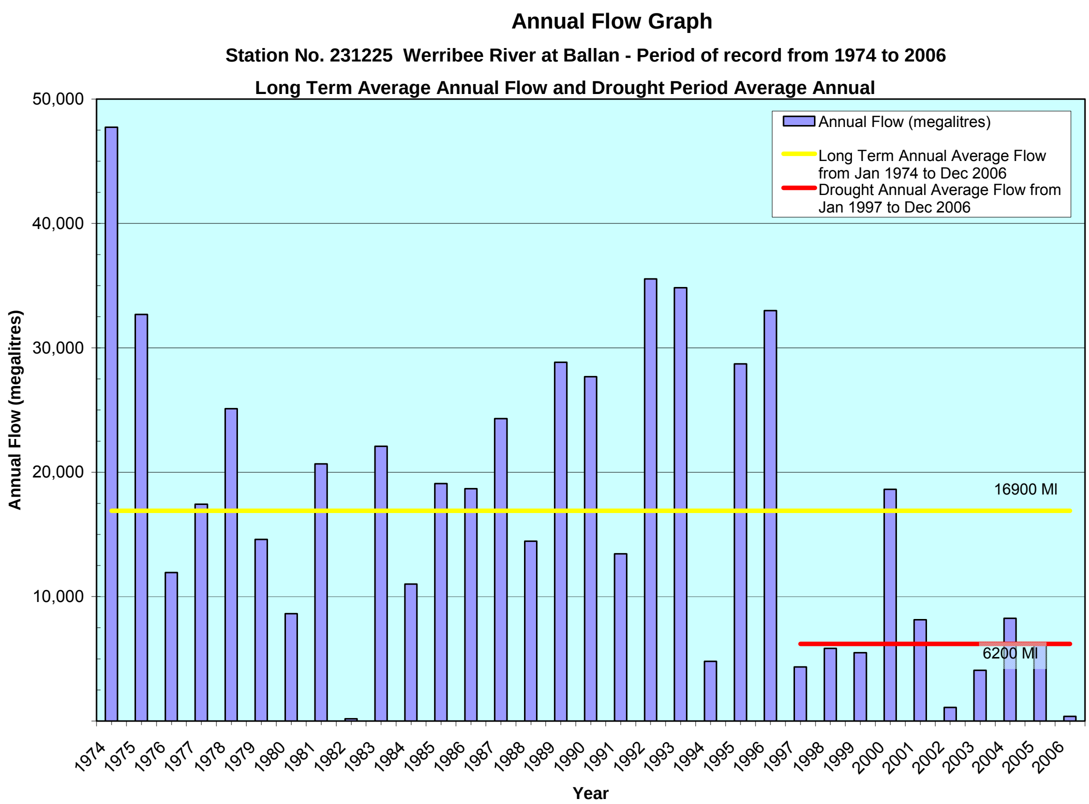
Over the past ten years, annual flows in the Mitchell River have been 60% of the long term average. In 2006/07 dry catchment conditions meant that inflows were 26% of the long term average. Unregulated diversions were restricted from August to January, banned until March, and then unrestricted for the remainder of 2006/07.

Figure 1-13 Annual streamflow at Melbourne's storages



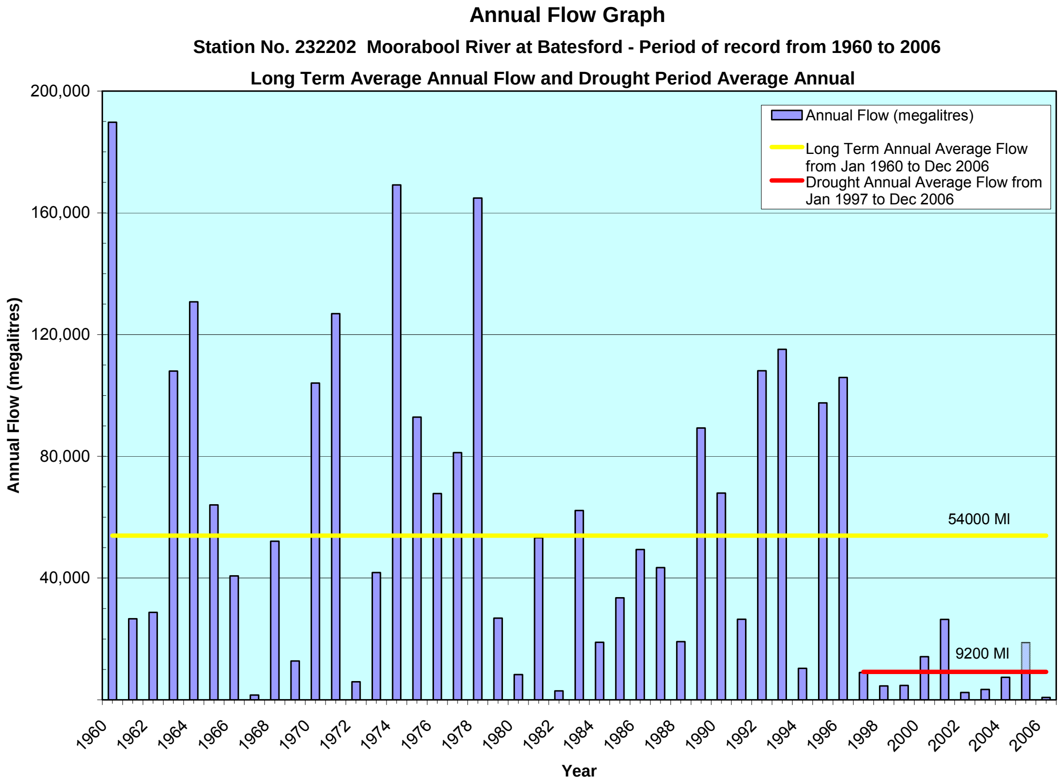
Since 1997, the average annual inflows to Melbourne's storages have been 63% of the long term average (1913 to 1997). Storages close to full in 1997 have since experienced a gradual decline. Inflows to Melbourne's storages continued to drop in 2006/07, and Stage 1 restrictions were implemented in September 2006, gradually increasing to Stage 3a in April 2007. Licensed diversions on unregulated streams in the Yarra basin were subject to restrictions and bans throughout the year.

Figure 1-14 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 16% at the beginning of the year to 9% at the end. Inflows in 2006/07 were 8% of the long term average. Irrigators in the Werribee and Bacchus Marsh districts, who received an 80% allocation in 2005/06, experienced a significant reduction in allocations in 2006/07 in response to the dry basin conditions, receiving only 10% in 2006/07. Werribee irrigators are taking advantage of the Werribee Recycled Water Scheme, with 85% of Werribee's market gardeners (the largest customer group in the district) using recycled water on crops.

Figure 1-15 Annual streamflow at Moorabool River



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

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. In 2006/07 storages decreased from 20% at the start of the year to 5% by year end. Stringent restrictions or total irrigation bans were in place on licensed irrigation diversions from the Moorabool River throughout the year.

1.2.2 Bushfires

In the summer of 2006/07 bushfires had a major influence on the availability of water in a number of areas of the state. Large parts of the Thomson, Macalister, Mitchell, Goulburn, Broken and Ovens catchments in eastern Victoria, and the Grampians in western Victoria were burnt.

North of the divide, concerns were held about the quality of water supplies to towns such as Mansfield, Sawmill Settlement, Merrijig, Benalla, Myrtleford, Bright and Harrietville after the bushfires. However, major water quality problems did not eventuate. Water corporations were able to pass the poor quality water flushed down the rivers after storms or, when necessary, caution customers about using poor quality water and issue alerts to boil drinking water.

South of the divide, the bushfires led to acute water quality problems for Maffra and for towns supplied by the Mitchell River, including Bairnsdale and Lakes Entrance.

The first significant rainfall events after the bushfires in the Macalister catchment resulted in extremely turbid water that could not be treated with existing facilities at Maffra and Lake Glenmaggie. The problem was delayed for Maffra because of the buffering action of Lake Glenmaggie which gave Gippsland Water time to upgrade its water treatment plant to cope with high turbidity water. Water was carted to the small settlements of Glenmaggie and Coongulla, which are supplied directly from Lake Glenmaggie.

Rainfall events after the bushfires in the Mitchell River catchment caused very high turbidity levels in the Mitchell River. As a result, East Gippsland Water was not able to pump from the river to supply the towns serviced from its Mitchell River system. However, the authority had enough water stored in its off-stream storages to give it time to implement emergency contingency measures.

1.2.3 Blue-green algal blooms

Low streamflows were a contributing factor to the outbreak of a number of blue-green algal blooms in 2006/07. Low inflows and storages, warm temperatures and high nutrient loads can result in rapid growth of blue-green algae with blooms becoming visible across the water surface. Blue-green algae can irritate the skin and, when they die, can deplete oxygen levels in the water to such an extent that it can harm or kill aquatic life.

Table 1-3 summarises the high alert blue-green algal blooms recorded between March and June 2007. The high alert status advises that direct use for drinking water, domestic and stock watering and recreational activities (swimming, diving etc) should be avoided. Under a high alert blue-green algal bloom, water businesses must notify the public and activate their risk management plans to ensure that either treatment removes the algae or the water source is taken off-line.

Table 1-3 High alert blue-green algal blooms from March to June 2007

Basin	Location	Time period	Management response
Ovens	Blampieds – Tagells / Entrance	April to June 2007	Media release issued
Campaspe	Campaspe River downstream of Lake Eppalock	March 2007	Media release issued, customers notified to avoid using water from the site for any purpose
	Lake Eppalock	March 2007	Warning signs erected, Coliban Water notified for treatment response
	River Murray at Echuca	May 2007	Daily monitoring
Loddon	Laanecoorie Reservoir	March 2007	Media release issued, warning signs erected
	Lake Boga	March to June 2007	Media release issued
	Loddon River at Kerang Weir	March 2007	Testing confirmed cell count was decreasing
	Loddon River at Laanecoorie	March 2007	Media release issued, warning signs erected
	Tullaroop Reservoir	March to May 2007	Media release issued
	Reedy Lake at Apex Park	March 2007	Media release issued, warning signs erected
	Torrumbarry Irrigation Area	March 2007	Testing confirmed cell count was decreasing
	Trentham Reservoir No.1 & No.2	May 2007	Reservoir not in use
	Centenary Reservoir	May 2007	Taken off-line
Mallee	Hattah Lakes	March to April 2007	Warning signs erected, park users notified
Thomson	Gippsland Lakes – Warm Holes No.5	April 2007	Regular monitoring
South Gippsland	Korrumburra No.1 storage	March 2007	Storage isolated and treated
	Lance Creek Reservoir	June 2007	Ongoing monitoring
Bunyip	Berwick Springs – Greaves Road retarding basin	April 2007	Testing confirmed cell count was decreasing
	Monbulk Creek retarding basin	April 2007	Warning signs erected, regular monitoring
Yarra	Yan Yean Reservoir	March to April 2007	Taken off-line
	Henley golf course – lake	April 2007	Warning signs erected
Werribee	Merrimu Reservoir	March to June 2007	Media release issued, regular sampling
	Werribee River, Werribee South	March to June 2007	Media release issued, warning signs erected, regular sampling
	Western Treatment Plant	March 2007	Media release issued, major lagoon isolated from recycled water supply.
	Pykes Creek Reservoir	April to May 2007	Consultation between Southern Rural Water and Western Water, media release issued, warning signs erected
	Pykes Creek	April 2007	Warning signs erected
Barwon	Blue Waters Lake	March 2007	Warning signs erected
	Barwon River – 'The Falls'	May 2007	Warning signs erected
	Painkalac Reservoir	May 2007	Reservoir closed, daily monitoring, water carted for supply

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 to provide a continuous and reliable water supply to towns and farms.

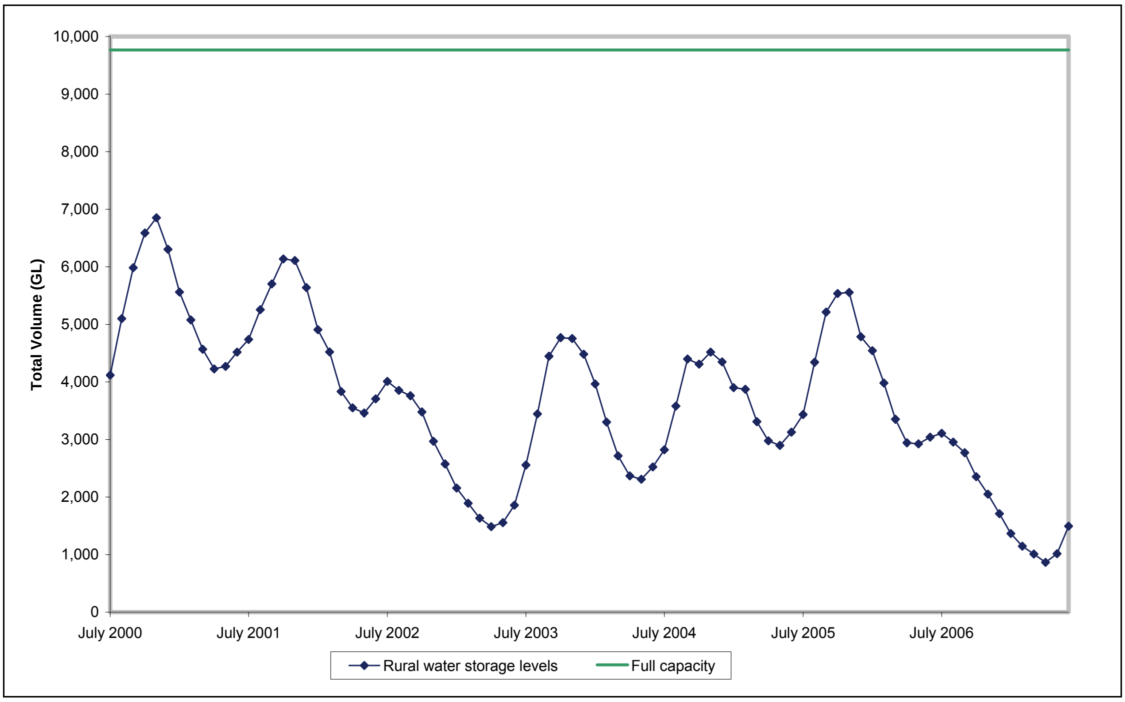
Victoria's major water storages are capable of holding around 11,540,000 ML when completely full. This includes 1,773,000 ML for Melbourne and 9,767,000 ML for regional urban and rural water supplies, well in excess of any one year's annual use. For example, Melbourne's total water consumption in 2006/07 was around 400,000 ML, which is about 23% of its total storage capacity.

The total volume of water in major rural reservoirs typically increases over the winter/spring filling period and is usually at its maximum in October. However, as can be seen in Figure 1-16, in 2006/07 the storage levels did not follow this pattern and decreased during this period. They then continued to drop over summer and autumn as water was released from the reservoirs, predominantly supplying irrigation demands. During 2006/07 storage levels fell from 3,040,000 ML (31% of capacity) at the start of July 2006 to 1,494,520 ML (15% of capacity) at the end of June 2007.

Storage levels vary greatly across the state. At the end of June 2007 storages in the Wimmera, Glenelg, Maribyrnong, Campaspe, Loddon and Werribee basins were all less than 10% full. In contrast, storages in the Ovens basin were 80% full due to greater inflows received in the latter part of the year.

Information on storage levels in individual basins is set out in Appendix B and in the state water accounts.

Figure 1-16 Volume in major rural water authority storages from 1 July 2000 to 30 June 2007



Melbourne's water storage levels fell from 850,800 ML (48% of capacity) at the start of July 2006 to 549,150 ML (31% of capacity) at the end of June 2007. Figure 1-17 shows a similar pattern to Figure 1-16, in that the usual winter and spring increase in storages did not eventuate for Melbourne, with the rain in late 2007 providing the only increase in storages.

Figure 1-17 Volume in Melbourne Water Corporation storages from 1 July 2000 to 30 June 2007

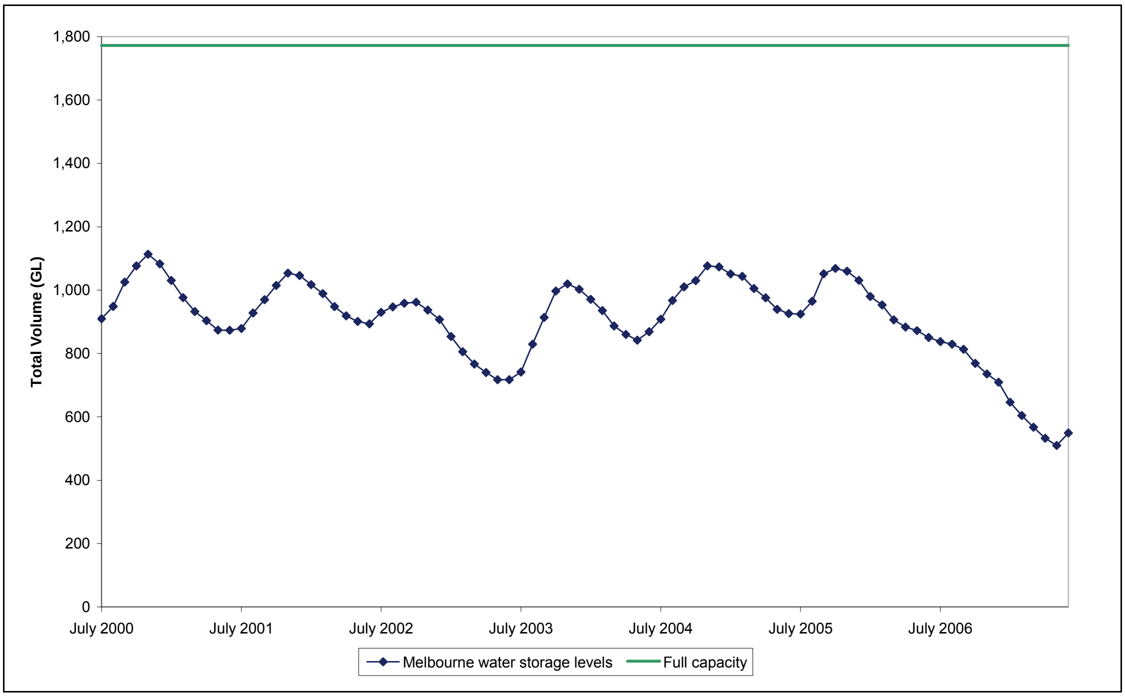
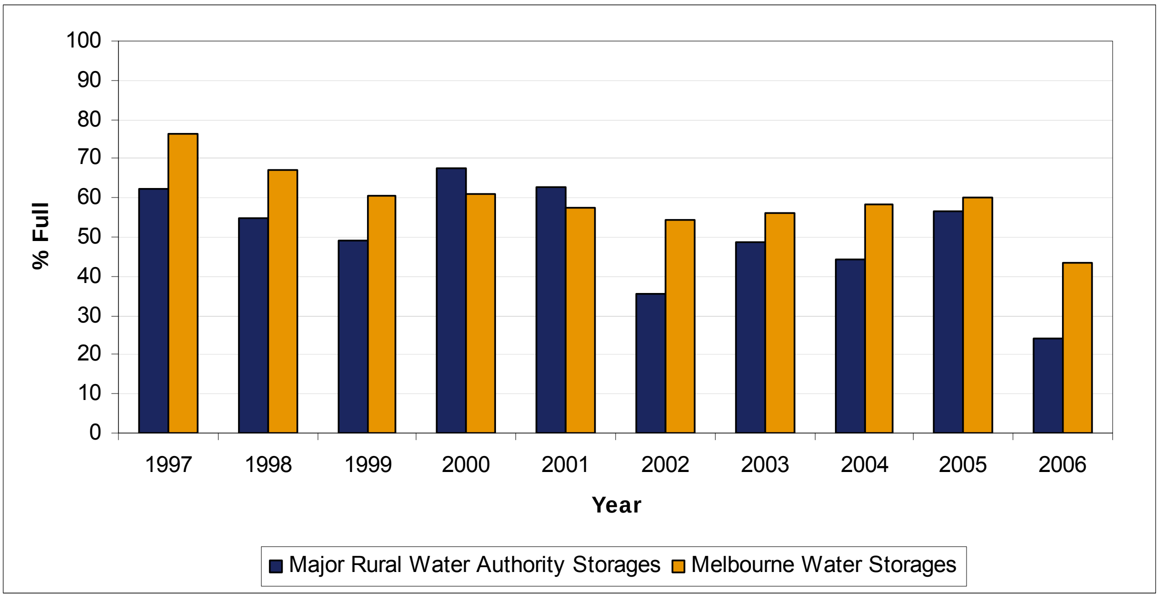


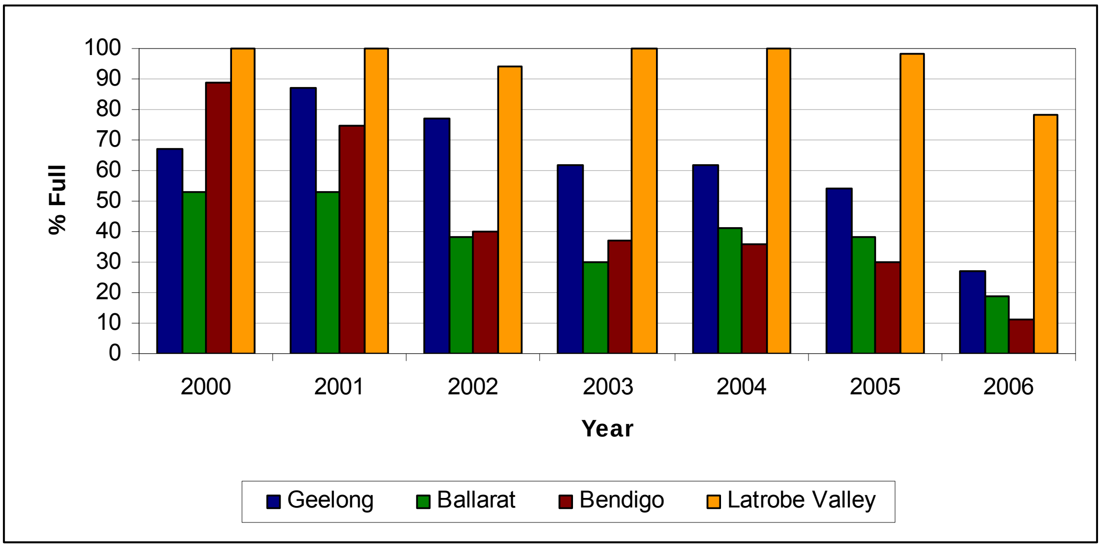
Figure 1-18 shows October storage levels from 1997 to 2006. October storage levels generally declined from 1997 to 2002 but started to recover between 2003 and 2005. While Melbourne's water storages remained relatively stable in October 2006, rural water authority storages experienced a significant drop in volumes between June and October 2006.

Figure 1-18 Water stored in reservoirs at the end of October, 1997-2006 (shown as a percentage of total storage capacity)



October storage levels from 2000 to 2006 for selected regional centres are shown in Figure 1-19 (the Moondarra Reservoir has been used as a proxy for the Latrobe Valley). With the exception of the Latrobe Valley, the water storages for the other cities have experienced a more pronounced decline in 2006 than Melbourne or the rural storages.

Figure 1-19 Water stored in key regional cities' reservoirs at the end of October, 2000-2006 (shown as a percentage of total storage capacity)



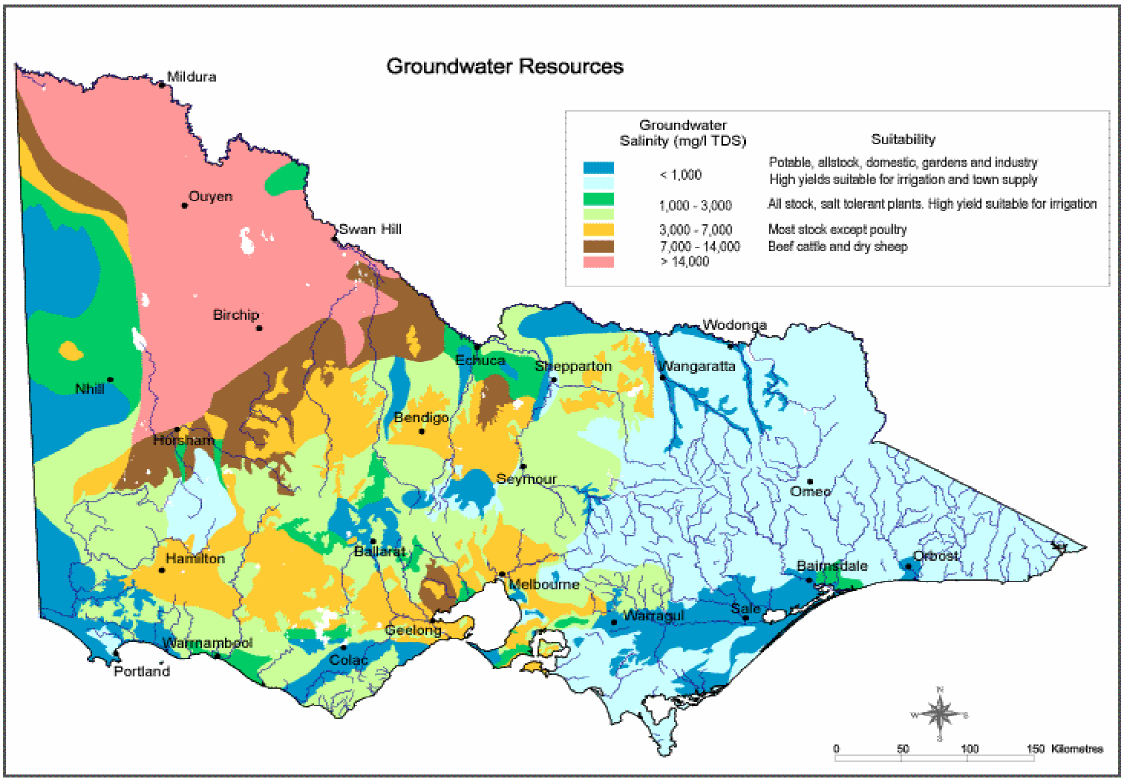
1.4 Groundwater

In Victoria, groundwater resources are used for a variety of purposes. In some areas, groundwater supplements surface water. In others such as in the west of the state, whole communities are dependent on groundwater for all purposes including town supply. Nevertheless, groundwater use is far less than surface water and is only equal to 15% of total surface water use.

The quality of groundwater is highly variable, with suitability for consumptive use being determined largely by the level of salinity. Figure 1-20 shows the location and salinity levels of Victoria's groundwater resources.

Groundwater resources occur naturally and are either a consequence of geological formation or recharge from the penetration of rain and other water sources through soils and rocks. Soil moisture conditions are a dominant factor in determining the volume and rate of groundwater recharge. Soils need to be sufficiently saturated to enable water to pass below the root zone and allow the groundwater system to recharge. Groundwater recharge is diminished during extended dry periods such as those observed in some Victorian aquifers since 1993.

Figure 1-20 Location and quality of Victoria's groundwater resources



The location of aquifers is unrelated to surface water basin boundaries, with some aquifers extending beneath several basins and others contained within a surface water basin boundary. Furthermore, some aquifers are interconnected with surface water resources whilst others are unconnected. For the purpose of the basin accounts, groundwater use has been apportioned according to surface area by basin. See Chapter 5 for an explanation of the method used.

Trends in water levels in key aquifers around the state are monitored on a quarterly basis. Water levels in some heavily used aquifers fell throughout 2006/07, attributed to diminished recharge coupled with continuing demand.

Declining groundwater levels can result in reduced access to the resource. For some users this leads to increased pumping costs or the need to drill deeper bores. For others it can mean being subject to restrictions that aim to ensure that groundwater levels do not continue to decline. The environment can be affected by declining groundwater levels when the baseflow to waterways, wetlands and other groundwater dependent ecosystems also decline. The challenge is to manage the resource sustainably, optimising the volume extracted while ensuring groundwater levels remain stable.

Where groundwater management areas show decreases in water levels or where they are highly utilised, they are declared as water supply protection areas (WSPAs) and management plans are developed. (See Chapter 3 for an explanation of the various groundwater management units). Where groundwater management plans have been implemented, declining groundwater levels have largely been halted.

Water level trends, using the past five or more years of data gathered from the State Observation Bore Network (SOBN), are presented in Figure 1-21 and Table 1-4. Where long term declines in levels have been observed, a management response has been implemented, either through the development of management plans or in some instances a qualification of groundwater rights. Whilst technical studies to support management planning have been undertaken in a number of groundwater management areas, no new groundwater management plans were completed for WSPAs in 2006/07.

Figure 1-21 Groundwater trends as at February 2007

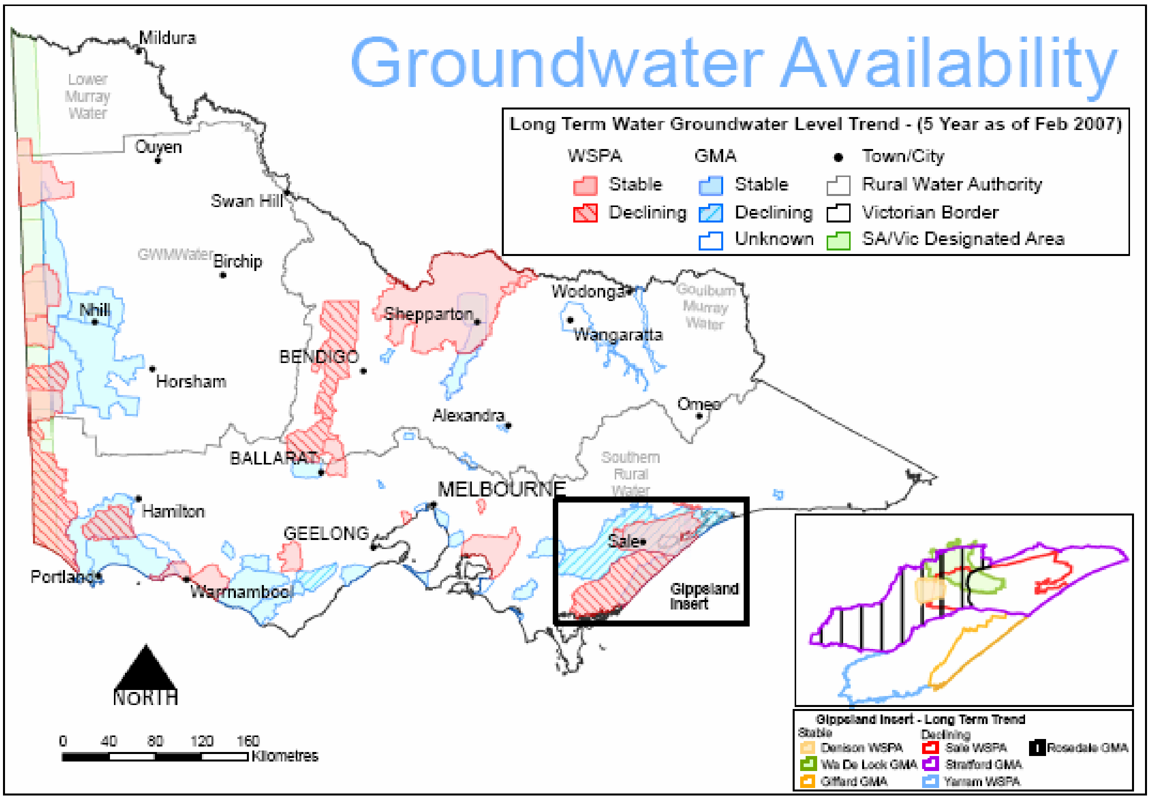


Table 1-4 Long term trends in groundwater levels monitored through the State Observation Bore Network

Groundwater management unit	Name	Water level trend (5+ year trend as interpreted Feb 2007)	Management response
WSPA	Apsley	Stable	
WSPA	Bungaree	Stable	
WSPA	Campaspe Deep Lead	Stable	Approved management plan in place
WSPA	Condah	Declining	Management plan being developed
WSPA	Denison	Stable	
WSPA	Deutgam	Stable	
WSPA	Glenelg	Declining	Management plan being developed
WSPA	Kaniva	Stable	
WSPA	Katunga	Stable	Approved management plan in place
WSPA	Koo Wee Rup	Stable	Management plan in place
WSPA	Mid Loddon	Declining	Management plan being developed
WSPA	Murrayville	Stable	Approved management plan in place
WSPA	Neuarpur	Declining	Management plan being reviewed
WSPA	Nullawarre	Stable	Approved management plan in place
WSPA	Sale	Stable	Management plan being developed
WSPA	Shepparton Irrigation Region	Declining	Management plan achieving salinity control
WSPA	Springhill	Stable	Approved management plan in place
WSPA	Telopea Downs	Stable	
WSPA	Upper Loddon	Declining	Management plan being developed
WSPA	Wandin Yallock	Stable	
WSPA	Warrion	Stable	
WSPA	Wy Yung	Stable	
WSPA	Yangery	Stable	Approved management plan in place
WSPA	Yarram	Declining	Management plan being developed
GMA	Alexandra	Not available	
GMA	Balrootan	Stable	
GMA	Barnawatha	Stable	
GMA	Cardigan	Stable	
GMA	Colongulac	Stable	
GMA	Corinella	Not available	
GMA	Cut Paw Paw	Not available	
GMA	Ellesmere	Stable	
GMA	Frankston	Stable	
GMA	Gellibrand	Stable	
GMA	Gerangamete	Declining	
GMA	Giffard	Stable	
GMA	Glenormiston	Stable	
GMA	Goorambat	Stable	
GMA	Goroke	Stable	
GMA	Hawkesdale	Not available	
GMA	Heywood	Stable	
GMA	Jan Juc	Stable	
GMA	Kaniva TCSA	Stable	
GMA	Kialla	Stable	
GMA	Kinglake	Not available	
GMA	Lancefield	Stable	
GMA	Leongatha	Stable	
GMA	Little Desert	Stable	
GMA	Merrimu	Stable	
GMA	Moe	Stable	
GMA	Moorabbin	Stable	
GMA	Mullindolingong	Stable	

Groundwater management unit	Name	Water level trend (5+ year trend as interpreted Feb 2007)	Management response
GMA	Murmungee	Not available	
GMA	Nagambie	Stable	
GMA	Nepean	Not available	
GMA	Newlingrook	Stable	
GMA	Nhill	Stable	
GMA	Orbost	Stable	
GMA	Paaratte	Stable	
GMA	Portland	Stable	
GMA	Rosedale	Declining	
GMA	Stratford	Declining	
GMA	Tarwin	Stable	
GMA	Wa De Lock	Stable	

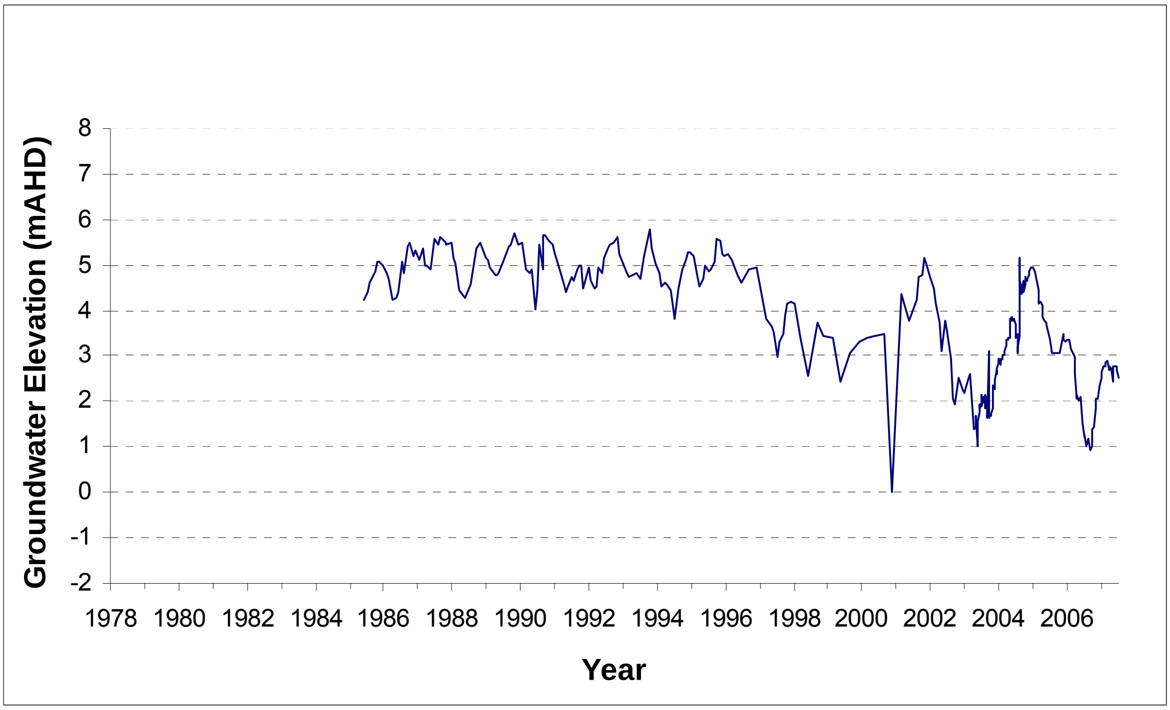
Note:
'Not available' means there are no SOBN bores in the GMA to monitor. The Department of Sustainability and Environment has a program to install new SOBN bores and replace old ones as an *Our Water Our Future* action plan initiative.

1.4.1 Deutgam

Deutgam, in the Werribee basin, is a WSPA without a management plan. In the absence of a plan, groundwater use is metered, levels are monitored and management occurs through a range of other tools including the ability to qualify rights and actively monitoring compliance.

Table 1.4 provides five year water level trend data as at February 2007. Whilst Deutgam's trend is shown as stable, information from the third quarter of 2006/07 indicates declining groundwater and a serious risk of seawater intrusion. On 8 June 2007 the Minister for Water qualified the rights to take groundwater from the Deutgam WSPA to zero. The qualification included a range of exceptions to ensure human and animal health and safety. It was the only qualification of groundwater rights in Victoria in 2006/07.

Figure 1-22 B59536 hydrograph – Deutgam

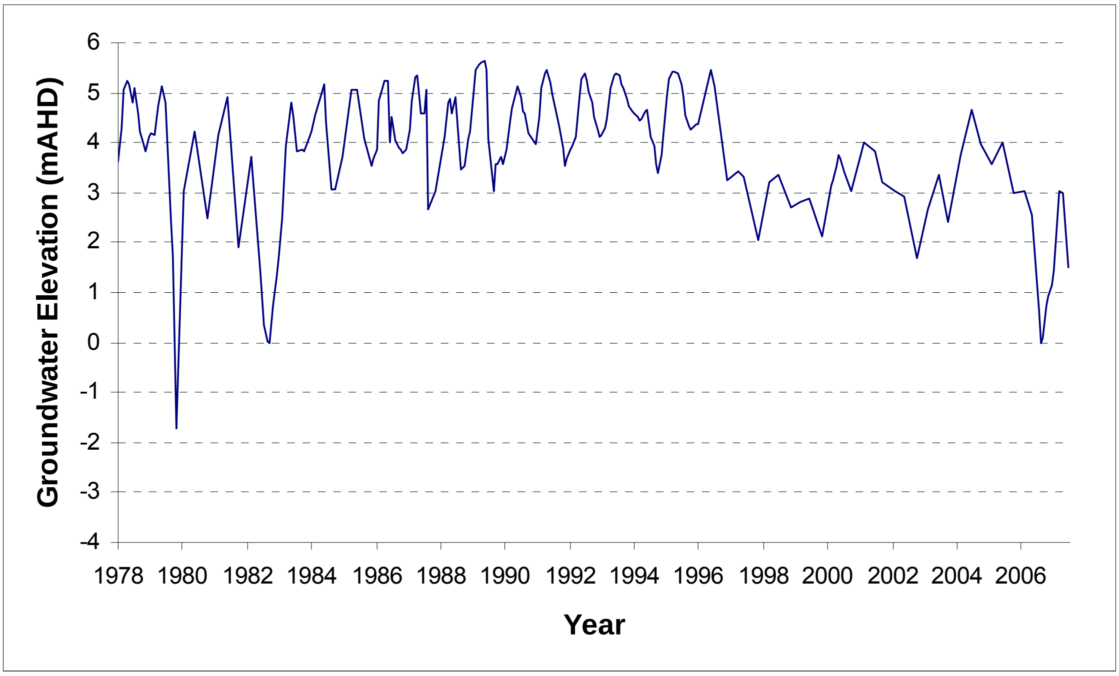


1.4.2 Koo Wee Rup

Concerns about long term falling groundwater levels, which were near and below sea level, and risk of seawater intrusion led to the declaration of the Koo Wee Rup-Dalmore Groundwater Conservation area in 1972 under the provisions of the *Groundwater Act 1969*. The arrangements established a monitoring and metering program. In the mid 1980s, licensed entitlements were reduced significantly and a number of sub zones were created to halt the decline in groundwater levels and avert the potential for sea water intrusion.

The recovery of the groundwater levels during the summer pumping season since the 1980s reflects the positive impact of the management arrangements and change in groundwater use in this part of the Bunyip basin.

Figure 1-23 B71190 hydrograph – Koo Wee Rup



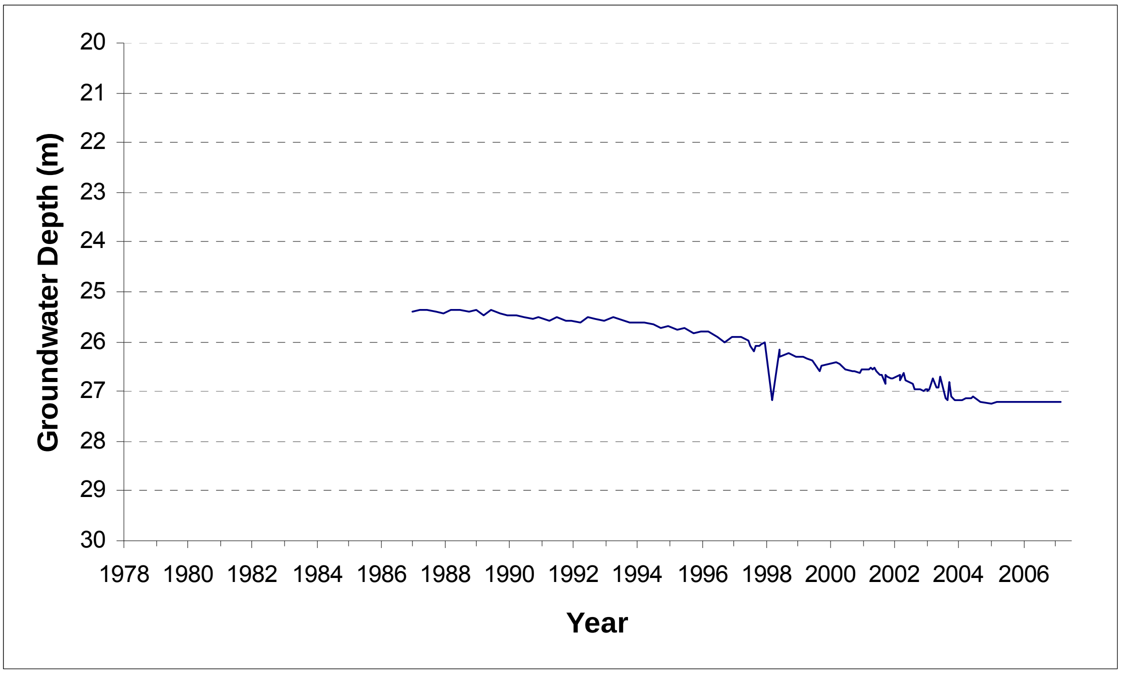
1.4.3 Neuarpur

In 2001, a trend in declining water levels was observed in Neuarpur WSPA, whilst elsewhere in the West Wimmera groundwater levels were stable. At that time the causes of the decline, whether from groundwater extraction or lack of recharge, were unclear. The Victorian Government implemented a metering program and undertook research to identify the reasons.

At that time, the primary aquifer in the Neuarpur WSPA, the Tertiary Limestone Aquifer, was considered a renewable resource receiving annual recharge. However, technical assessments received in 2006/07 indicated this resource should be regarded as non-renewable for water allocation and management purposes.

Groundwater levels in the Tertiary Limestone Aquifer have dropped by approximately two metres over ten years in the area of concentrated extractions around Neuarpur. In the immediate term this decline in groundwater levels appears manageable, however over the longer term an agreed policy position for use of non-renewable resources in this region must be developed.

Figure 1-24 B85628 hydrograph – Neuarpur



1.5 Conclusion

The severe drought conditions in Victoria worsened during 2006/07, and the majority of the state experienced below average rainfall for the eleventh successive year. This reduction in rainfall was particularly severe during spring 2006 and saw Melbourne record its lowest ever 365-day rainfall total ending in May 2007. Rainfall throughout the rest of the state, with the exception of Gippsland and some regions in the west, ranged between 40% and 80% of the long term average. Most of the Murray and Goulburn basins, home to the majority of irrigation in the state, received between 40% and 60% of the long term average.

A decade of below average rainfall has resulted in extremely dry catchments, and the 2006/07 streamflow in many areas of the state was the lowest on record. At a statewide level, streamflow was just 26% of average and declined by more than half compared with the streamflow recorded in 2005/06. Fifteen basins recorded streamflows of less than 20% of the long term average, including the Murray basin where inflows declined by more than 3,273,000 ML.

Low inflows led to storage volumes halving over the course of the year. At the beginning of 2006/07, storages held 4,709,800 ML, or 37% of total capacity. By the end of the year, the volume in storage had dropped to 2,271,500 ML, or 18% of capacity.

Notably, storage levels during 2006/07 did not follow the normal behaviour of recovery during winter and spring, and both Melbourne and rural storages continued to fall. In most areas, a restricted supply for urban and irrigation use was able to be maintained in 2006/07 only by drawing heavily on storages. At the end of 2006/07, storage levels in some basins were extremely low, including the Glenelg (2%), Campaspe (2%), Maribyrnong (4%) and Loddon (6%). Out of the 19 basins with major storages, seven had storage levels of less than 10%.

Similarly, water levels in a number of aquifers fell throughout 2006/07, with nine aquifers now exhibiting a long term trend of declining water levels and being regularly monitored.

2 Management of scarce water resources

2.1 Responding to drought conditions

Victoria is now experiencing its worst drought on record.

Victoria's water allocation framework provides a number of measures to conserve and allocate water between users in response to seasonal conditions. These include permanent water savings measures and water restrictions in urban areas, seasonal allocations in irrigation districts, and restrictions, rosters and bans on drawing water from unregulated streams.

All of these measures were employed, to varying degrees, in Victoria's river basins in 2006/07. However, the severity of the drought led the Victorian Government, water businesses and consumers to take additional measures during the year to respond to water shortages. These actions are described below.

2.2 Role of government in responding to drought

In times of serious water shortage and prolonged drought, the Victorian Government plays an important role in assisting and guiding water businesses. Specifically, this role is to implement and expand water conservation measures and contingency responses, forge new agreements and new approaches to water management and sharing, and activate emergency plans to provide immediate short term relief to those most in need.

Victoria's water businesses are responsible for maintaining sufficient water supplies during drought and implementing and funding contingency measures if required. The government worked closely with water businesses in 2006/07, monitoring the water supply situation and tracking the effectiveness of response measures. As the drought continued, water businesses implemented their short term drought contingency plans for urban water supply systems. Many plans, however, were based on the experience of historical drought and recovery sequences. They did not foresee a drought as severe as that experienced in 2006/07, especially with reservoirs already depleted following a series of dry years. In early spring 2006, the government requested water businesses to review and update their contingency plans to address the rapidly deepening drought for the remainder of 2006/07.

While water businesses are expected to manage the risks of dry years within their bulk entitlements by implementing their drought response plans and make up shortfalls in water supply through the water market where possible, 2006/07 was an extremely dry year. The Minister for Water invoked his emergency powers to declare water shortages and qualify rights to water on a number of occasions. The government provided the water businesses with guidelines on the circumstances under which qualification of rights would be considered.

Where water markets operate, the government's preferred approach is to enable water sharing by encouraging water trading, rather than qualifying entitlement holders' rights, which would take water off one class of water users to supply another. Government played an important role in facilitating agreement on water sharing across large water supply systems spanning several river basins and water businesses (e.g. northern Victorian irrigation areas, and the Murray-Darling Basin). This ensured that essential urban, rural and environmental needs were met and the necessary contingency measures, including qualification of rights, were coordinated.

For northern Victorian irrigation systems, this approach required the implementation of contingency measures that would increase seasonal allocations to levels at which the water market would be viable. Such measures included allowing carry-over of irrigators' allocations into the following year, pumping dead storage from otherwise empty reservoirs, announcing early irrigation allocations before it was possible to deliver the water through the channel system, and selective operation of irrigation channels in order to minimise losses.

The government also had an important role in protecting environmental assets when difficult water sharing decisions were required to ensure that essential human and stock needs were met. Half of the rights qualified during 2006/07 involved a reduction in environmental flows. All these qualifications of rights were conditional on adequate environmental monitoring and emergency contingency plans being implemented to manage the risk of poor water quality in rivers. Whilst it was accepted that the environment could suffer damage as a result of the qualifications, the environmental safeguards focussed on recovery to prevent critical loss of fish species by protecting key refuges for recolonisation and preventing catastrophic events (fish kills or algal blooms) if possible.

The government provided $178 million of drought assistance for farmers and rural communities across all drought-affected areas of Victoria, which included dry land farming areas as well as irrigation areas. Some of the initiatives in this assistance package included provision of:

- additional emergency water supply points for domestic, stock and fire fighting purposes
- help for rural towns to secure emergency water supplies by identifying and accessing groundwater bores

- financial assistance to: irrigators and stock and domestic farmers receiving less than 50% of their water entitlements; eligible farmers for their council rates; and Wimmera-Mallee farmers for purchasing water tanks
- funding for water businesses to pump dead storage from reservoirs
- additional drought-related extension services for farmers
- additional rural financial counsellors for farmers
- a range of employment projects for rural communities including fencing works, pest management, stock containment and environmental works managed through the catchment management authorities, and grants to the 37 councils in declared drought affected areas for local infrastructure works
- funding assistance to allow community facilities and sport grounds to continue to operate over the summer months
- additional social support services for families in some of the worst drought-affected communities.

The government also made available rebate schemes for urban water customers such as the Water Smart Gardens and Homes Rebate Scheme. Through the release of the second stage of the *Our Water Our Future* action plan in June 2007, the government has committed approximately $4.9 billion to major infrastructure projects to boost Victoria's water supplies and protect against drought. Projects include the Wonthaggi desalination plant, major pipeline projects and upgrading Melbourne's Eastern Treatment Plant. Part 3 of this report provides an update on these projects from the *State Water Report 2005/2006*.

By allowing for the possibility that the low flows experienced over the past 10 years could continue, the government has ensured that the risk of severe drought is considered in its long term water resource planning for the state's water supply systems by allowing for the possibility that the low flows experienced over the past 10 years might continue.

The government is currently developing sustainable water strategies which 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 (the Central Region Sustainable Water Strategy was completed in October 2006).

2.3 Qualification of rights

As outlined in section 2.2, one of the powers vested in the Minister for Water is the ability to qualify rights to water in order to maintain essential supplies to towns and rural communities. These powers are specified in section 33AAA of the *Water Act 1989*.

The Minister may declare a temporary qualification of rights where a water shortage exists in an area or water system. A water shortage exists where the quality of water available is or will shortly be inadequate to meet the needs of water users.

Due to the water shortages experienced during the year, temporary qualifications were imposed on 28 occasions in 12 different basins. One half of the qualifications had the effect of reducing passing flow requirements in order to preserve water in the system for consumptive purposes. The remainder took various forms, but were all imposed to maintain essential supplies for urban or rural users. Table 2-1 provides an overview of the qualifications imposed during the year. These are discussed in more detail in the relevant state water accounts.

The only qualification of rights recorded on groundwater use in 2006/07 was for the Deutgam WSPA in the Werribee basin, managed by Southern Rural Water. Rights were qualified to 25% of licensed entitlement until 8 June 2007 when the Minister for Water qualified rights to 0%.

Water corporations are expected to manage the risks of low water availability in dry years through their drought response plans and where possible the water market. Rights to water are clearly specified in bulk entitlements, environmental entitlements, water shares and licences and water must not be taken outside of the existing provisions. However in extremely dry years the Minister has emergency powers to declare that a water shortage exists and qualify rights to water; this power is only used to meet critical needs.

The qualification of rights often involves increasing a water corporation's access to water in a waterway by reducing environmental flows downstream of a harvesting point. This can impact on other users downstream of the harvesting point, and often reduces environmental flows. Before making a decision to qualify rights, the Minister will need to be convinced that:

- the water corporation is unable to meet the critical needs of its customers under its bulk entitlement;
- all other reasonable contingency options have been identified and implemented; and
- the impacts on other parties have been assessed, and appropriate remedial action is proposed to manage those impacts.

The qualification of rights was used by the environment to allow more controlled management of water during the drought. This involved the storing of some of the qualified water for emergency environment release to improve water quality, usually through the provision of freshening flows.

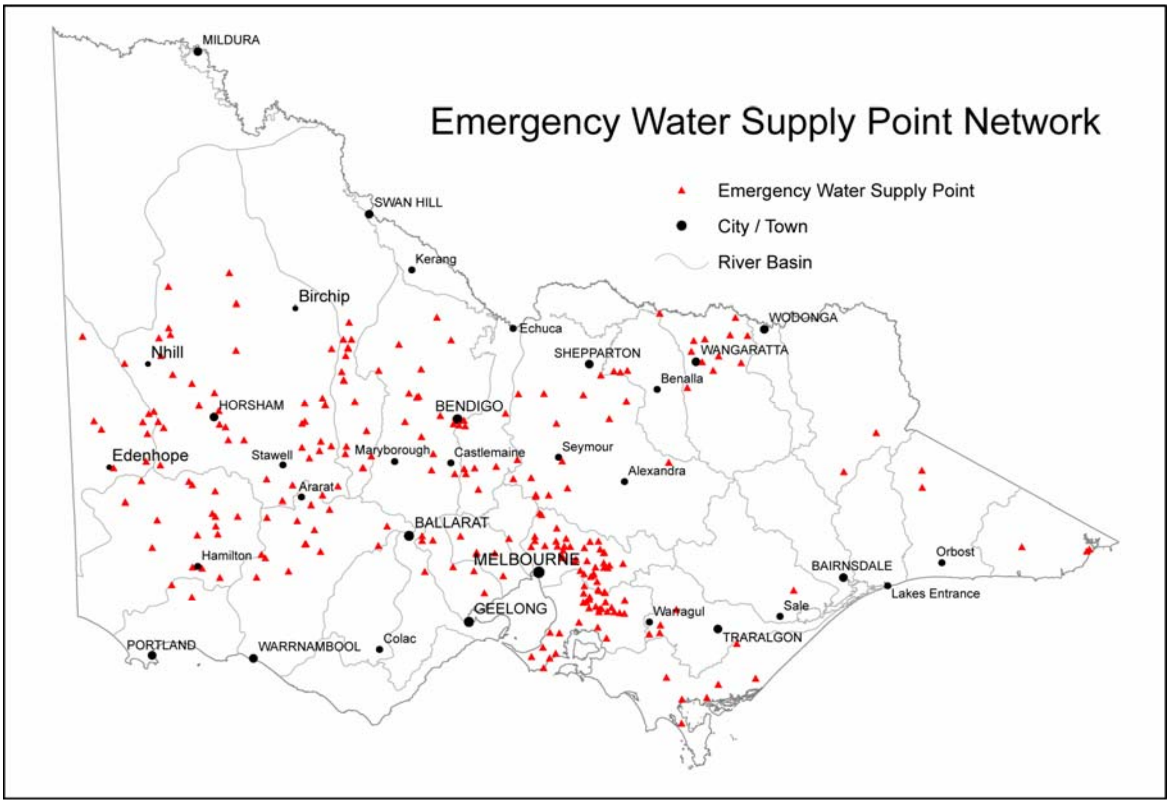
Table 2-1 Qualifications of rights in 2006/07

Basin	Number of rights qualified	Qualification type							
		New diversion point provided	Extended pumping/ diversion times	Reduced passing flow requirements	Differential access by priority entitlements	Modified cap	Access to unallocated water provided	Modified operating rules	Environmental water traded on market
Ovens	1	1							
Goulburn	3	1		1					1
Campaspe	4			3	1				
Loddon	3			1	2				
Mitchell	1			1					
Thomson	2			1				1	
Latrobe	2			1		1			
South Gippsland	5		1	4					
Yarra	1			1					
Werribee	2				1		1		
Moorabool	2	1		1					
Otway Coast	1		1						
Total	28	3	2	14	5	1	1	1	1

2.4 Emergency water supply network

In locations where water shortages were becoming critical, the Victorian Government and water businesses acted to ensure emergency water supply points were available to eligible customers. Emergency water supply points comprise a combination of municipal drought relief bores, urban surface water standpipes and surface extraction points including selected points on channels and streams. In 2006/07, the existing emergency water supply network was expanded to meet the needs of water users.

Figure 2-1 Emergency water supply point network 2006/07



More than 220 emergency water supply points were in operation around Victoria. They were accessed by rural customers in need of water for domestic and stock purposes, who carted the water to their properties. The government allocated $4 million to upgrade the emergency water supply network, including upgrading existing sites and establishing new sites in consultation with water authorities. Local councils are also involved in the control of access and maintenance of these sites.

Figure 2-1 is a statewide map of emergency water supply points. The two main concentrations of bores are in the west of the state, where low rainfall and very low streamflows have made it increasingly difficult to supply domestic and stock needs, and to the east of Melbourne, where population density is relatively higher than other parts of the state.

2.5 Urban water restrictions

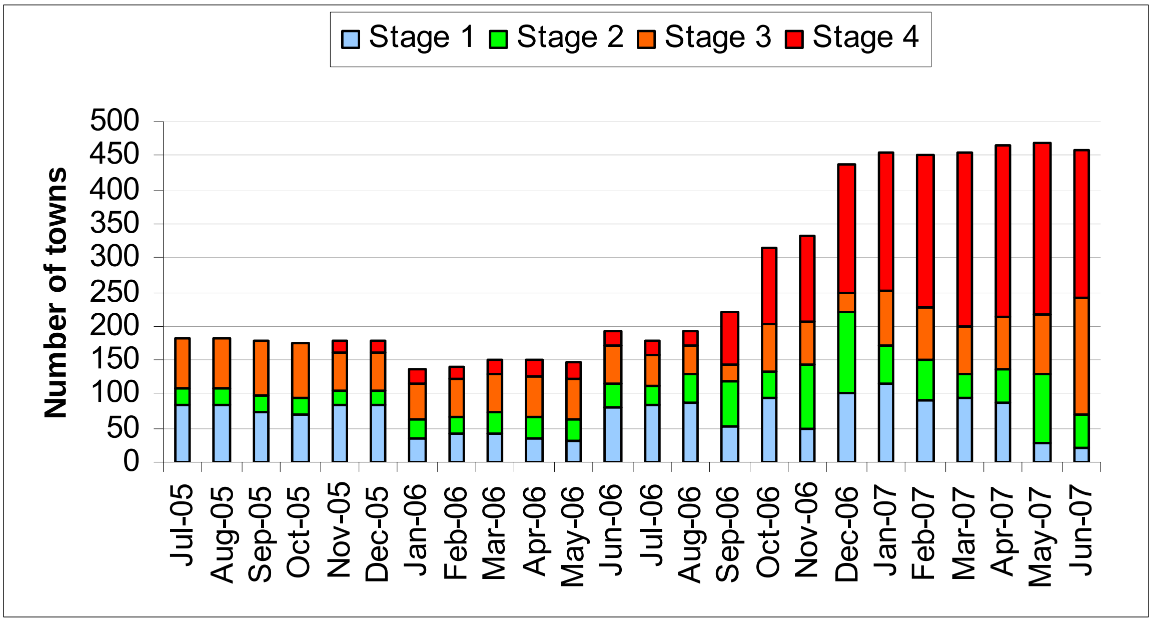
Under the Victorian *Uniform Drought Water Restriction Guidelines for the State*, all Victorian towns (with the exception of towns served by East Gippsland Water and South Gippsland Water) moved to a uniform scale of water restrictions in mid to late 2006. The scale has four stages of restrictions, with increasing levels of severity. Whilst water businesses are able to tailor the restrictions under each stage to suit local conditions, each stage's restrictions are mostly generic across the state. The trigger points for each stage of water restrictions are outlined in the drought response plan of each water business. This document also includes contingency measures for temporary water supplies or savings beyond Stage 4.

The number of towns on water restrictions more than doubled during 2006/07. At 1 July 2006, 192 towns were on some form of water restrictions. By 30 June 2007, that number had increased to 457, with 214 towns on Stage 4 restrictions. Under the guidelines, Stage 4 restrictions prohibit a range of activities, including:

- the watering of any public, residential or commercial garden or lawn
- the watering of sports grounds
- cleaning of vehicles with water with the exception of windows, mirrors and lights
- cleaning of building facades or windows with water
- filling any new pond, lake or swimming pool.

Figure 2-2 summarises the number of towns on restrictions over 2005/06 and 2006/07, and the level of those restrictions.

Figure 2-2 Number of Victorian towns on restrictions, 2005/06 and 2006/07

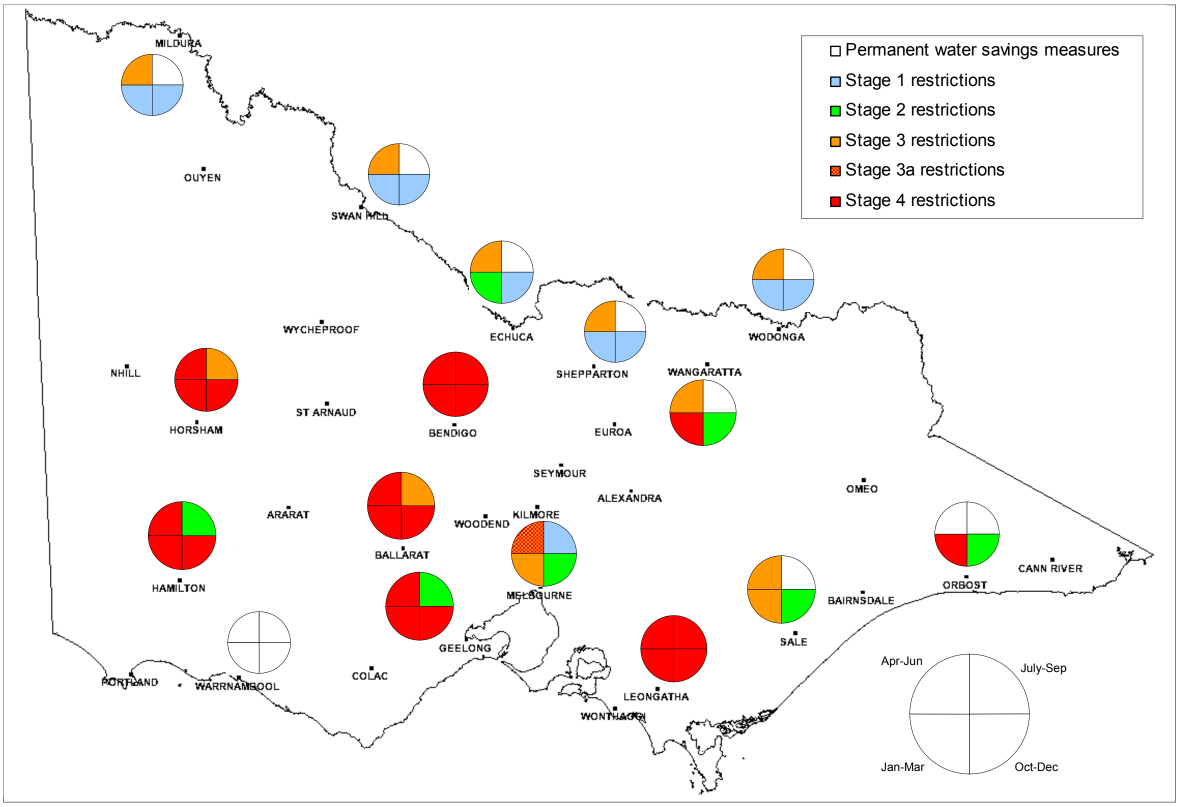


Note: Melbourne, which was on Stage 3a restrictions from April 2007, has been included in Stage 3 in Figure 2-2.

As discussed in Chapter 3, increasing restrictions have significantly contributed to substantially lower water consumption compared with either historic or recent levels. Urban water businesses reported that metered water use was 11% or 53,700 ML lower in 2006/07 compared with 2005/06. This is the equivalent of annual water use by approximately 320,000 households.

Figure 2-3 shows the level of restrictions for the major population centres and the manner in which they changed over 2006/07. With the exception of Orbost and Warrnambool, all towns shown finished the year on a higher level of restriction than they began. Towns in East Gippsland ended the year on permanent water savings measures due to the heavy rains and associated flooding experienced in late June 2007.

Figure 2-3 Changes in restrictions levels for major towns, 2006/07



Note: Each quadrant in the circles represents a quarter of the 2006/07 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.

2.6 Water carting

When a town's water supply system is unable to meet the demand for water, it is sometimes necessary to resort to water carting. Water carting programs were introduced in 2006/07 in a number of towns, with varying volumes of water being transported.

Carting water is a time consuming and expensive exercise and, as such, the decision to implement a carting program is usually a last resort and generally only implemented in smaller towns. By way of example, Goulburn Valley Water carted a total of 112 ML of water to Broadford, Euroa and Violet Town from March 2007. This program cost Goulburn Valley Water $1.1 million, or approximately $9,400 for every megalitre delivered.

Table 2-2 summarises the towns that received water via a carting program in 2006/07.

Table 2-2 Towns receiving carted water 2006/07

Basin	Water authority	Town receiving water	Source of water	Period	Volume
Ovens	North East Water	Whitfield	Wangaratta	February to May	Not available
Ovens	North East Water	Springhurst	Wangaratta	February to end of year	0.03 ML per day
Goulburn	Goulburn Valley Water	Broadford	Seymour	April to end of year	1.0 ML per day
Goulburn	Goulburn Valley Water	Euroa	Seymour	March to May	0.8 ML per day
Goulburn	Goulburn Valley Water	Violet Town	Murchison	March to May	0.2 ML per day
Goulburn	Goulburn Valley Water	Mansfield	Alexandra	January to April	0.03 ML per day
Campaspe	Coliban Water	Axedale	Bendigo	June to end of year	0.08 ML per day
Loddon	Coliban Water	Raywood and Sebastian	Bendigo	April to end of year	0.08 ML/day
Avoca	GWMWater	Rural customers in basin	Various GWMWater storages	October to end of year	Not available

Basin	Water authority	Town receiving water	Source of water	Period	Volume
Wimmera	GWMWater	Rural customers in basin	Various GWMWater storages	October to end of year	Not available
Wimmera	GWMWater	Wycheproof	Birchip	October to year end	0.3 ML every second month
Mitchell	East Gippsland Water	Lindenow and Lindenow South(1)	Mitchell River	June	Not available
Thomson	Gippsland Water	Coongulla and Glenmaggie	Heyfield	February to end of year	0.1 ML per day
Latrobe	Gippsland Water	Thorpdale	Trafalgar	December	Not available
South Gippsland	Gippsland Water	Seaspray	Rosedale	December to February	Not available
South Gippsland	South Gippsland Water	Poowong, Loch and Nyora	Korumburra Coal Mine	April to May	0.3 ML per day
South Gippsland	South Gippsland Water	Fish Creek	Foster	April to May	0.12 ML per day
Barwon	Barwon Water	Rural customers on Boundary Creek	Colac	December to April	2.5 ML total
Werribee	Central Highlands Water	Blackwood	Colebrook reservoir	January to April	0.4 ML per day
Werribee	Western Water	Myrniong	Bacchus Marsh (Yarra Water)	April to June	4 ML total

Note:
(1) Water carting required due to pipeline damage during Mitchell River flood in June.

2.7 Alternative supplies of water

The drought forced a number of water businesses to investigate and employ alternative sources of water during 2006/07. These alternatives varied depending on the location of the business and the size of the shortfall between demand and the available supply.

The value of groundwater as an emergency water source during drought was highlighted during 2006/07. Access to new groundwater sources was a major part of water authorities' contingency plans as the flow in rivers and streams declined. Drilling contractors had a difficult time meeting demand – water authorities were forced to compete for their services with private individuals seeking groundwater.

Towns normally relying on surface water that sought groundwater for emergency supplies are listed in Table 2-3. Not all attempts to find alternative groundwater supplies were successful. In several cases, the new groundwater bores were only partially successful, providing less water than hoped for.

Table 2-3 Use of groundwater as an emergency supply 2006/07

Water authority	Basin	Supply system	Successful/not successful
Central Highlands Water	Corangamite	Ballarat	Successful
Barwon Water	Barwon	Geelong	Successful (within existing licence)
East Gippsland Water	Mitchell	Mitchell	Successful
Gippsland Water	Latrobe	Thorpdale	Successful
GWMWater	Wimmera	Horsham and temporary supply for Iluka mineral sands mine	Successful
	Glenelg	Iluka mineral sands mine	Successful
	Millicent Coast	Edenhope	Successful
	Hopkins	Lake Bolac, Moyston, Wickliffe and Willaura	Successful
North East Water	Ovens	Wangaratta	Successful (the bores were commissioned, but not used in 2006/07)
South Gippsland Water	South Gippsland	Leongatha	Partially successful
		Wonthaggi	Not successful
		Korumburra	Partially successful
		Toora	Not successful
Westernport Water	South Gippsland	Phillip Island	Successful
Wannon Water	Glenelg	Hamilton	Partially successful

Many towns across the state use groundwater in place of, or as a supplement to, surface water for their normal water supply. These towns and the volume of groundwater used for urban purposes during 2006/07 are identified in the state water accounts.

Some water authorities supplemented their normal surface water supplies from other surface water sources (not including water carting – refer section 2.6 above) as summarised in Table 2-4.

Table 2-4 Alternative surface water sources 2006/07

Water authority	Basin	Supply system	Alternative surface water source
Barwon Water	Moorabool	Meredith/Lethbridge	East Moorabool reservoirs via She Oaks water treatment plant
Central Highlands Water	Barwon/Moorabool	Ballarat	Goldfields Superpipe. Water is sourced from the Goulburn basin (not completed for 2006/07) Newlyn Reservoir (Loddon basin) via Cosgrave Reservoir Kaolin pit
Coliban Water	Campaspe/Loddon	Bendigo, Castlemaine	Goldfields Superpipe. Water is sourced from the Goulburn basin (not completed for 2006/07)
		Coliban	Pipe from Bendigo Water Reclamation Plant to Spring Gully Reservoir for potable substitution of recycled water for public lands and irrigation
		Heathcote, Tooborac	Connection to Lake Eppalock – Bendigo pipeline to receive water from Sandhurst Reservoir
Goulburn Valley Water	Murray	Cobram, Strathmerton, Barmah, Numurkah etc	Carryover of approximately 5,500 ML within the Murray irrigation system for use in 2007/08
	Goulburn	Woods Point	Goulburn River
North East Water	Ovens	Whitfield	King River
		Bright and Wandiligong	Dredge holes in Harrietville
		Porepunkah	Pipeline to Bright reticulation system
South Gippsland Water	South Gippsland	Leongatha and Korumburra	Coalition Creek Tarwin River West Branch
		Wonthaggi	Powlett River
Western Water	Werribee and Maribyrnong	Bacchus Marsh/Melton, Sunbury/Macedon, Romsey, Woodend	Melbourne system
		Woodend	Macedon storages
		Lancefield	Disinfected and unfiltered surface water to supplement groundwater
Westernport Water	South Gippsland	Westernport including Phillip Island	South Gippsland Water's Lance Creek Reservoir Bass River (not completed for 2006/07)

As their normal sources of water supply became scarcer, water businesses increased the volume of wastewater that was treated and subsequently re-used as recycled water. The recycled water was used in fit-for-purpose applications such as watering golf courses and sports grounds, industry and horticulture, substituting for potable water which was retained for domestic use. The volume of recycled water increased by 20% compared with 2005/06, resulting in an additional 15,600 ML of recycled water. Recycled water is discussed in more detail in section 3.9 of Chapter 3.

2.8 Infrastructure modification

A number of upgrades to water supply infrastructure were commissioned in 2006/07 to improve water supplies during drought. These include new and upgraded storages, pipelines, groundwater supplies and treatment plants.

Table 2-5 summarises the key infrastructure modifications that were underway in 2006/07 to assist in managing drought and fire impact.

Table 2-5 Infrastructure improvements to manage drought 2006/07

Basin	Water business	Infrastructure	Description
Murray	North East Water	Treatment plant	Installed temporary treatment plant to manage expected water quality issues due to low level releases from Lake Dartmouth
Murray	Lower Murray Water	Pipeline	Construction continued on the Robinvale high pressure system which will replace the current open channel delivery system
Ovens	North East Water	Storage	Goulburn-Murray Water pumped dead storage from Lake Buffalo to supply Wangaratta
	North East Water	Pipeline	Secure Porepunkah supply by connecting to Bright system
Goulburn	Goulburn-Murray Water	Storage	Goulburn-Murray Water pumped dead storage from Waranga Basin to supply irrigators
Campaspe/Loddon	Coliban Water	Storage	Use of evaporation saving product on several storage basins
	Coliban Water	Pipeline	Temporary piping of irrigation channels at Harcourt
Loddon	Goulburn-Murray Water	Storage	Goulburn-Murray Water pumped dead storage from Tullaroop Reservoir to maintain environmental flows
Wimmera/Mallee	GWMWater	Pipeline	Construction commenced on the Wimmera-Mallee Pipeline Project which will replace 17,500km of open channels with pressurised pipelines
Mitchell	East Gippsland Water	Treatment	Commissioned water clarification units and clarification basins to treat highly turbid water after bushfires
Thomson	Gippsland Water	Treatment plant	Upgraded Maffra water treatment plant to treat water with higher turbidity as a result of bushfires and floods.
Bunyip	Melbourne Water	Storage	The draw-down limit (the volume below which water cannot be used for quality reasons) was reduced in the Cardinia Reservoir from 160,000 ML to 130,000 ML
Yarra	Melbourne Water	Storage	Installed back up pump at Maroondah Reservoir to secure supply for Healesville
Yarra	Melbourne Water	Storage	The draw-down limit was reduced in the Sugarloaf Reservoir from 35,000 ML to 20,000 ML and in the Yan Yean Reservoir from 9,000 ML to 6,000 ML, in effect increasing capacity by a combined 18,000 ML
Thomson	Melbourne Water	Storage	Recommissioned Swingler Weir, increasing the volume of water that can be harvested from the Thomson Reservoir
Yarra	Melbourne Water	Pumps	Installed new pumps at the Yering offtake to allow greater operational flexibility
Werribee	Western Water	Storages	Pumped dead storage from Pykes Creek Reservoir as required for supply to Bacchus Marsh Irrigation District
Moorabool	Barwon Water	Pipeline	Construction of pipeline from Moorabool water treatment plant to Lethbridge to reduce demand on Meredith system.
	Central Highlands Water	Pipeline	Connected Newlyn Reservoir to the Ballarat system.
Barwon	Barwon Water	Groundwater	Upgraded capacity of Barwon Downs bore field from 35 ML/day to 55 ML/day
Corangamite	Barwon Water	Storage	Construction of new service basin in Colac to provide storage over summer
Glenelg	Wannon Water	Storages	Introduced evaporation retardant on storages that supply Hamilton and Glenthompson

2.9 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. An irrigator's 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 may be greater than 100% of entitlement. Initial allocations are made early in the irrigation season based on the current volume of water in storage, estimated inflows during the season and the amount of water required to provide for subsequent years. Allocations are reviewed by water businesses throughout the irrigation season and increased if the available water exceeds their forecasts. The initial seasonal allocations are often low because water businesses do not know until late spring how much water will be available for use.

The 2006/07 seasonal allocations for Victoria's irrigation districts are shown in Table 2-6. Low inflows resulted in all irrigation systems receiving less than 100% allocation. All irrigation systems received lower allocations than in preceding years, with the majority experiencing significant reductions.

Goulburn-Murray Water's districts, with the exception of the Campaspe district, all received at least a 100% allocation in 2005/06. In contrast, in 2006/07 only the Murray system received anything higher than an 80% allocation, with Murray irrigators receiving 95%. The Goulburn system, which supplies more water entitlement holders than any other system, received 29%. Irrigators in the Campaspe and Loddon systems received a zero allocation, after receiving 31% and 100% respectively in 2005/06.

Allocations in the southern and western irrigation districts outside the Goulburn-Murray region were generally lower than the north of the state, with only the Thomson-Macalister system, which received 60% allocation, reaching anything higher than 10% of water right.

Table 2-6 Seasonal irrigation water allocations

Irrigation system	Initial allocation August 2006 (% of entitlement)	Mid season allocation February 2007 (% of entitlement)	Final allocation May 2007 (% of entitlement)	2005/06 final allocation (% of entitlement)
Murray – gravity	81	95	95	144
Murray – pumped	81	95	95	114
Goulburn	0	24	29	100
Broken	42	71	77	170
Campaspe	0	0	0	31
Loddon	0	0	0	100
Bullarook Creek	29	36	36	190
Wimmera	0	0	0	5
Thomson - Macalister	30	45	60	115
Werribee	5	10	10	80
Bacchus Marsh	0	10	10	80
Maribyrnong (Southern Rural Water)	0	5	5	15
Maribyrnong (Melbourne Water)	0	0	0	15

Lower seasonal allocations and reduced water availability for urban purposes led to an increase in the amount of water traded on the water market as rural customers, urban water businesses and power stations sought to augment their water supply. The number of temporary transfers of seasonal allocation increased by 74% compared with 2005/06, with 370,000 ML being traded. Water entitlement transfers are discussed in section 3.8 of Chapter 3.

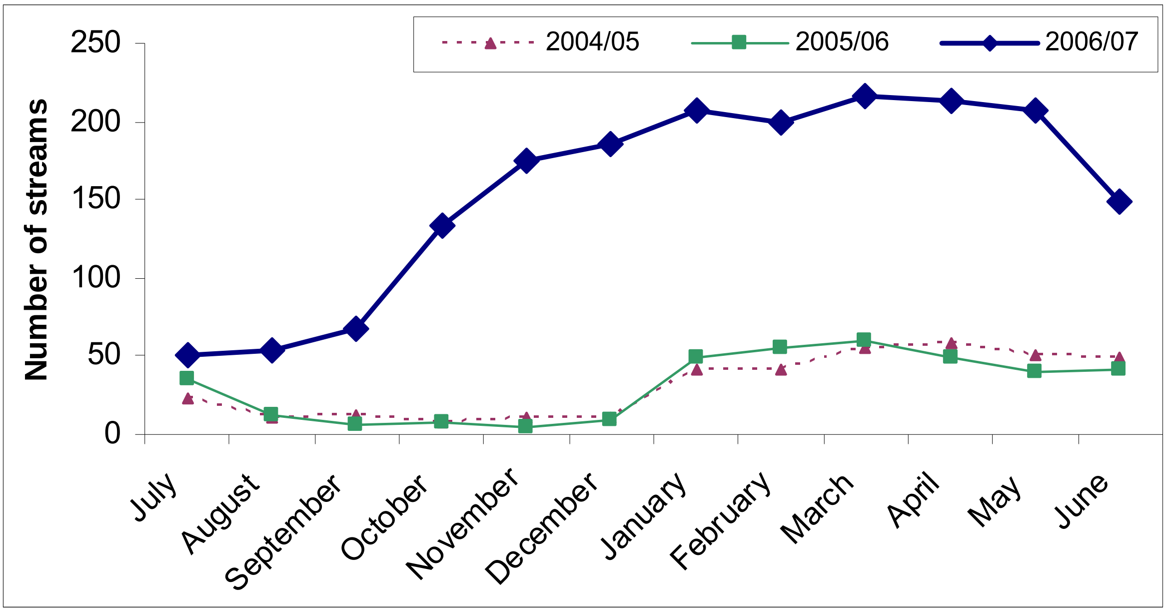
2.10 Restrictions on diversions from unregulated streams

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

Restrictions on diversions from unregulated streams typically fluctuate over the course of the year depending on rainfall and streamflows. Restrictions and bans are usually most severe in summer and autumn and are likely to be lifted over the winter and spring seasons.

Restrictions on diversions in 2006/07 broadly followed this trend; however the magnitude of restrictions was significantly different from prior years. Although restrictions were at their most severe in summer, restrictions started to increase significantly in October and did not relent until June. Restrictions reached their peak in March 2007, with 217 unregulated streams on restrictions and irrigation bans on the majority. In June 2007 there were still 149 streams on some form of restriction compared to 41 in June 2006.

Figure 2-4 Number of Victorian unregulated streams on restrictions



2.11 Restrictions on groundwater use

The only restriction on groundwater use was the qualification of rights in the Deutgam WSPA, discussed in section 2.3.

2.12 Conclusion

The 2006/07 drought stands amongst the most severe in the state's history. Records for the lowest streamflows were broken in many river basins and storages were drawn down to record low levels. Diversions under consumptive entitlements (surface water and groundwater) totalled 3,982,540 ML in 2006/07, a 24% reduction compared with the 5,209,876 ML diverted in the previous year. Despite the extreme severity of the drought in 2006/07, the Victorian Government, water businesses and communities all played an active role in successfully responding to the water shortages and were able to minimise the impacts on consumptive water users. The actions taken ensured that the resource remained at a sustainable level for commencing 2007/08.

A number of drought contingency actions were implemented over the course of the year. The number of towns on restrictions more than doubled in 2006/07 and there were more towns on Stage 4 restrictions at the end of the year than there were on any form of restrictions at the beginning of the year.

Seasonal allocations in irrigation districts were in many regions at record lows. Irrigators in the Campaspe, Loddon and Wimmera irrigation districts received zero allocation. Only the Murray (95%) and Broken (77%) systems received allocations greater than 60%.

In extreme case of water shortage for cities and towns, the Minister for Water used his powers under the Water Act to qualify rights to water on 28 occasions. Half the qualifications reduced passing flow requirements to ensure adequate water supplies for towns. Many of the qualifications remained in place at the end of the year.

Farmers responsible for their own water supplies suffered severe water shortages. More than 200 unregulated streams were on restrictions in March 2007, and at the end of the year more than three times as many streams were on restrictions than at the beginning. Water businesses across the state extended the existing emergency water supply points network, providing farmers with the opportunity to cart water to their properties. The government provided funding to upgrade existing and establish new sites, involving local councils in control of access and maintenance of the sites.

With surface water sources of supply failing, many communities looked to groundwater to augment their usual water supplies. Groundwater use increased throughout Victoria, and many water businesses drilled new groundwater bores. Other emergency contingency measures, such as pumping water from below the outlet levels of storages, or building new pipelines to access alternative surface water sources, were implemented to increase water availability.

As a last resort, several water businesses were forced to cart water by road to towns experiencing severe shortages.

The state water accounts provide additional information on the drought contingency measures undertaken in each basin.

3 Water for consumptive use

3.1 Victoria's water allocation framework

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

- **Bulk entitlements**

  A bulk entitlement is a right to water granted to urban and rural water businesses and other selected bodies (e.g. electricity generators) to use and supply water. Water businesses then distribute the water to their customers. Rural water businesses' customers include irrigators who receive a regulated supply under their own entitlements in the form of water rights or licences, urban businesses 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 Environment are used for environmental purposes. The Act now provides specifically for environmental entitlements to be issued to the Minister for Environment. It is expected that over time bulk entitlements held by the Minister for Environment will be converted to environmental entitlements.

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

- **Water rights and water shares**

  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 receive an allocation each year and are entitled to sales water when sufficient water is available.

  From 1 July 2007, water rights were unbundled in northern Victorian regulated systems into water shares, delivery shares and water-use licences. Information on these entitlements is stored in the Victorian Water Register.

- **Water licences**

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

As noted in Chapter 2, in extreme circumstances the Minister for Water has the authority to qualify rights to water outlined in bulk entitlements and licences.

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 Water Act and are not formally issued.

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

3.2 Consumptive entitlements

Table 3-1 presents a summary of Victoria's consumptive entitlements in both 2006/07 and 2005/06. The total volume of consumptive entitlements changes each year as new entitlements are issued or existing entitlements are modified.

Most basins in the state are capped and therefore there will be only a minor increase in the total number of entitlements from one year to the next. No new entitlements are created in capped catchments unless the entitlement is purchased from an existing user. This ensures no net increase in entitlement in a capped catchment. The reason for the significant increase in the volume of bulk entitlements between 2005/06 and 2006/07 is the completion of several bulk entitlement conversions, e.g. for Melbourne. Formerly these were legal rights to take water, but these rights were imprecisely defined and not quantifiable.

While there are a small number of entitlements not yet converted to bulk entitlements, most future changes to the total entitlement volumes will arise from the completion of large scale water savings projects. This enables the loss component of existing consumptive entitlements to be converted to new environmental and other consumptive entitlements.

The change in the volume of licences may be explained by improvements in the water businesses' record keeping, and, to some extent in some basins, could reflect an increase in licences issued.

Table 3-1 Consumptive water entitlements in Victoria as at 30 June

Entitlement	Volume 2006/07 (ML)	Volume 2005/06 (ML)
Surface water		
Bulk entitlements(1)	5,839,440	5,452,230
Licences(2)	330,910	279,550
Small catchment dams (mainly domestic and stock)(3)	364,700	523,200
Groundwater licences(4)	1,001,000	879,900
Total water entitlements	**7,536,050**	**7,134,880**

Notes:
(1) An estimate of the total volume of bulk entitlement granted as at 30 June 2007. Total volume does not include environmental entitlements. The increase from 2005/06 is caused mainly by conversion of long standing rights into bulk entitlements.
(2) Includes only licences issued for unregulated rivers. Licences within regulated water supply systems are not included as they are part of rural water businesses' bulk entitlements.
(3) Estimate of water taken by small catchment dams in 2006/07 includes 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 in 2001) to be licensed (or registered), a process that is currently underway. The 2006/07 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 may now also be counted as a licensed volume.
(4) The increase in groundwater licences is explained by a change in the methodology of accounting for groundwater licences in 2006/07, where the entitlement limit and licensed entitlements are deemed equivalent in GMUs outside of the Central Region. See Chapter 5 for more detail.

3.3 Water availability and use

The volume and use of Victoria's water resources for 2006/07 is summarised in Table 3-2.

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 the 'use' on a farm or in a town, it is the bulk volume of water extracted from a stream or groundwater bore.

In previous years, the volume of water allocated to users through entitlements and licences has been far less than the available resource. For example, in 2005/06, the total resource was 15,296,700 ML and the volume of entitlements totalled 6,254,980 ML. As Table 3-2 shows, in 2006/07, however, the dramatic decline in streamflow meant that the volume of entitlements was much closer to the total available resource (6,535,050 ML compared to 7,072,400 ML).

This demonstrates an important feature of the water allocation framework: an entitlement does not necessarily guarantee that the entitlement volume will always be available for diversion. A business with an entitlement must meet all the conditions of that entitlement including obligations to meet passing flows and share any shortfall of the available water with other entitlement holders including the environment. Water businesses addressed each shortfall by drawing on their reserves in storage and reducing their customers' use of water (urban restrictions and irrigation allocations) to ensure that they operated within the conditions of their entitlements. As a consequence, businesses' total diversions from streams across the state were significantly less than the available resource.

The range of water businesses' drought contingency measures is discussed in Chapter 2 and the state water accounts.

Table 3-2 Victoria's water availability and water taken for consumptive use in 2006/07

	Surface water(1) (ML)	Groundwater(2) (ML)	Recycled water (ML)
Total resource	7,072,400	1,041,990	392,093
Entitlement/allocation	6,535,050	1,001,000	not available
Water used	3,456,430	526,110	111,490

Notes:
(1) Catchment inflow as shown in each basin water balance in the 2006/07 state water accounts, excluding inter-basin transfers, irrigation return flows and recycled water.
(2) The actual groundwater resource (i.e. the volume of water in aquifers) is unknown and therefore for the purposes of the Victorian Water Accounts 2006-2007, the total resource has been assumed to be the total volume of entitlements issued.

3.3.1 Diversions under surface water consumptive entitlements

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

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

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

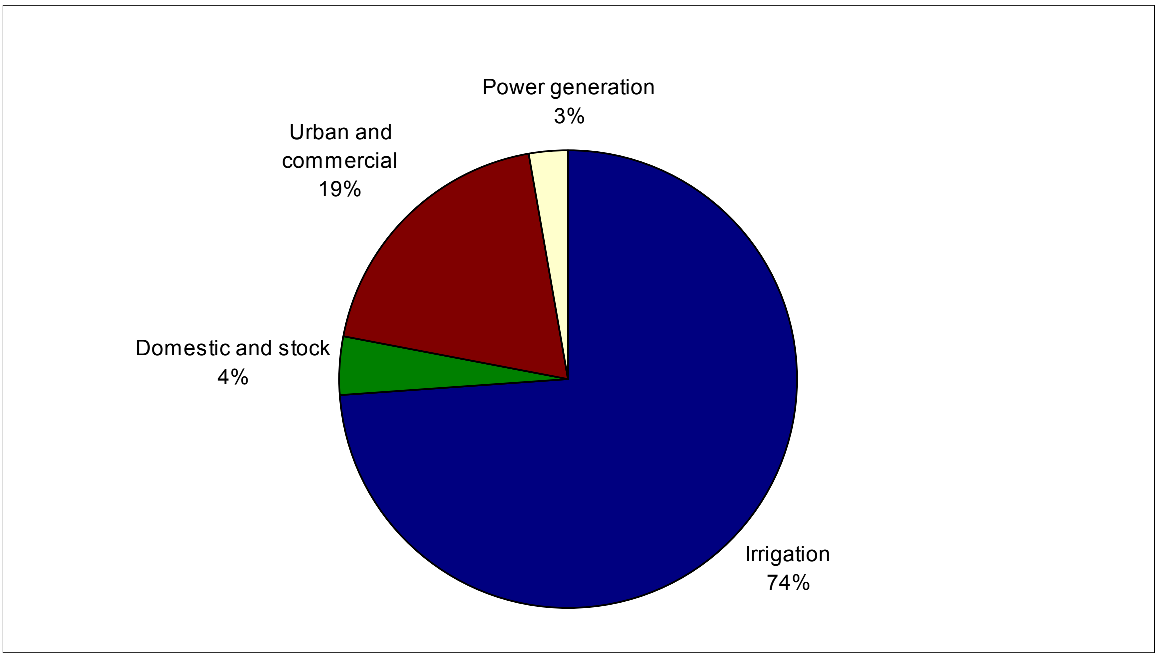
Table 3-3 Diversions made under consumptive entitlements 2006/07

Consumptive end use	Volume of water diverted (ML)
Irrigation	2,559,830
Domestic and stock	132,080
Urban and commercial	666,910
Power generation	97,620
Total consumptive diversions 2006/07	**3,456,440**
Total consumptive diversions 2005/06	**4,843,580**

As demonstrated in Table 3-3, the volume of water taken under consumptive bulk entitlements reduced significantly in 2006/07 compared with 2005/06. One bulk entitlement (Goulburn-Murray Water's Eildon – Goulburn Weir) accounted for close to half of an approximately 1,400,000 ML reduction in diversions. In 2005/06, Goulburn-Murray Water diverted 1,442,584 ML under this entitlement when Goulburn irrigators received a 100% seasonal allocation. In 2006/07, with allocations not exceeding 29%, Goulburn-Murray Water diverted 760,256 ML.

Irrigation is still by far the highest category of water use in the state, comprising 74% of all diversions (Figure 3-1). This proportion has declined slightly in recent years, however because lower allocations have resulted in less water being diverted for irrigation, even as urban restrictions have at the same time reduced the water consumed by urban customers. Since 2003/04, when irrigation accounted for 78% of Victoria's water use, it has fallen each year to the current 74%.

Figure 3-1 Total diversions for consumptive purposes in Victoria, 2006/07



3.3.2 Urban surface water consumption

Consumption in urban areas is often measured by the metered volume of water delivered to customers. This differs from Table 3-3 and Figure 3-1 in that it does not take into account water lost in the distribution network through evaporation, leakage and any metering error. Therefore the metered consumption volumes discussed below are less than the urban diversions volumes in Table 3-3 and Figure 3-1.

Metered urban water consumption in Victoria fell as water restrictions and increased awareness of the sustainable use of the resource took effect. Total urban water consumption, by residential and non-residential users, fell by 8% in 2006/07 compared to 2005/06. The largest declines were in regional Victoria, with regional residential customers reducing their water consumption by 13% and regional non-residential usage declining by 11%.

Table 3-4 Urban metered water consumption in Victoria 2006/07

	2006/07 (ML)	2005/06 (ML)[(1)]	% Change
Melbourne – residential	248,730	273,200	-9%
Melbourne – non-residential	108,100	117,440	-8%
Regional – residential	110,640	127,070	-13%
Regional – non-residential	60,350	67,460	-11%
Power generators[(2)]	96,130	95,310	1%
Other major Latrobe Valley industrial users	23,350	25,150	-7%
Total urban consumption	**647,300**	**705,630**	**-8%**

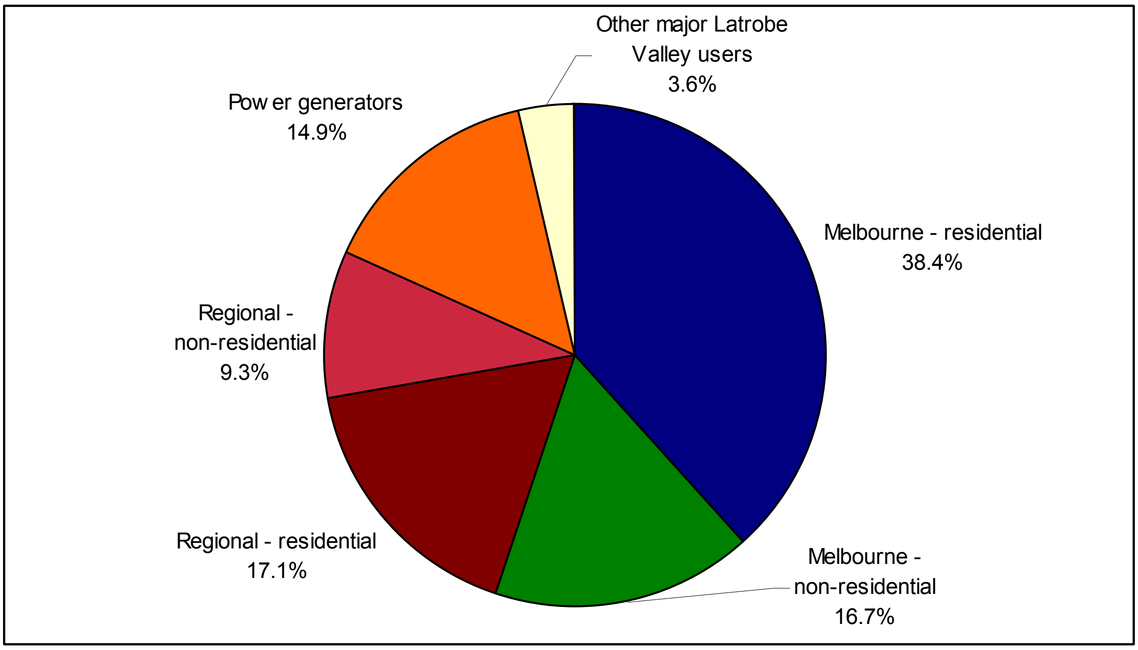
Notes:

(1) The 2005/06 metered water consumption shown in the table should not be directly compared with the volumes in Table 2-3 in the State Water Report 2005/2006. The 2005/06 table displayed the total volume of water received by the water businesses from headworks and does not reflect the volume of water ultimately recorded on customers' meters.

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

Table 3-4 is represented as a pie chart in Figure 3-2.

Figure 3-2 Consumptive uses of urban and commercial metered water in Victoria 2006/07



3.3.3 Consumption by major users

In October 2006, the *Water Act 1989* and the *Water Industry Act 1994* were amended to oblige urban water authorities and the metropolitan retailers to publicly report on major urban water customers. In accordance with the amendments, these water businesses published in their annual reports the number of customers that fell into a range of water consumption bands. Table 3-5 presents a summary of the major water user information reported for 2006/07.

Table 3-5 Major urban water users in Victoria 2006/07

Water consumption	Number of customers
Equal to or greater than 50 ML and less than 100 ML	212
Equal to or greater than 100 ML and less than 200 ML	116
Equal to or greater than 200 ML and less than 300 ML	40
Equal to or greater than 300 ML and less than 400 ML	22
Equal to or greater than 400 ML and less than 500 ML	17
Equal to or greater than 500 ML and less than 750 ML	20
Equal to or greater than 750 ML and less than 1,000 ML	10
Greater than 1,000 ML	29
Total customers	**466**

The top 200 non-residential water consumers in Melbourne have continued to reduce their water consumption In 2006/07; the aggregate water use of this group of customers had declined by 7,600 ML since 2001/02, a reduction of nearly 17%. The Victorian Government has decided to extend the 'Top 200' program to all non-residential customers that use more than 10 ML of potable water annually, which will account for approximately 1,850 customers.

3.4 Urban water conservation measures

3.4.1 Water Smart Gardens and Homes Rebates Scheme

A key component of the state's water conservation strategy is the Water Smart Gardens and Home Rebates Scheme. Since January 2003, the scheme has provided over 162,000 rebates for urban water customers, saving more than one billion litres of potable water each year.

Table 3-6 Water Smart Gardens and Homes Rebates Scheme 2006/07

Water savings device	Rebates per device for 2006/07	Rebate amount
AAA shower rose	2,112	$10
Dual flush toilet	3,389	$50
Greywater permanent tank system	704	$500
High pressure cleaning device	705	$30
Rainwater tank to toilet system	399	$150
Rainwater tank > 4500 litres	642	$150
Rainwater tank 1001 – 1700 litres	629	$150
Rainwater tank 1701 – 2250 litres	993	$150
Rainwater tank 2251 – 3600 litres	638	$150
Rainwater tank 3601 – 4500 litres	583	$150
Rainwater tank 600 – 1000 litres	900	$150
Large rainwater tank 2000 – 4999 litres(1)	241	$500
Large rainwater tank 5000 or more litres (connected to toilet or laundry)(1)	172	$900
Large rainwater tank 5000 or more litres (connected to toilet and laundry)(1)	278	$1,000
Water conservation audit	822	$30
Rebate for purchasing $100 worth of water savings devices	19,847	$30
Total number of rebates	**33,054**	

Note:
(1) Rebates for large rainwater tanks were only available from 1 January 2007.

3.4.2 Schools Water Efficiency Program

Additional savings of potable water are also being achieved in Victoria's 2,200 primary and secondary schools connected to the reticulated water supply system through the Schools Water Efficiency Program (SWEP). Operating since 2006, SWEP offers schools the opportunity to identify and implement low cost solutions to achieve indoor water savings. Savings can be achieved through measures such as flow control valves on taps and water fountains and identifying leaks.

At the end of 2006/07, 408 schools had committed to join SWEP, 307 schools had completed audits to identify estimated water savings opportunities, while 244 had all works completed.

Water use records indicate that schools enrolled in SWEP have achieved an average reduction in water consumption of about 14% by the end of 2006/07.

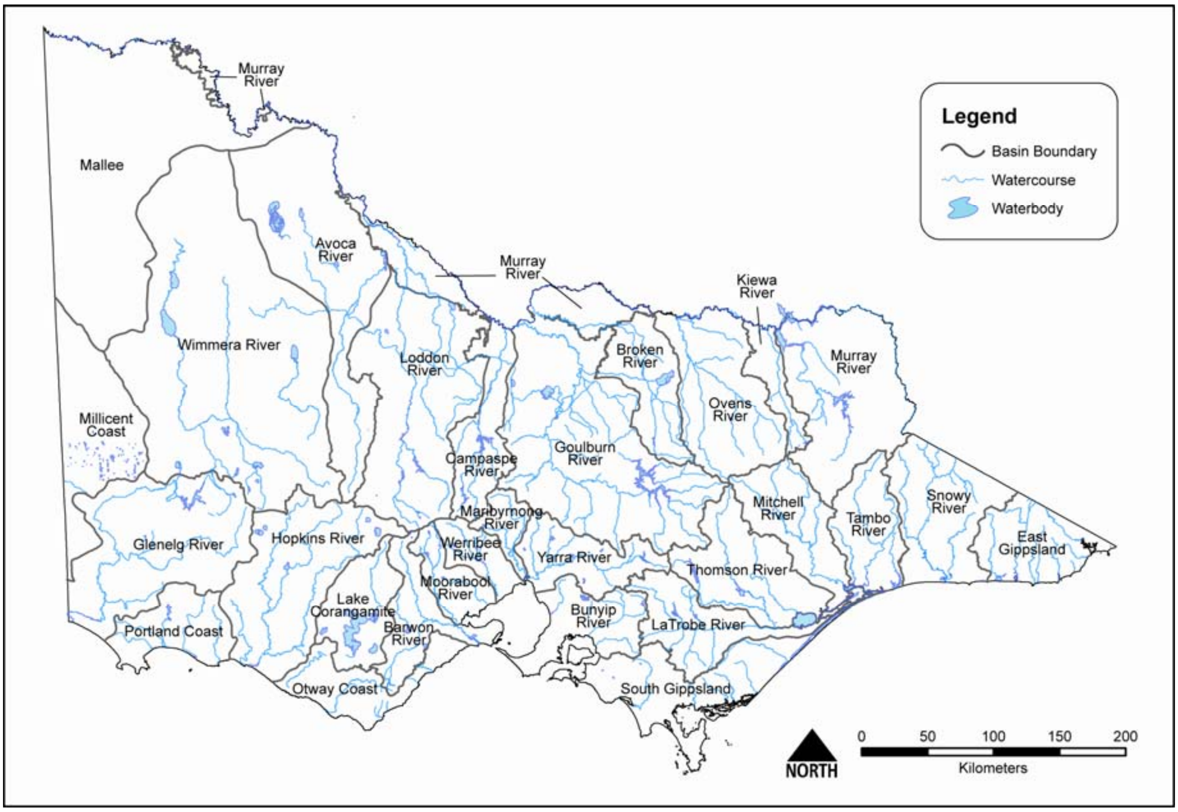
3.4.3 Stormwater and Urban Water Conservation Fund

In 2006/07, progress was made on the 66 projects funded under the $10 million Stormwater and Urban Water Conservation Fund. The three year fund has been set up to contribute to new infrastructure, demonstration projects and water conservation education programs across the state. It is open to local government, water businesses, managers of recreational facilities and business and industry.

The supported projects are expected to save in excess of two billion litres of potable water per year.

3.5 Surface water entitlement and use

Figure 3-3 River basins in Victoria for the state water accounts



The following information on water taken from Victoria's rivers is summarised according to river basins as defined by the Australian Water Resource Council (AWRC). The exception to this is the Murray basin which, for the purposes of this report, includes the Upper Murray basin as defined by AWRC and areas in Victoria supplied from the River Murray downstream of Lake Hume. The extent of each of Victoria's river basins is shown in Figure 3-3. Refer to the state water accounts in Part 2 of this report for details of water availability and use in each river basin.

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

The state water accounts in Part 2 of this report show water use against each bulk entitlement and an assessment of compliance with the entitlement volume. Some bulk entitlements have an upper limit described, for example, as a five-year or 10-year rolling average. In these cases, compliance is assessed at the end of the full term of the bulk entitlement. The outcome of the compliance calculation is reported in the relevant basin chapter.

The information on water use against water business entitlements in Part 2, the state water accounts, is as reported in water business annual reports except where water businesses 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 for 2006/07 was not available when the Victorian Water Accounts 2006-2007 was prepared.

Table 3-7 shows the volume of entitlements and water used under bulk entitlements, licences and rights in each basin and the volume diverted from waterways in 2006/07. The volume diverted in each basin is within the entitlement volume.

The total volume of bulk entitlements reported in Table 3-7 includes new bulk entitlements created during 2006/07, however it does not include bulk entitlements for several water supply systems where formal bulk entitlements are yet to be completed, e.g. in the Bunyip basin.

Due to the drought, the volume of water taken under bulk entitlements in 2006/07 was 50% 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.

Table 3-7 Volume allocated and taken under surface water entitlements in 2006/07

Basin	Bulk entitlements[1]			Unregulated river licensed diversions[1]			Small catch-ment 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	2,114,140	1,460,780	69%	27,910	21,300	76%	6,500
Kiewa	1,150	690	60%	18,510	5,500	30%	3,900
Ovens	45,380	16,190	36%	24,920	4,100	16%	15,700
Broken	52,580	17,560	33%	10,090	5,500	55%	15,400
Goulburn	1,999,100	791,400	40%	40,060	8,400	21%	46,500
Campaspe	135,000	13,730	10%	8,710	200	2%	19,100
Loddon	121,240	3,930	3%	30,600	5,100	17%	21,500
Avoca	280	10	4%	3,620	1,600	44%	6,500
Mallee	0	0	n/a	0	0	n/a	0
Wimmera	210,950	8,630	4%	2,490	1,800	72%	7,300
East Gippsland	620	280	45%	760	200	26%	1,100
Snowy	2,200	1,060	48%	3,900	800	21%	3,400
Tambo	3,650	60	2%	4,050	1,000	25%	3,700
Mitchell	5,900	3,460	59%	22,810	9,000	39%	4,300
Thomson	458,940	357,260	78%	7,100	5,800	82%	6,500
Latrobe	192,740	150,410	78%	18,040	14,000	78%	20,500
South Gippsland	15,620	7,820	50%	13,180	7,600	58%	24,100
Bunyip[5]	0	6,350	n/a	17,980	10,400	58%	15,400
Yarra	411,250	90,450	22%	45,280	33,200	73%	15,100
Maribyrnong	9,680	730	8%	1,790	1,300	73%	5,600
Werribee	36,190	3,540	10%	1,180	500	42%	4,900
Moorabool	43,100	9,980	23%	2,020	1,400	69%	15,300
Barwon	55,730	17,460	31%	4,740	1,700	36%	19,100
Corangamite	0	0	n/a	980	100	10%	6,800
Otway Coast	19,230	14,470	75%	7,720	1,700	22%	10,200
Hopkins	630	370	59%	9,010	4,400	49%	31,000
Portland Coast	0	0	n/a	2,180	800	37%	7,000
Glenelg[6]	5,000	1,380	28%	1,180	1,000	85%	28,300
Millicent Coast	0	0	n/a	100	100	100%	0
Total	**5,940,300**	**2,978,000**	**50%**	**330,910**	**148,500**	**45%**	**364,700**

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 2007. 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. Includes environmental and consumptive entitlements.

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

(4) Refers to the total volume harvested by small catchment dams, (ie. for both domestic and stock and irrigation and commercial use) including water estimated as lost to evaporation. Domestic and stock volumes for small catchment dams in 2006/07 are based on the Flow Stress Ranking Project and an estimate of volumes used based on 1982 usage. This represents a change in methodology from the figures presented in the State Water Report 2005/2006.

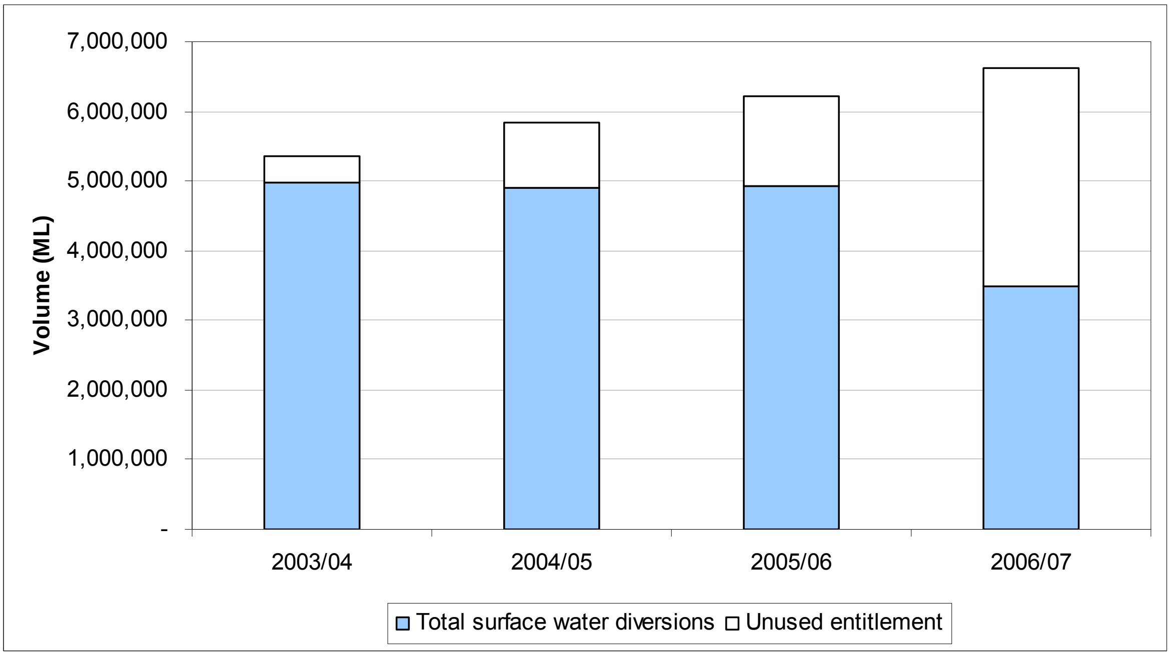
(5) The bulk entitlements in this basin are yet to be finalised, therefore the entitlement taken in 2006/07 has not been calculated.

(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

Figure 3-4 shows the volume of water diverted under surface water entitlements, over the past four years. The volume of entitlements has grown each year for the reasons outlined in section 3.2. For the first three years, the volume diverted under these entitlements and licences remained largely stable as most irrigation seasonal allocations remained at or around 100% or more and urban restrictions were lower and isolated to specific regions in the state. In 2006/07, the drought reduced water availability, and irrigation allocations were much lower, urban restrictions became more widespread and severe and the number of unregulated streams with irrigation bans or other restrictions tripled. Consequently, the volume of water diverted reduced substantially.

Figure 3-4 Surface water entitlements and associated diversions



3.6 Groundwater 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.

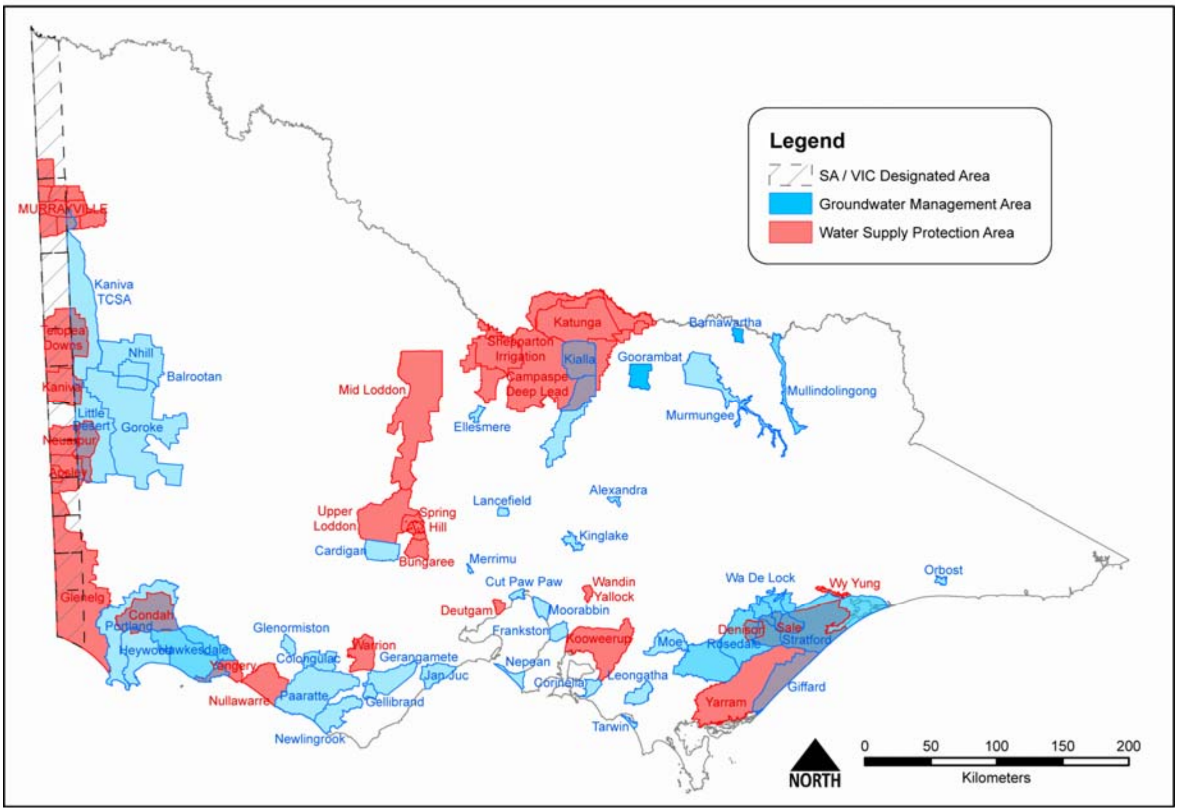
Areas of significant groundwater use have been identified through the groundwater licensing and bore construction system. Areas with significant groundwater resource are established as Groundwater Management Areas and, where the resource is under pressure Water Supply Protection Areas (WSPAs) are established. At present, there are 67 GMUs in Victoria, of which 24 are WSPAs, 40 are GMAs and 3 are unincorporated areas.

Victoria is in the process of determining Permissible Consumptive Volumes (PCVs) to cap groundwater extraction and stabilise use in all GMAs. In October 2006 the Minister for Water declared PCVs for 26 GMAs in the Central region.

Figure 3-5 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.

Figure 3-5 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.

Groundwater management plans have been completed for eight WSPAs, with technical work being undertaken to inform management options on those WSPAs showing declining long term water levels (as detailed in Chapter 1, Table 1-3). On completion of this technical work, appropriate management actions will be identified and initiated, including future monitoring regimes.

Victoria's State Observation Bore Network monitoring program collects data from 2,500 bores across the state. This information is supplemented by other monitoring programs undertaken by water businesses.

Victorian water businesses also have comprehensive compliance programs in place. These are supported by Victorian Government initiatives to improve metering of all significant irrigation and commercial use.

3.7 Statewide overview of groundwater use for 2006/07

Continued dry conditions across the state, the associated depletion of soil moisture and the increased reliance on groundwater to augment urban supplies contributed to declining water levels in some Victorian aquifers.

Full details of water entitlements and use from each GMA and WSPA during 2006/07 are presented in Appendix A. In summary:

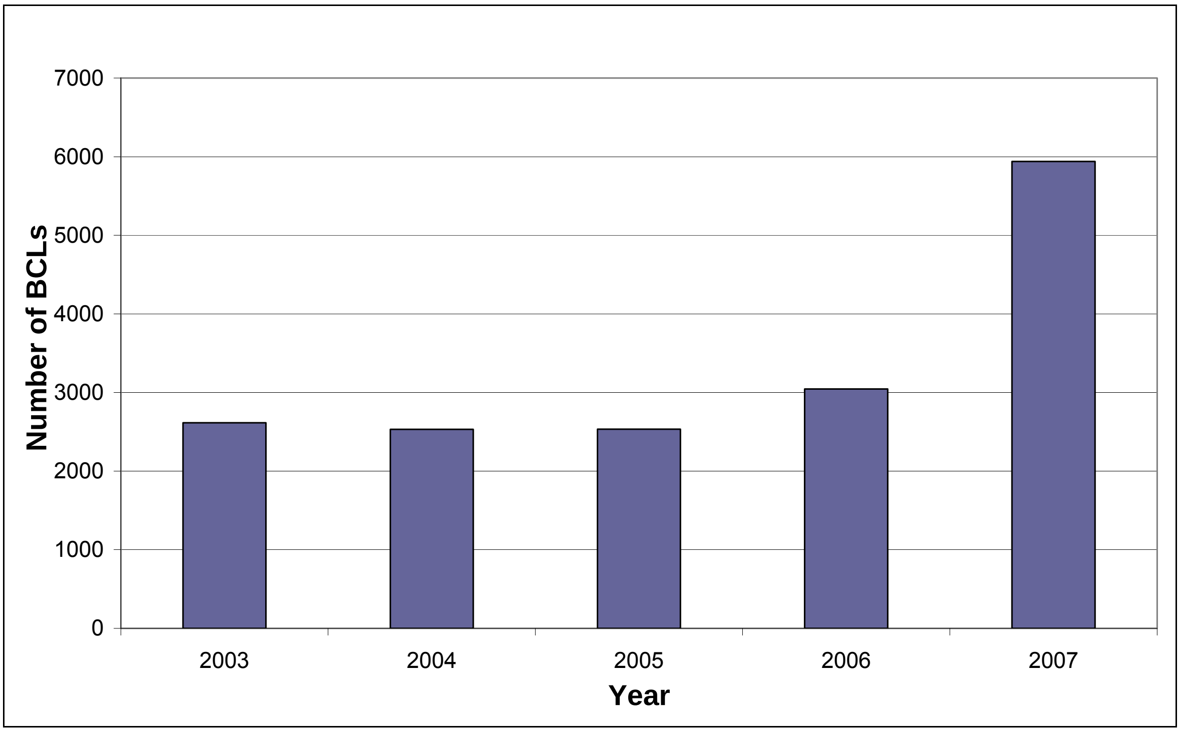
- The total groundwater entitlement was 1,001,000 ML.
- As a result of the declining availability of surface water, groundwater use increased significantly in 2006/07 compared with 2005/06. The total estimated groundwater use across the state, including domestic and stock use, was about 526,110 ML, an increase of 44% from the volume used in 2005/06 (366,300 ML).
- Domestic and stock use is estimated to account for around 9% of the state's total groundwater use, which is similar to 2005/06. This figure is an estimate as the *Water Act 1989* does not require a licence to be issued for this purpose and extractions are not metered. However the increase in the drilling of domestic and stock bores means this figure should be applied with caution.
- In Victoria's GMAs, licensed groundwater entitlements totalled 254,400 ML with total estimated use of 93,100 ML consisting of 75,700 ML of metered extractions and an estimated 17,400 ML of unmetered extractions. Estimated domestic and stock use in these areas was 16,000 ML.
- Licensed groundwater entitlements in WSPAs totalled 639,200 ML, with 344,600 ML of metered extractions. Total estimated domestic and stock use in these areas was 25,900 ML
- Estimated groundwater entitlement in the unincorporated areas was 114,000 ML, with approximately

46,500 ML being extracted. This is relatively unchanged from 2005/06 when entitlement was 112,000 ML and 42,900 ML was extracted.

- Urban water businesses relied significantly more on groundwater to supplement surface water for urban supplies. Water businesses in aggregate used their 47,000 ML of licensed entitlements to extract 22,800 ML of groundwater for urban use. This is an 87% increase on the 2005/06 groundwater extraction of 12,200 ML.

Figures available for the 2007 calendar year indicate the drilling of domestic and stock bores increased significantly. To drill a domestic and stock bore, a bore construction licence (BCL) is required. During the period 2003 to 2006, BCLs issued in the Melbourne area displayed a stable trend. However in 2007, BCLs issued in this area almost doubled from 3,044 to 5,940.

Figure 3-6 Total number of bore construction licences issued since 2003 in Melbourne area



Note: This barchart covers 35 local government areas within the Melbourne area.

A statewide program to meter significant groundwater bores is almost complete. Goulburn-Murray Water, Southern Rural Water and GWMWater estimated that at the end of 2006/07, outside of unincorporated areas, approximately 290 bores or 7% remain to be metered out of a total of 4,270 bores. As more meters are installed, the groundwater data presented in the Victorian Water Accounts is able to improve in terms of reliability and accuracy.

3.8 Water entitlement transfers

The water markets, where they exist, are the main mechanism by which irrigators and urban water businesses, manage their water supplies. The large number of irrigators and entitlement volumes in the Murray and Goulburn basins means the 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 have much smaller markets and comprise the majority of the balance.

Trade is generally more active in dry conditions and when seasonal allocations are low – this is when the ‘scarcity’ value of water increases. An exception to this is when seasonal allocations are exceptionally low, which means that the volume of water available to trade on the temporary market is lower and sometimes non-existent.

In total, approximately 70,000 ML of permanent water entitlements were traded in 2006/07, from more than 1,100 transactions. This included a net 14,570 ML transferred interstate, four times as much as 2005/06. As the drought continued, more irrigators decided to permanently sell their water entitlements, with the volume of permanent water traded increasing by approximately 75% compared to 2005/06.

The temporary market is always more active than the permanent market, and approximately 380,000 ML was temporarily exchanged via more than 23,000 transactions. Temporary trades in the Murray irrigation districts, including the Murray, Kiewa and Ovens basins, more than doubled compared with 2005/06. Basins where seasonal allocations were significantly lower than 2005/06, including the Goulburn, Loddon, Campaspe, Thomson, Latrobe and Werribee basins, experienced lower volumes of temporary trades as there was limited water to exchange.

The volume of surface water entitlements transferred on a permanent or temporary basis is shown in Table 3-8.

Table 3-8 Permanent and temporary trades, 2006/07

Basin	Permanent entitlement transfers				Temporary entitlement transfers			
	Bought (ML)	Sold (ML)	Number of trades	Net transfer to basin	Bought (ML)	Sold (ML)	Number of trades	Net transfer to basin
Murray	51,890	28,600	738	23,290	188,180	223,970	10,075	-35,790
Kiewa	10	10	0	0	1,970	1,970	84	0
Ovens	160	100	4	60	3,080	3,050	151	40
Broken	0	0	0	0	3,570	3,490	223	80
Goulburn	3,750	30,310	315	-26,550	130,870	75,220	11,205	55,650
Campaspe	110	1,240	12	-1,140	130	10	5	120
Loddon	30	8,890	38	-8,860	25,250	25,360	1,552	-110
Avoca	0	0	0	0	0	0	0	0
Mallee	0	0	0	0	0	0	0	0
Wimmera	0	0	0	0	50	50	0	0
East Gippsland	0	0	0	0	0	0	0	0
Snowy	0	0	0	0	0	0	0	0
Tambo	0	0	0	0	0	0	0	0
Mitchell	0	0	0	0	0	0	0	0
Thomson	370	370	6	0	8,490	8,410	269	80
Latrobe	0	0	0	0	15,610	15,610	27	0
South Gippsland	0	0	0	0	0	0	0	0
Bunyip	0	0	0	0	0	0	0	0
Yarra	0	0	0	0	0	0	0	0
Maribyrnong	0	0	0	0	80	80	0	0
Werribee	0	0	0	0	960	960	61	0
Moorabool	0	0	0	0	0	0	0	0
Barwon	0	0	0	0	0	0	0	0
Corangamite	0	0	0	0	0	0	0	0
Otway Coast	0	0	0	0	0	0	0	0
Hopkins	0	0	0	0	0	0	0	0
Portland Coast	0	0	0	0	0	0	0	0
Glenelg	0	0	0	0	0	0	0	0
Millicent Coast	0	0	0	0	0	0	0	0
Total	**56,320**	**69,520**	**1,113**	**-13,200**	**378,240**	**358,180**	**23,652**	**20,070**
Interstate	1,720	16,290	130	-14,570	49,450	38,600	1,146	10,850
Unaccounted difference	n/a	n/a	n/a	1,370	n/a	n/a	n/a	9,220

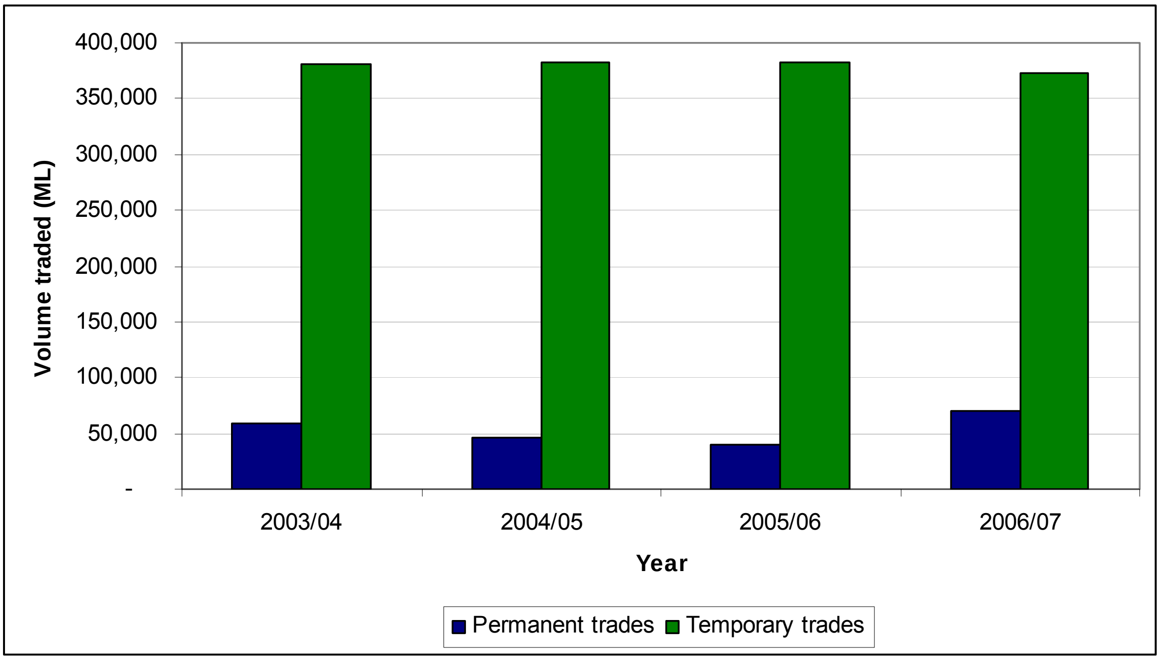
n/a: not applicable.

The unaccounted difference in Table 3-8 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 businesses. The Victorian Water Register commenced operation on 1 July 2007 for the Northern part of Victoria and will include Southern Victoria from 1 July 2008. It should substantially reduce or eliminate unaccounted differences in the future. The Water Register records all water entitlements, seasonal allocations, licences and trades in a centralised accounting database system. Each transaction is recorded electronically according to commonly accepted accounting standards and protocols.

Urban water businesses that participated in the water market in 2006/07 were Coliban Water, Goulburn Valley Water, North East Water and Gippsland Water. Goulburn Valley Water was the most active in terms of the numbers of trades, selling 4,327 ML of temporary water to irrigators from a number of its bulk entitlements in 36 different transactions. Gippsland Water also bought 5,500 ML of water to supplement its Blue Rock bulk entitlement. Details of trades are reported in the state water accounts for each of the bulk entitlements held by water businesses.

Table 3-8 shows the volume of water permanently and temporarily traded since 2003/04. Although the volume of water traded on the temporary market has remained stable, specific basins have recorded large changes as seasonal allocations have fluctuated.

Figure 3-7 Permanent and temporary transfers of entitlements 2003/04 to 2006/07



Trade in permanent licensed groundwater entitlements fell in 2006/07, after increasing in each of the preceding three years. In total, there were only nine transfers of permanent entitlements in groundwater, totalling 360 ML, compared to 890 ML in 2005/06 and 740 ML in 2004/05. Temporary trades, on the other hand, increased significantly. In 2005/06, 7,400 ML of temporary groundwater was exchanged in 90 transactions. In 2006/07, there were 208 temporary trades of groundwater, with 19,476 ML of entitlements changing hands. Trades in groundwater areas managed by Goulburn-Murray Water experienced the highest increase, with the 3,040 ML traded in 2005/06 rising to 12,230 ML in 2006/07.

3.9 Recycled water

The volume of water that was recycled by Victoria's water businesses continued to grow in 2006/07, with a total of 95,500 ML of wastewater recycled for use external to treatment plants. This represented approximately one quarter of the total volume available for reuse at the end of the wastewater treatment process. An additional 15,978 ML was recycled for use within the wastewater treatment process, which increases the proportion of recycled water to 28% of wastewater available for recycling. 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 total volume of water recycled increased by more than 15,000 ML in 2006/07 compared to 2005/06. This growth in the volume of recycled water was predominately driven by increases at Melbourne Water's two wastewater treatment plants – the Eastern Treatment Plant and the Western Treatment Plant.

In 2005/06, the volume of water recycled by the Eastern Treatment Plant was 6,632 ML. In 2006/07, this volume had increased to 10,424 ML as participation in the Eastern Irrigation Scheme grew. Under this program, Melbourne Water sells Class C recycled water to private sector operator TopAq, which further treats the water to Class A standard and delivers the water to horticultural, recreational and industrial users.

The volume of water recycled by the Western Treatment Plant increased from 38,126 ML in 2005/06 to 51,440 ML in 2006/07. The majority of this increase is attributable to increased use of recycled water in the Werribee Irrigation District recycling scheme. Recycled water sold to irrigators under the scheme increased more than seven-fold from 1,279 ML in 2005/06 to 10,946 ML in 2006/07. Recycled water used by Melbourne Water's Werribee Agricultural Group, on pasture used for sheep and cattle farming within the Western Treatment Plant boundary, also increased by more than 4,000 ML in 2006/07.

Including the treatment plants operated by the Melbourne metropolitan retailers, the volume of water recycled in Melbourne was 64,650 ML, or 22%. 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 31%, or

30,878 ML, of the wastewater available for reuse. Although the volume of recycled water used in regional Victoria fell from 2005/06 (33,105 ML), this was due to lower overall water consumption and therefore less wastewater entering the treatment plants.

Table 3-9 Volume of wastewater recycled in 2006/07

Basin[1]	Total volume of wastewater produced	Volume recycled excluding within process (ML)	% of wastewater recycled excluding within process	Volume recycled within process (ML)	% of wastewater recycled including within process
Murray	9,481	5,063	53%	0	53%
Kiewa	92	56	61%	0	61%
Ovens	1,817	948	52%	0	52%
Broken	490	430	88%	0	88%
Goulburn	7,325	6,216	85%	0	85%
Campaspe	782	694	89%	0	89%
Loddon	7,853	2,520	32%	0	32%
Avoca	199	199	100%	0	100%
Mallee	n/a	n/a	n/a	n/a	n/a
Wimmera	1,541	1,527	99%	15	100%
East Gippsland	71	71	100%	0	100%
Snowy	198	198	100%	0	100%
Tambo	738	738	100%	0	100%
Mitchell	1,371	1,371	100%	0	100%
Thomson	332	295	89%	0	89%
Latrobe	20,859	660	3%	0	3%
South Gippsland	3,692	357	10%	8	10%
Bunyip	137,821	12,723	9%	13,976	19%
Yarra	8,073	741	9%	871	20%
Maribyrnong	2,387	1,109	46%	180	54%
Werribee	150,080	55,281	37%	0	37%
Moorabool	n/a	n/a	n/a	n/a	n/a
Barwon	25,019	2,593	10%	836	14%
Corangamite	1,836	199	11%	29	12%
Otway Coast	1,256	380	30%	55	35%
Hopkins	5,640	693	12%	8	12%
Portland Coast	1,996	128	6%	0	6%
Glenelg	1,102	296	27%	0	27%
Millicent Coast	42	42	100%	0	100%
Total 2006/07	**392,093**	**95,528**	**24%**	**15,978**	**28%**
Total 2005/06	**440,001**	**79,906**	**18%**	**15,833**	**22%**

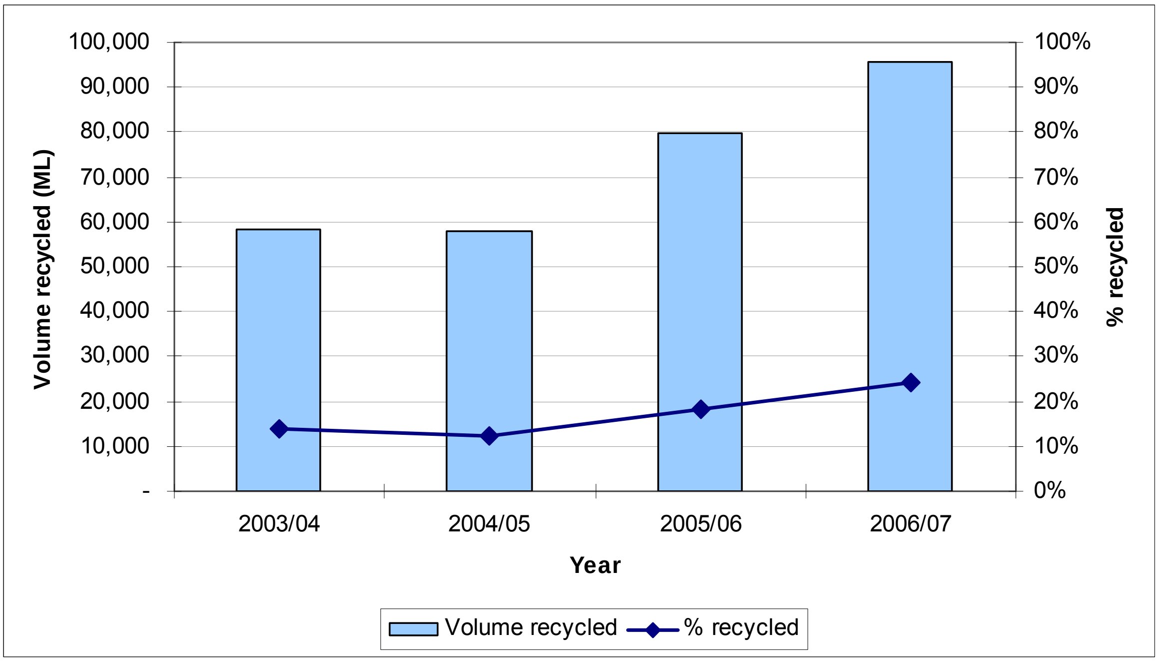
Notes:

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

n/a: Not applicable as there are no wastewater treatment plants within the basin.

Figure 3-8 shows the trend in recycled water over the past four years. In 2003/04 and 2004/05, the volume recycled was slightly less than 60,000 ML, with Melbourne contributing 20,000 ML to 25,000 ML. In the next two years, as demand for recycled water has increased due to the drought and more recycling schemes have come on line, the volume of water recycled has grown substantially, as has the percentage recycled. As noted above, Melbourne recycled almost 65,000 ML in 2006/07 – three times the volume it recycled in 2003/04. Regional Victoria has continued to reuse around 30% of the wastewater it produces, which, depending on the volumes entering the treatment plants, has ranged from around 31,000 ML to 38,000 ML per annum.

Figure 3-8 Recycled water volume and percentage 2003/04 to 2006/07 (excluding recycled water used 'within process')



3.10 Conclusions

As the drought became more severe and water availability to all sectors dramatically decreased, the volume of water used fell. Diversions from streams under bulk entitlements fell by more than 25% compared to 2005/06, storages were drawn down, seasonal irrigation allocations were substantially lower, whilst the number of towns on water restrictions more than doubled.

In the past four years, the volume of entitlements has grown as an increasing number of bulk entitlements have been formalised. The volume of water taken from streams had remained relatively stable at around 5,000,000 ML each year from 2003/04 to 2005/06. In 2006/07, however, surface water diversions fell to 3,500,000 ML from entitlements totalling more than 6,400,000 ML.

Faced with a reduction in inflows and declining storage levels, and the associated decrease in surface water diversions, water businesses and their customers have sought alternative sources of water to augment traditional surface water supplies. Groundwater use across the state increased by 44% in 2006/07, and the volume of groundwater used for urban supplies increased by 87%.

Recycled water use, particularly in Melbourne, has increased significantly in recent years. Water businesses now recycle 37,000 ML more wastewater than they did three years ago, the equivalent of 205,000 households' annual water use in 2006/07. Regional Victoria recycled more than 30% of its wastewater, and the Melbourne water businesses increased their reuse to 22%.

As water has become more scarce, water businesses and to a larger extent irrigation customers have sought to meet their water needs by trading water allocations on the water market (where water markets exist). Water trading activity has increased significantly since 2003/04, with approximately 70,000 ML of permanent water entitlement being exchanged in 2006/07 and 380,000 ML of seasonal allocations being temporarily traded. The number of trades in 2006/07 almost doubled from approximately 14,000 in 2005/06 to 25,000 in 2006/07.

4 Water for the environment

4.1 The environment's share of water

The Environmental Water Reserve (EWR) was created in 2005 through an amendment to the *Water Act 1989*. It is the legal foundation upon which water can be set aside to maintain the environmental values of rivers and streams. While the *State Water Report 2005/2006* accounted for surface water EWR, the *Victorian Water Accounts 2006-2007* reports on a full 12 months of the EWR.

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 discussion of key projects to enhance the EWR is available in Part 3.

4.2 Reporting on the EWR

The state water 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 amendments to the Water Act by the *Water (Resource Management) Act 2005*, a number of bulk entitlements for the environment were granted and remain in place. Following these amendments, environmental entitlements were able to be established. Environmental entitlements are issued by the Minister for Water and granted to the Minister for Environment, as were bulk entitlements for the environment. Responsibility for managing environmental entitlements is usually delegated to catchment management authorities or the Department of Sustainability and Environment.
- Passing flow requirements are the flows that a water business must pass at its weirs, reservoirs or other defined points before it can take any water for consumptive use. Some of this water is normally set aside for the environment. These flows are specified as obligations, and water businesses must allow these flows to pass as a consequence of their right to take water from the stream. Water businesses 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 allocated for consumptive use. Two SFMPs were in place in the Yarra basin in 2006/07 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 businesses' and other entitlement holders' water entitlements, and any other defined elements of the EWR as outlined above.

The 2006/07 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

Four new environmental entitlements were created in 2006/07.

The Yarra environmental entitlement and the Silver & Wallaby Creeks environmental entitlement were created in October 2006 in conjunction with the establishment of bulk entitlements for the Melbourne retailers and Western Water.

The Yarra environmental entitlement provides for minimum summer and winter flows in the Yarra River in addition to an annual allocation of the first 17,000 ML of net inflow. This annual allocation was intended to commence accruing from 1 July 2007; however in April 2007 the Minister for Water temporarily qualified the implementation of the additional flows until Stage 2 water restrictions in Melbourne are lifted.

Silver and Wallaby Creeks are located in the Goulburn basin and are a source of water for Melbourne. The new environmental entitlement establishes minimum flow requirements in Silver Creek (at the point where the Hellhole, Muddy, Silver and Stony Creeks combine) and Wallaby Creek below Wallaby Creek weir.

Both the Yarra and Silver & Wallaby Creek entitlements are managed by Melbourne Water.

Two environmental entitlements were created in June 2007 - the Campaspe and Goulburn Living Murray environmental entitlements. These entitlements have been created as part of the conversion of 'sales' water to 'low reliability' water shares with 20% of these water shares being converted to the environmental entitlements. They are designed to be used to provide increased environmental flows along the River Murray, specifically to meet the ecological objectives for use of Living Murray water developed by the Murray-Darling Basin Commission.

The Goulburn System Snowy Environmental Reserve entitlement was increased in October 2006 to reflect water savings of 300 ML per annum identified since the completion of the Normanville pipeline project.

Two entitlements in place at the commencement of 2006/07 were amended during the year, with an effective date of 1 July 2007:

- An amendment to the River Murray Flora and Fauna entitlement created an additional 100,412 ML of low reliability entitlement in the River Murray and Broken Creek systems. As with the newly created Campaspe and Goulburn environmental entitlements, this additional water is part of Victoria's Living Murray commitment. The amendment to the River Murray Flora and Fauna entitlement also revised the operating rules for the Barmah-Millewa Forest Environmental Water Allocation.
- The Loddon entitlement was similarly amended to add 2,105 ML of low reliability entitlement.

The Snowy River (Victorian component) entitlements are assigned two-thirds to the Snowy River and one third to the River Murray and came from a number of water savings projects within the Murray and Goulburn water supply systems.

The Barmah-Millewa Forest Environmental Water Allocation is not strictly an environmental entitlement but has many similar characteristics. It is a significant operational rule embedded in consumptive entitlements and is part of the EWR. 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.

Table 4-1 lists the entitlements for the environment in place in 2006/07. As the Campaspe and Goulburn Living Murray entitlements were created in June 2007 but did not come become operational until 1 July 2007, they are not shown in the table.

Where relevant, the use of this water is described more fully in the separate basin chapters in Part 2.

Table 4-1 Entitlements for the environment in place in 2006/07 (ML)

Entitlement	Entitlement at 30 June 2007 A	2006/07 allocation B	Allocation carried over from 2005/06 C	Total water available in 2006/07 B+C	Water used in 2006/07 D	Carried over to 2007/08 B+C-D
River Murray – Flora and Fauna(1) (2)	27,600	26,220	0	26,220	19,282	6,900(6)
River Murray – Barmah/Millewa Forest	75,000	75,000	-6,000	69,000	0	69,000
Wimmera and **Glenelg** Rivers(5)	40,563	260	3,419	3,679	0	3,679
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	10,897(4)	22,490	31,000	22,490	800
Thomson River	10,000	10,000	461	10,461	4,587	5,874
Loddon River(1)	2,000	0	0	0	0	0
Yarra River(3)	17,000	0	0	0	0	0

Notes:

(1) Entitlement amounts increased on 1 July 2007, however as they took effect during the 2007/08 year these are not shown in the table.

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

(3) While the Yarra entitlement was created in 2006, environmental entitlements did not start accruing until 1 July 2007.

(4) Releases are based on the allocation at the end of January, which was 10,897 ML.

(5) Note that the Wimmera and Glenelg Rivers entitlement actually operates on a November to November water year, however figures reported in the table are based on a July to June year.

(6) 5% loss due to evaporation ~ 6,600 ML.

4.4 Drought conditions and environmental water

Aside from qualifications of passing flows (discussed below) releases under two environmental entitlements were curtailed during 2006/07:

- No water was released under the Wimmera and Glenelg Rivers bulk entitlement in 2006/07 following a direction to withhold releases until the available water resource situation improves.
- In March 2007 passing flows under the Thomson entitlement were temporarily qualified, enabling savings of up to 4,000 ML per year for the Melbourne system.

4.5 Compliance with passing flow requirements

Each water business is required to report on whether it has complied with its obligations to pass flows at dams, weirs and other extraction points specified through bulk entitlements. Generally a high level of compliance was reported during 2006/07, and details are in the state water accounts in Part 2 of this report.

A number of actions were reported by water businesses as underway in 2006/07 to help improve the level of compliance reporting, including:

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

As discussed in Chapter 2, the Minister acted to qualify rights in relation to passing flow requirements in 12 basins during 2006/07. In nine of these basins the qualifications included a reduction or elimination of the need to meet passing flow requirements.

4.6 Total flow at 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 use. This is expressed as a proportion of the annual flow of water that would have left the basin if there were no extractions.

Given the highly variable and seasonal nature of flows in Victorian rivers and the complex demands made of them by water extractions for consumption, 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. It also includes water not used under consumptive entitlements and, in some cases, water traded out of a system.

In 2006/07 the basins that experienced the lowest proportions of water leaving the basin as a percentage of total flow were the Loddon (7%), Werribee (6%), Wimmera (0%) and Avoca (0%). The Loddon, Werribee and Avoca basins also had less than 5% of water leaving the basin in 2005/06.

There were five basins where the proportion of annual flow leaving the basin was greater than 90% in 2006/07, down from nine in 2005/06. All were in the south of the state.

Across the state the proportion of total flow leaving the basins has been increasing slightly in recent years and moved upward from 60% in 2005/06 to 67% in 2006/07. However, in volumetric terms the amount of water leaving the basins reduced by 49% from 9,231 GL in 2005/06 to 4,747 GL in 2006/07, reflecting substantially lower basin inflows.

Figure 4-1 Basin outflows 2003/04 to 2006/07

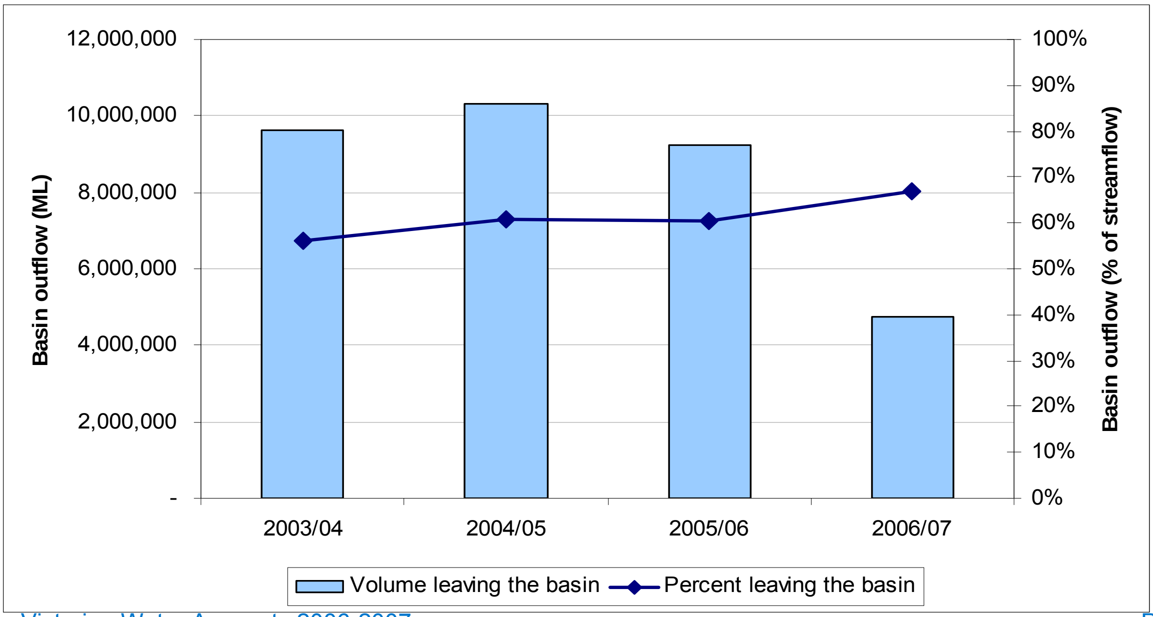


Table 4-2 Volume leaving the basin 2006/07

Basin	Outflow to	2006/07			2005/06
		Streamflow if no extractions (ML)	Total volume leaving the basin (ML)	Proportion of total flow leaving the basin in 2006/07 (%)	Proportion of total flow leaving the basin in 2005/06 (%)
Murray [1]	River Murray (South Australia)	1,140,900	807,900	71%	33%
Kiewa[2]	River Murray	169,800	147,000	87%	97%
Ovens	River Murray	190,400	119,400	63%	97%
Broken	River Murray	71,700	28,100	39%	51%
Goulburn	River Murray	777,700	165,500	21%	24%
Campaspe	River Murray	34,500	4,300	12%	10%
Loddon	River Murray	39,900	2,800	7%	5%
Avoca[6]	Lake Bael Bael and the Marshes	16,500	0	0%	2%
Mallee[3]	River Murray	not available	not available	not available	not available
Wimmera [6]	Lakes Hindmarsh and Albacutya	43,700	100	0%	10%
East Gippsland	Bass Strait	788,600	786,900	100%	100%
Snowy (Vic. only)[4]	Bass Strait	780,800	774,900	99%	99%
Tambo	Bass Strait	115,600	108,800	94%	96%
Mitchell	Bass Strait	353,800	335,700	95%	97%
Thomson	Bass Strait	665,200	326,600	49%	54%
Latrobe	Bass Strait	306,500	194,000	63%	79%
South Gippsland	Bass Strait, Western Port	191,100	147,200	77%	93%
Bunyip	Bass Strait, Western Port, Port Phillip Bay	265,900	241,700	91%	95%
Yarra [5]	Port Phillip Bay	388,200	136,100	35%	43%
Maribyrnong	Port Phillip Bay	19,600	4,600	23%	53%
Werribee	Port Phillip Bay	15,400	900	6%	4%
Moorabool	Port Phillip Bay	25,100	3,400	14%	7%
Barwon	Port Phillip Bay, Bass Strait	83,400	31,700	38%	57%
Corangamite[6]	Corangamite lakes	11,700	2,300	20%	75%
Otway Coast	Bass Strait	297,000	264,700	89%	93%
Hopkins	Bass Strait	82,100	31,000	38%	36%
Portland Coast	Bass Strait	57,100	39,100	68%	70%
Glenelg	Bass Strait	140,200	42,200	30%	37%
Millicent Coast[3]	South Australia	not available	not available	not available	not available
Total		**7,072,400**	**4,746,900**	**67%**	**60%**

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

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

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

4.7 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 Victoria in 2006/07, both of which are located in the Yarra basin. No new SFMPs were finalised during 2006/07, however preparatory work continued on a number of SFMPs with the focus on rivers with high environmental values that are flow-stressed.

A necessary precursor to the establishment of a SFMP is the declaration by the Minister of a Water Supply Protection Area (WSPA). Six WSPAs were created in 2006/07 with a view to the future creation of SFMPs.

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 2006/07
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	 WSPA declared in 2006/07 WSPA declared in 2006/07
Thomson: Avon River	 Preparatory work/WSPA declared in 2006/07
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 Submitted to Minister[3] Draft completed in 2006. To be finalised in 2007/08 following completion of streamflow tender Draft completed in 2006. To be finalised in 2007/08 following completion of streamflow tender Draft completed in 2006. To be finalised in 2007/08 following completion of streamflow tender Preparatory work/WSPA declared in 2006/07 Preparatory work/WSPA declared in 2006/07
Maribyrnong (upper)	Preparatory work
Barwon: Main stem and tributaries to the south including Leigh River, but excluding Moorabool River	 Preparatory work/WSPA declared in 2006/07
Otway Coast: Gellibrand River	 Preparatory work
Hopkins: Merri River	 Preparatory work

During 2006/07 the Victorian Government commenced a pilot streamflow tender project in Stringybark Creek, Olinda Creek, and Pauls, Steels and Dixons Creeks. The tender involves licence holders nominating alterations to their licence conditions which will improve environmental flows, together with a bid for funding to comply with the nominated licence conditions. Successful bids will be those which offer the best value for money. The pilot tender project will be completed in 2007/08, after which the SFMPs for these areas will be finalised.

[3] This streamflow management plan was approved on 4 October 2007.

4.8 Donations

One way in which water can be provided to the EWR is through donations of water to the environment.

To date donations have taken the form of temporary transfers. Under this approach seasonal allocations of water in systems declared as water supply protection areas may be transferred to the environment in order to alleviate environmental stress. (In non-declared systems licences or water rights may be transferred temporarily to achieve the same outcome). Temporary transfers typically occur towards the end of the irrigation system when the water holder is confident they will not need the donated water. From an environmental perspective temporary transfers can be very useful, however as they occur towards the end of the irrigation season they can be difficult to plan for and hence the benefits may be limited.

Donated water may be provided to the environment through a number of means. In the first instance, and depending upon the nature of the transfer (including whether the transfer is permanent or temporary, and whether it is in a declared or non-declared system) this may involve the transfer of water to parties including the Minister for Environment, the Minister for Water, the local catchment management authority, or the secretary of the Department of Sustainability and Environment.

Given the drought conditions that existed in 2006/07 no donations of water were recorded. This contrasts with 2004/05 and 2005/06 when 1.3 GL and 5.6 GL of seasonal allocations were donated by River Murray irrigators via temporary transfer to the River Murray Flora and Fauna Bulk Entitlement.

4.9 Conclusion

The EWR was established in 2005 and while the *State Water Report 2005/2006* reported on the surface water EWR, the *Victorian Water Accounts 2006-2007* is the first report that documents a full twelve months of the EWR in operation. The EWR can include environmental entitlements, passing flow requirements, SFMPs and water passing the outlet of the basin.

The ongoing drought has presented a number of challenges for the environment’s allocation of water. As water supplies for towns and priority rural users became threatened as the year progressed, the Minister for Water acted to qualify rights to water set out in the EWR to ensure water was available for those users.

Of the 28 qualifications of rights declared in 2006/07, 14 had the effect of reducing passing flow requirements or postponing releases of environmental water to secure higher urban supplies. The volume of water released under environmental entitlements (excluding the Barmah/Millewa Forest Environmental Allocation) reduced from 68,900 ML in 2005/06 to 46,359 ML in 2006/07.

Basin outflows in 2006/07 were higher as a percentage of total inflows than recent years; however this was due to lower inflows, not higher outflows. In each of the three years from 2003/04 to 2005/06, the actual volume of water flowing out of each of Victoria’s 29 basins ranged between 9,230 GL and 10,320 GL. In 2006/07, this volume had declined to 4,747 GL, 49% lower than the previous year.

Although no new SFMPs were created in 2006/07, work continued on many SFMPs. Six WSPAs were declared in four basins, which represents a necessary first step to the creation of a SFMP.

Diversions for consumptive use in 2006/07 reduced by 25% compared with 2005/06 and environmental releases fell by 33%. As water availability continued to decline, managing the balance between the water needs of urban and rural consumers and the water needs of the environment become increasingly important in 2006/07.

Part 2
Basin water accounts 2006/07

Part 2 presents an account of water in each of Victoria's 29 river basins during 2006/07.

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

Chapters 6 to 34 report on each basin, providing:

- a basin summary, which reflects data contained within the state water accounts as well as contextual information about what occurred in the basin in the reporting period
- the current management arrangements for water resources within the basin
- information on rainfall, inflows and storages in the basin in 2006/07
- a map of the basin
- the total water resources in each basin
- surface water, groundwater, recycled water and water for the environment in the basin
- drought contingency measures and seasonal allocations and restrictions on water use, diversions and extractions

Alphabetical listing of Victoria's river basins

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 chapter.

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 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 to maintain its health at a level acceptable to the community.

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

The accounts present information on the location of 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 2006 to 30 June 2007. The responsibilities for water management are reported in the state water accounts as they existed during the 2006/07 period. Any changes to responsibilities since the end of June 2007 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 transfers and use from surface water entitlements have been reported to the nearest megalitre as required to assess compliance. All other values in the report, such as catchment inflows, the surface water balance and small catchment dam usage have been rounded to the nearest 100 ML 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 *Victorian Water Accounts 2006-2007* 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). The benchmark is undertaken every five years and is next due for completion in 2009.

5.2 Data sources

The state water accounts are compiled from information obtained from:

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

5.3 Comparison with 2005/06

This is the fourth year that the water accounts have been compiled. Water balance information for each basin in 2006/07 is presented alongside the values reported in 2005/06 for comparative purposes.

Differences between 2006/07 and previous years are, in most cases, the result of changes in climatic conditions or water use. However, as noted below, some differences are due to improvements in estimation methodologies or data collection methods. In some cases, minor errors, omissions or updates relating to the published 2005/06 data were identified in preparing the 2006/07 data. In these cases, revised 2005/06 figures have been presented with accompanying notes explaining why those figures are different to what was reported last year.

In many cases, these revisions flow through to the water balance of the relevant basin. Where a revision to a 2005/06 number has already been explained in the table that provides input into the water balance (e.g. a bulk entitlement table), a note has not also been included accompanying the water balance table. Due to the catchment inflows in most cases being back-calculated based on the other terms in the water balance, any change to one of those terms will also impact the catchment inflow.

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 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 2006/07 values and those of the previous year/s
- where data is only applicable to some basins (such as streamflow management plans), the affected basins contain references to the relevant items.

5.4.1 Surface water resources

Surface water is always reported in the basin from which it is extracted. However, the report usually (but not 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 to divert water from Lake Eppalock, which is located in the Campaspe basin, and then transfer the 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 located.

5.4.2 Groundwater resources

As noted in Chapter 3, the management of groundwater in Victoria is based on allocating resources within:

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

Groundwater is managed not only across areas, but also at different aquifer depths. In Gippsland, 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 (GMUs), which often fall across more than one river basin. As a result, it is not possible to accurately apportion groundwater entitlements and use to specific river basins.

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

In 2006/07, the accounting for groundwater was revised. The proportion of a GMU's surface area within a given basin has been used as a proxy for the proportion of the GMU's total entitlement and use that is located within the basin. For example, the Cut Paw Paw GMA spans both the Maribyrnong basin (where 23.2% of its surface area is located) and the Werribee basin (76.8%). Therefore, in the Maribyrnong basin, all volumes for the Cut Paw Paw GMA are accounted for by multiplying the total volume (e.g. entitlement volume, usage etc) by 23.2%.

It should be noted that when displayed in the report, percentages are rounded to the nearest percent; however the underlying calculation multiplies by the actual percent. In the above example, the Cut Paw Paw GMA in the Maribyrnong basin would show that it has 23% of its surface area within the basin, however all volumes would still be multiplied by 23.2%.

This method will not perfectly reflect where the entitlement and use is actually located. In the example above, it is likely that groundwater bores are not evenly distributed across the Cut Paw Paw GMA and therefore more or less than 23.2% of bores will be located within the Maribyrnong basin. Further, some bores are licensed to extract more water than others, which will also result in inaccuracies in the volumes reported. However, the revised methodology is likely to result in a more meaningful representation of groundwater entitlements and use in each of the basins.

As in prior years, a GMU will not be reported at all in a basin if it does not have at least 5% of its surface area within the basin. For example, in the Portland Coast basin chapter, Table 32-5 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. The Glenelg WSPA, which has 4% of its area within the Portland Coast basin, has not been included in Table 32-5, because it is lower than the 5% threshold. In this instance, the 4% that is located within the Portland Coast basin is added to the basin that holds the largest proportion of the WSPA's surface area, in this case, the Glenelg basin.

The entitlement limit included in the groundwater compliance table is set at the Permissible Consumptive Volume (PCV) of the aquifer where one exists and where there is no PCV, it equates to the total volume of entitlements issued. This volume is also used as a proxy for the total groundwater resource in Table x-2 in each basin. The total groundwater use in Table x-2 includes both licensed usage and usage from domestic and stock bores.

In some cases, water businesses reported entitlement limits as either higher or lower than the sum of all entitlements issued. In this case, each of the entitlement limit and licensed entitlement was set to whichever was the largest volume. For example, if a water business reported that the entitlement limit of a GMA was 6,000 ML, but the sum of its licensed entitlements was 7,000 ML, each was set to 7,000 ML. The one exception is the Portland GMA, which is known to have 7,581 ML of urban licensed volume, and therefore 100% of the Portland GMA urban licensed entitlement and metered use is allocated to the Portland Coast basin and not shared on a proportional basis with the Glenelg basin, in which the Portland GMA has 27% of its surface area. Only non-urban licensed volume and the unmetered use from these licences are allocated according to the surface area percentages. In GMUs that have permissible consumptive volumes (PCVs) as outlined in the CRSWS, if the PCV was higher than the sum of licensed entitlements, the entitlement limit was generally reported as the PCV volume.

As groundwater resources in UAs are largely undeveloped, resource information is not currently readily available in these areas and is not reported in each basin. A limitation of this approach is where urban groundwater use is sourced from a UA. For instance, in the Avoca basin, Avoca and Redbank are both supplied by groundwater from a UA, although there is no groundwater compliance table within the Avoca basin because there are no WSPAs or GMAs. In this instance, it was also necessary to amend Table 13-2 to show that there is groundwater available and used in the basin, although there is no groundwater compliance table.

Monitoring and measurement of groundwater resources is constantly improving. These improved measurements (e.g. better metering) have sometimes resulted in variances between the numbers of bores and entitlement/usage volumes reported in the *Victorian Water Accounts 2006-2007* and *State Water Report 2005/2006*. This should be considered when comparing the two years' data.

The interaction between surface water and groundwater introduces the potential for double counting of these resources. In determining permissible consumptive 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 all significant users and this will enable more accurate reporting in the future.

In non-metered areas, an estimate of use based on estimates from the relevant rural water business is provided for the 2006/07 Victorian Water Accounts.

5.4.3 Recycled water

Recycled water from towns with wastewater treatment plants has been assigned to river basins according to the point of discharge 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 business by the ESC, separated into categories including:

- volume of wastewater produced, excluding evaporation
- volume recycled for urban and industrial uses
- volume recycled for agricultural uses
- volume recycled for beneficial allocations (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 of the relevant water businesses 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 businesses must report on, in some cases it is possible that certain recycling activities may be classified by different businesses under different end-use categories.

In the three editions of the State Water Report, the volume of water recycled 'within process' was included in the total volume recycled and the percentage recycled. In the 2006/07 Victorian Water Accounts, the volume recycled within process has still been included in the volume recycled, but has been excluded from the percentage recycled. This methodology has been applied to be consistent with the percentages reported in the ESC's Annual Performance Report.

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

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

For urban water authorities and metropolitan retailers, restrictions target outdoor water use. Each of these urban water businesses has developed restriction policies which are applied in accordance with the Drought Response Plans developed for each supply system. All urban water businesses now have a four-stage restriction policy, with all except South Gippsland Water and East Gippsland Water adopting Uniform Drought Response Guidelines. 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.

When water restrictions are not in force, all water consumers must still abide by permanent water saving measures. These measures are developed at the water business level and designed to ensure the efficient use of resources at all times. For example, most permanent water savings measures 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 rural water businesses throughout the irrigation season and increased if the available water exceeds their forecasts. The initial seasonal allocations are often low because water authorities do not know until late spring how much water will be available for use. Seasonal allocations are reported for each basin with an irrigation supply system.

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

- rostering (also referred to as Stage 1 restrictions): restricts the time or day on which water can be diverted from rivers
- Stage 2, 3 and 4 restrictions: 25%, 50% and 75% reduction in diversion rate respectively
- Irrigation 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:

- 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. Figure x-1 in each basin includes all major storages over 1,000 ML in the basin – both on-stream and off-stream.
- The unknown item in each water balance is generally the catchment inflows. Inflows have been back-calculated as the sum of basin outflows plus diversions.
- The method of calculating in-stream 'losses', 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 businesses, domestic and stock water users were assumed to divert their full entitlement volume.
- The water accounts exclude diversions from rivers under domestic and stock rights which do not require a licence. The volume associated with these rights is relatively small.

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

In the Murray basin, inflows to Lake Victoria were not recorded as inflows to the Murray basin since those flows are actually transfers from elsewhere within the basin. Since the volume held in the Menindee Lakes is lower than the defined threshold under which control reverts to New South Wales, Victoria had no share of inflows to the Menindee Lakes and therefore these have not been included in the Murray basin inflows. A release to the Murray via the Snowy hydroelectric scheme was included as an inflow or transfer to the basin because it is consistent with the water balance protocols established in the methodology.

5.7 Small catchment dams

As in 2005/06, small catchment dam information was sourced from the Department of Sustainability and Environment's Flow Stress Ranking project. During 2006/07 flows were well below average across the state and were the lowest on record in many areas. Because small catchment dams are only able to harvest flows from their upstream catchments, the dams must harvest less water when low flow conditions are prevalent. As a result, usage and the impact on inflows have been adjusted to reflect the low inflows.

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

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 businesses have an obligation to report on water use against their entitlements in their annual reports. These annual reports can be found on each water business'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. Volumes diverted under bulk entitlements are provided by the water businesses and have not been audited to ensure compliance was actually achieved.
- 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 the proportion of the aquifer that lies within a basin and not at the individual licence holder level, which is assessed separately by water businesses.

Where a bulk entitlement was not finalised prior to 1 July 2007, compliance against that entitlement has not been assessed in the 2006/07 water accounts and will be presented in future water accounts.

5.9 Drought contingency measures

The drought contingency measures included in the basin chapters were obtained from the questionnaires distributed to water businesses and the Department of Sustainability and Environment's Office of Water. The drought contingency measures reported are intended to highlight the most important short to medium term measures taken and do not represent an exhaustive list. Longer term measures, such as Victoria's desalination and foodbowl modernisation proposals are not included in the accounts, but are outlined in Part 3 of the Report.

5.10 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 catchment management authorities
- responses to questionnaires sent to water businesses 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 Sustainable Water Environment and Innovation division.

Information on whether water businesses had met passing flow requirements was obtained from a questionnaire sent to the water businesses.

5.11 Comparison of the water accounts with other data sources

The Victorian water accounts for 2006/07 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 consequently the values presented in the water accounts may be subject to revision within those documents. The method of reporting may also be different: small catchment dams, for example, are reported in the water accounts but not included in diversion figures for extraction cap reporting.

Water businesses present information individually in each of their annual reports. It is important to note when comparing the water accounts with these annual reports that the water business 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 businesses that an accurate picture of volumes traded can be obtained for the Murray basin.

While all efforts have been taken to ensure the accuracy and completeness of data presented, the 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)

This chapter sets out the accounts for the Murray basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

6.1 Murray basin summary

The Murray basin experienced record low inflows in 2006/07, reaching only 16% of the long term average and falling more than 3,250,000 ML from 2005/06. Despite this significant reduction in streamflow, irrigators still received a 95% allocation, which was announced early in the irrigation season (October 2006). This allocation was supplied by drawing the storages down significantly. Major storages ended the year 15% full, a reduction of more than 1,660,000 ML.

Rural diverters on unregulated streams experienced tighter restrictions on their water use than those in regulated systems. In 2005/06, only diverters on Sandy Creek and Lockharts Creek experienced restrictions on diversions. In 2006/07, some 18 streams were placed under restrictions or bans, with diversions banned on most streams at the end of the year. Groundwater use increased by 60% as the traditional surface water supplies were unable to meet demand.

The hot and dry conditions that prevailed throughout the year contributed to significantly higher evaporation losses in the Murray basin. Approximately 517,200 ML of water was lost due to evaporation and channel seepage, an increase of 83,000 ML, or 19%, compared with 2005/06. Water authorities are converting open irrigation channels to pipelines, such as in Lower Murray Water's Robinvale irrigation district, in a bid to reduce system losses.

Lower inflows and falling storage levels resulted in urban water restrictions being introduced and progressively increased throughout the year. In 2005/06, Stage 1 restrictions were in force for customers on the Murray system. At the end of 2006/07, all towns in the Murray basin were on water restrictions, with many including Mildura on the higher Stage 3 and Stage 4 restrictions.

6.2 Responsibilities for management of water resources

The Murray-Darling Basin Commission (MDBC) is responsible for managing the water resources of the Murray basin 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.

Table 6-1 shows the responsibilities of various authorities within the Victorian controlled parts of the Murray basin in 2006/07. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 6-1 Responsibilities for water resources management within the Murray basin (Victoria), 2006/07

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-ordinates 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 upstream of 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 Wodonga and Yarrawonga	
Goulburn Valley Water			Towns in the Murray Valley Irrigation Area including Cobram	
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

6.3 Rainfall, inflows and storage in 2006/07

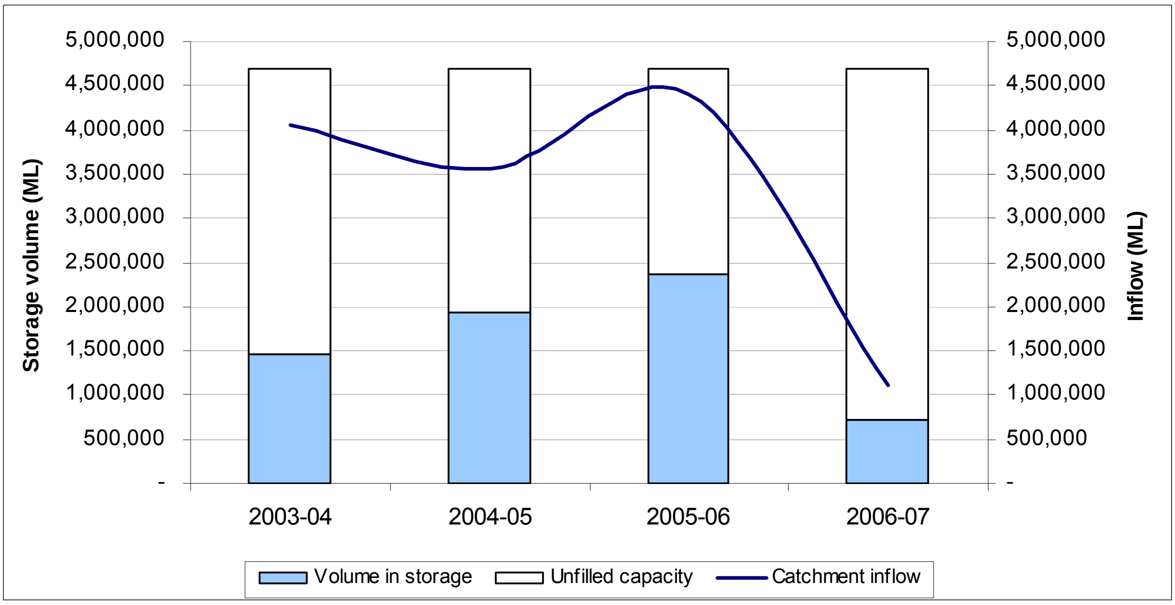
In 2006/07, rainfall in the Murray basin ranged between 40% and 80% of the long term average, a significant reduction from the previous three years that experienced rainfall between 80% and 100% of average. Reduced rainfall and dry soil contributed to record low inflows to some storages. Catchment inflows in the Murray basin were 16% of the long term average (7,000,000 ML), a significant decline from previous years (Figure 6-1).

The total reduction in inflow in 2006/07 compared with 2005/06 was 3,306,600 ML.

As inflows into the basin reduced, storage levels also fell in order to maintain an irrigation supply. At the beginning of the year the volume of water stored in the Murray basin was 2,376,400 ML. At the end of the year, storage levels had fallen to 715,200 ML, a decrease of 70%.

Figure 6-1 incorporates all on-stream storages greater than 1,000 ML capacity. In the Murray basin, this includes Victoria’s share of Lake Hume, Lake Dartmouth, Lake Cullulleraine, Lake Victoria and the Menindee Lakes.

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



6.4 Total water resources in the basin

Victoria’s share of the total volumes of water available and supplied from water resources in the Murray basin is shown in Table 6-2. The total surface water resource includes Victoria’s share of inflows to Lake Dartmouth, Lake Hume, Lake Victoria and the Menindee Lakes, Victoria's share of inflows from the Kiewa River, as well as outflows from other Victorian rivers (Ovens, Broken, Goulburn, Campaspe, and Loddon) into the River Murray. In 2006/07, surface water usage in the basin exceeded the volume of water that flowed into the basin, resulting in a large draw-down of storage levels.

Table 6-2 Summary of total water resources and water use in the Murray basin (Victoria), 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	1,209,100	1,488,600
Groundwater(2)	120,000	59,800
Recycled water	9,480	5,060

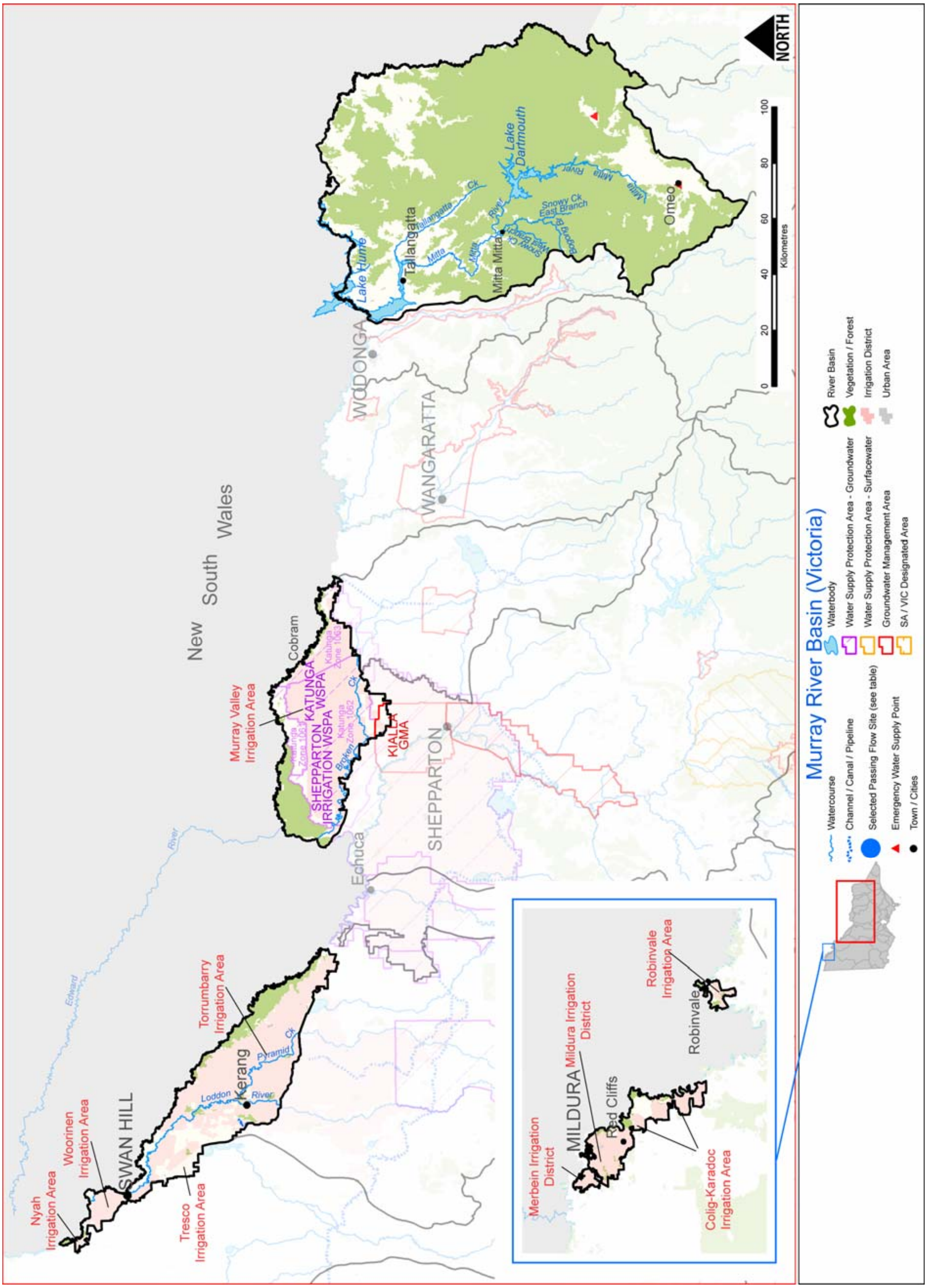
Note:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 6-8.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the State Water Report 2005/2006.

6.5 Location of water resources

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



6.5.1 Infrastructure projects to improve water availability

Lower Murray Water continued its preliminary workplan for the Robinvale high pressure system. 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.

6.6 Surface water resources

6.6.1 Water balance

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

Although usage in the basin decreased, mainly in response to reduced irrigation allocations, lower inflows resulted in far less water flowing into South Australia. The hot, dry conditions in the Murray basin resulted in significantly more storage evaporation and in-stream losses to groundwater and evaporation. The volume of water lost increased by approximately 82,600 ML compared with 2005/06.

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

Water account component	2006/07 (ML)(1)	2005/06 (ML)(1)
Major on-stream storage		
Volume in storage at start of year	2,376,400	1,976,500
Volume in storage at end of year	715,200	2,376,400
Change in storage	**-1,661,200**	**399,900**
Inflows		
Catchment inflow(2)	1,140,900	4,394,300
Spills from NSW share of storage	0	0
Return flow from irrigation	65,100	117,500
Treated wastewater discharged back to river(3)	3,070	3,850
Sub-total	**1,209,100**	**4,515,700**
Usage		
Urban diversions	38,170	41,440
Irrigation district diversions	1,150,700	1,241,900
Licensed diversions from regulated streams	252,600	251,600
Licensed diversions from unregulated streams	21,300	16,800
Environmental water diversions	19,300	61,100
Small catchment dams(4)	6,500	6,500
Sub-total	**1,488,600**	**1,619,300**
Losses		
Net evaporation losses from major storages	162,200	151,200
Evaporation from small catchment dams(4)	800	1,100
In-stream infiltration to groundwater, flows to floodplain and evaporation(5)	354,200	282,300
Sub-total	**517,200**	**434,600**
Water passed at outlet of basin		
River Murray flow to South Australia from Victoria's allocation	807,900	1,471,000
Spills to NSW share of storages	0	542,000
Ceding to NSW storages per Murray-Darling Basin Agreement(6)	56,600	48,900

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

(3) The State Water Report 2005/2006 report inadvertently included 1,480 ML of wastewater that was evaporated in the volume of wastewater discharged back to river. This has been amended in Table 6-3.

(4) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(5) Value estimated via back-calculation based on the difference between Victoria's share of inflows and outflows. Includes environmental diversions under surplus flow conditions.

(6) The volume of water ceded to New South Wales in 2005/06 inadvertently omitted the volume ceded from Lake Dartmouth in the State Water Report 2005/2006. This has been amended in Table 6-3.

6.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 6-4 are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 6-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	7,200	3,600	n/a
Registered commercial and irrigation	3,400	2,900	n/a
Total	**10,600**	**6,500**	**7,300**

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

6.6.3 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 New South Wales and South Australian entitlements transferred into and out of the Murray basin is shown in Table 6-5 (where a negative value represents water being traded into Victoria), whilst a summary of Victorian entitlements traded within the Murray basin is shown in Table 6-6.

Both the number and volume of Victorian entitlements traded within the Murray basin increased substantially in 2006/07 compared with 2005/06. Seasonal allocations were 95% in Murray irrigation districts compared with between 114% and 144% in 2005/06. As a result, many irrigators used the water market to manage their water requirements. Overall, there was a net transfer of permanent entitlements into the basin, but a net transfer of temporary entitlements out of the basin.

Table 6-5 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	550	14,020	14,570
Temporary transfer of water right and sales	-23,400	12,550	-10,850
Total transfers 2006/07	**-22,850**	**26,570**	**3,720**
Total transfers 2005/06	**-28,640**	**4,610**	**-24,030**

Table 6-6 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)
North East Water								
Dartmouth	0	0	0	0	6	0	1	6
River Murray	2	0	1	2	0	195	3	-195
FMIT								
FMIT – Water right	317	317	47	0	2,869	2,869	261	0
FMIT – Sales water					0	0	0	0
GWMWater								
River Murray	0	0	0	0	1,260	0	2	1,260
Goulburn-Murray Water								
Murray Valley – Water right	315	382	15	-67	52,477	38,780	2,578	13,697
Murray Valley – Sales					0	0		0
Kerang-Cohuna – Water right	3,552	8,459	63	-4,907	64,381	49,943	2,245	14,438
Kerang-Cohuna – Sales water					0	0		0
Swan Hill – Water right	1,982	741	24	1,241	7,806	14,752	804	-6,946
Swan Hill – Sales water					0	0		0
Woorinen – Water right	423	60	3	363	1,265	2,891	242	-1,626
Woorinen – Sales water					0	0		0
Nyah – Water right	0	238	7	-238	455	3,521	265	-3,067
Nyah – Sales water					0	0		0
Tresco – Water right	49	96	7	-47	808	1,325	141	-517
Tresco – Sales water					0	0		0
Mitta Mitta – Water right	0	0	0	0	2,117	4,104	109	-1,987
Mitta Mitta – Sales water					0	0		0
River Murray – Water right	188	2,362	18	-2,174	9,309	26,168	695	-16,858
River Murray – Sales water					0	0		0
Lower Murray Water								
River Murray – Lower Murray Water	491	0	14	491	969	3,700	9	-2,731
River Murray – Sunraysia Water	44,574	15,950	539	28,624	44,460	75,724	2,720	-31,264
Minister for the Environment								
River Murray – Flora & Fauna	0	0	0	0	0	0	0	0
Total 2006/07	**51,893**	**28,604**	**738**	**23,288**	**188,182**	**223,971**	**10,075**	**-35,789**
Total 2005/06	**33,932**	**18,707**	**482**	**15,225**	**141,852**	**154,753**	**4,548**	**-8,359**

n/a: information not available

6.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 6-7.

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 6-7 if water use is not more than the maximum volume allowed to be diverted in 2006/07.

Table 6-7 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 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance?(1) (2)
East Gippsland Water					
Omeo	n/a	n/a	0	67	n/a
Coliban Water					
River Murray	1	6,285	0	4,563	Yes
Goulburn Valley Water					
River Murray	1	5,593	0	4,554	Yes
North East Water					
Bundalong(3)	1	51	0	25	Yes
Corryong(3)	1	680	0	325	Yes
Cudgewa(3)	1	29	0	0	Yes
Dartmouth(3)	1	60	6	38	Yes
Walwa(3)	1	61	0	26	Yes
River Murray	1	12,792	-195	9,595	Yes
GWMWater					
River Murray	1	3,317	1,260	3,250	Yes
FMIT					
River Murray	1	79,315	0	47,653	Yes
Goulburn-Murray Water					
River Murray	1	1,532,247	-2,866	1,053,816	Yes
Lower Murray Water					
River Murray – (former) Lower Murray Water	1	30,971	-2,731	18,981	Yes
River Murray – (former) Sunraysia Water	1	408,148	-31,264	291,967	Yes
Minister for the Environment					
River Murray – Flora and Fauna(2)	1	27,600	0	19,282	Yes
River Murray – Snowy Environmental Reserve	1	6,988	0	6,639	Yes
Total annual volume of bulk entitlements 2006/07		**2,114,137**	**-35,789**	**1,460,780**	
Total annual volume of bulk entitlements 2005/06		**2,160,461**	**-8,359**	**1,596,015**	
Licensed diversions from unregulated streams 2006/07		*27,912*		*21,300*	
Licensed diversions from unregulated streams 2005/06(4)		*28,309*		*16,800*	

Notes:

(1) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.

(2) 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 2006/07.

(3) These bulk entitlements were inadvertently omitted from the State Water Report 2005/2006. The 2005/06 figures in Table 6-7 have been updated to reflect the correct 2005/06 volumes.

(4) The calculation method for licensed diversions from unregulated streams has changed for the Victorian Water Accounts 2006-2007. The updated methodology has been applied to the 2005/06 licensed volume and diversions in Table 6-7.

n/a: information not available.

6.7 Groundwater resources

Licensed groundwater entitlements and use for the Kialla GMA and Katunga and Shepparton WSPAs are shown in Table 6-8. Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts.

Groundwater usage in the Murray basin increased significantly in 2006/07. The Katunga WSPA and the Shepparton WSPA are the main groundwater areas in the basin and licensed usage increased by 43% and 74% respectively in these WSPAs. The Shepparton WSPA's water level is exhibiting a long term declining trend and the Department of Sustainability and Environment is preparing a management plan to address salinity control. An approved management plan is already in place for the Katunga WSPA.

Table 6-8 Licensed groundwater volumes, Murray basin (Victoria) 2006/07

WSPA/GMA(1)	GMA/ WSPA depth limits(2) (m)	Entitlement limit(3) (ML/year)	Licensed entitlement(4) (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Katunga WSPA (80%)	>25	48,055	48,055	24,779	0	24,779	17,385
Kialla GMA (7%)(5)	>25	175	175	0	105	105	80
Shepparton WSPA (31%)	≤25	71,791	71,791	33,783	0	33,783	19,405
Total		**120,020**	**120,020**	**58,562**	**105**	**58,667**	**36,869**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.
(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.
(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.
(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 6-9.

Table 6-9 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores(1)(2)	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Kialla GMA (7%)	0	0
Katunga WSPA (80%)	187	374
Shepparton WSPA (31%)	385	770
Total	**572**	**1,144**

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 volume in Table 6-8.
(2) The number of domestic and stock bores represents bores registered in the state database records as being drilled since 1965, multiplied by the surface area percentage within the basin.

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 6-10. Urban groundwater use remained relatively stable as surface water supplies for towns were not threatened.

Table 6-10 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2006/07 (ML)	Metered use 2005/06 (ML)
Barnawartha	293	94	98
Dinner Plain	60	35	61
Katunga	110	49	50
Strathmerton	730	0	13
Total	**1,193**	**178**	**222**

6.8 Drought contingency measures

A range of drought contingency measures were undertaken in the Murray basin in 2006/07. These include:

- restricting urban and rural water use (discussed below)
- providing emergency water supply points
- at Lake Dartmouth, a project to increase water availability at the low level outlet by pumping air into the intake tunnel to enable high rates of water release. North East Water installed a temporary treatment plant at Dartmouth to manage the expected lower water quality as a result of using this water.
- Goulburn Valley Water lowered its groundwater pump in Katunga in response to falling groundwater levels
- Goulburn Valley Water carried over 5,500 ML of water within the Murray irrigation system for use in 2007/08
- modifying off-take pipes used to supply Walwa, Rutherglen and Wahgunyah to pump water from lower river levels
- Goulburn-Murray Water drawing down Kow Swamp to below the regular minimum operating level and drawing down Kangaroo Lake, but above the minimum operating level
- reducing irrigation system losses by lowering operating levels in Kerang Lakes and closing the irrigation season early.

No rights to water were qualified in the Murray basin in 2006/07.

6.9 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 6-11.

Groundwater use was unrestricted in the Murray basin during 2006/07.

Table 6-11 Seasonal allocations and restrictions on water use in Murray basin (Victoria), 2006/07

Type of restriction	Area	Nature of restriction
Urban	Cohuna, Gunbower and Leitchville	Stage 1 from July 2006, decreasing to permanent water saving measures in September 2006, before increasing to Stage 1 in December 2006, Stage 2 in February 2007, and Stage 3 in June 2007
	Omeo	Stage 2 introduced December 2006, increasing to Stage 4 in February 2007, before decreasing to Stage 2 in May 2007 and permanent water saving measures in June 2007
	Picola, Nathalia and Numurkah	Stage 1 introduced December 2006, increasing to Stage 4 from May to June 2007
	Katunga	Stage 1 from December 2006 to June 2007
	Barmah, Cobram and Strathmerton	Stage 1 introduced December 2006, increasing to Stage 2 in May 2007 and Stage 3 in June 2007
	GWMWater customers serviced by the Northern Mallee Pipeline (including Ouyen, Patchewollock, and Walpeup)	Stage 1 restrictions from January 2007, increasing to Stage 2 in June 2007
	Lower Murray Water customers (including Kerang, Mildura and Swan Hill)	Stage 1 introduced December 2006, increasing to Stage 2 April 2007 and Stage 3 in June 2007
	Bellbridge	Stage 1 introduced November 2006, increasing to Stage 2 from January 2007 and Stage 3 in June 2007
	Cudgewa and Corryong	Stage 1 introduced November 2006, increasing to Stage 2 from December 2006 and Stage 3 from February 2007, before decreasing to Stage 2 from May to June 2007
	Walwa, Dartmouth, Jingellic and Mitta Mitta	Stage 1 restrictions November 2006 to June 2007
	Ebden and Tallangatta	Stage 1 restrictions introduced November 2006, increasing to Stage 2 in May 2007 and Stage 3 from June 2007
Licensed diversions from unregulated streams	Sandy Creek and Lockharts Creek	Irrigation ban from July 2006 to June 2007
	Sheepwash Creek	Stage 3 (50% reduction) from October 2006 to June 2007
	Cudgewa Creek (Upper Murray)	Stage 4 (75% reduction) from November 2006, increasing to an irrigation ban from January 2007, before reverting to Stage 3 from May 2007 to June 2007
	Nariel Creek (Upper Murray)	Stage 3 from November 2006, increasing to an irrigation ban from February 2007, before reducing to Stage 4 from March 2007 and unrestricted from May to June 2007
	Scrubby Creek and Snowy Creek	Irrigation ban December 2006 to June 2007
	Indi River	Stage 4 from January 2007, before reducing to Stage 2 (25% reduction) from March 2007 and unrestricted from May to June 2007
	Indigo Creek and Black Dog Creek	Irrigation ban January to June 2007
	Murray (below Hume) and Upper Murray (above Hume)	Irrigation ban February to June 2007
	Tallangatta Creek	Irrigation ban from September 2006, reducing to Stage 4 from October 2006, before increasing back to an irrigation ban from November 2006 to June 2007
	Waterfall (tributary of Tallangatta Creek)	Irrigation from September 2006 to June 2007
	Little Snowy Creek	Stage 2 from October 2006, increasing to Stage 4 from November 2006, and an irrigation ban from January to June 2007
	Livingston Creek and Little Scrubby Creek	Irrigation ban November 2006 to June 2007
	Livingston River	Irrigation ban in November 2006, unrestricted from December 2006 to June 2007
	Mitta Mitta tributaries	Irrigation ban February to June 2007
Irrigation	Murray system (gravity and pumped)	81% allocation announced in July 2006, increasing to 95% in October 2006

6.10 Recycled water

Around 53% of the volume of wastewater passing through treatment plants in the basin was recycled for consumptive use (Table 6-12), mostly for agricultural purposes. This is approximately equal to the proportion recycled in 2005/06; however lower water consumption reduced total quantities of both production volume and recycling volume.

Table 6-12 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Bellbridge	16	16	100%	0	16	0	0	0	0
Bundalong	0	0	0%	0	0	0	0	0	0
Cobram	308	308	100%	0	308	0	0	0	0
Cohuna	0	0	0%	0	0	0	0	0	0
Corryong	76	76	100%	0	76	0	0	0	0
Dartmouth	0	0	0%	0	0	0	0	0	0
Echuca	743	743	100%	0	743	0	0	0	0
Gunbower / Leitchville	0	0	0%	0	0	0	0	0	0
Koondrook	33	33	100%	0	33	0	0	0	0
Koorlong	1,175	1,175	100%	0	1,175	0	0	0	0
Lake Boga	31	0	0%	0	0	0	0	0	31
Merbein	12	12	100%	0	12	0	0	0	0
Mildura	1,665	1,665	100%	0	1,665	0	0	0	0
Nathalia	81	81	100%	0	81	0	0	0	0
Numurkah	94	94	100%	0	94	0	0	0	0
Nyah/Nyah West	41	0	0%	0	0	0	0	0	41
Omeo	23	23	100%	0	23	0	0	0	0
Red Cliffs	136	136	100%	136	0	0	0	0	0
Robinvale	184	184	100%	0	184	0	0	0	0
Strathmerton	0	0	0%	0	0	0	0	0	0
Swan Hill	1,272	0	0%	0	0	0	0	0	1,272
Tallangatta	98	98	100%	0	98	0	0	0	0
Wodonga	3,246	172	5%	172	0	0	0	3,074	0
Yarrawonga	248	248	100%	0	248	0	0	0	0
Total 2006/07	**9,481**	**5,063**	**53%**	**308**	**4,755**	**0**	**0**	**3,074**	**1,344**
Total 2005/06	**11,021**	**5,698**	**52%**	**303**	**5,395**	**0**	**0**	**3,845**	**1,477**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. to maintain biological processes. This value is not included in the total percent recycled, consistent with its treatment in the ESC's Performance Report.

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

6.11 Water for the environment

6.11.1 Environmental Water Reserve (EWR)

In 2006/07 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)
- water set aside for the environment through the operation of 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
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

6.11.2 Entitlements for the environment

The formal entitlements for the environment in the Murray basin in 2006/07 comprised the following:

- the River Murray Flora and Fauna Reserve Bulk Entitlement of 27,600 ML held by the Minister for the Environment. In 2006/07, some 19,300 ML was released under this bulk entitlement, which was a substantial decrease from the 61,100 ML released in 2005/06.
- the EWA for watering the Barmah-Millewa Forest. After releasing 513,000 ML to the lower 50% of the Barmah-Millewa wetlands in 2005/06, no water was released in 2006/07. A total of 69,000 ML has been carried over to 2007/08.

6.11.3 Passing flow requirements

Table 6-13 shows the passing flow requirements in the River Murray Flora and Fauna bulk entitlement.

Table 6-13 Selected 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-Millewa 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 2006/07.

6.11.4 Water leaving the basin

The Victorian component of water flowing from the Murray basin to South Australia was 807,900 ML in 2006/07. This represents 71% of the total inflows into the basin, compared with 33% in 2005/06, although the volume of water passed to South Australia declined by 663,100 ML.

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 to ecologically function.

7 Kiewa basin

This chapter sets out the accounts for the Kiewa basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

7.1 Kiewa basin summary

Decreased rainfall in the Kiewa basin contributed significantly to a large reduction in streamflow in 2006/07. The Kiewa basin's inflows in 2006/07 totalled 169,800 ML, approximately one quarter of that received in each of the past three years, which were around the long term average.

The reduction in streamflow impacted rural diverters on most streams in the basin, with diversions banned on many streams by the end of the year. Urban customers, who began the year with no water restrictions, had Stage 1 restrictions introduced in November and, by the end of the year, many towns including Wodonga were on Stage 3 restrictions.

While the Kiewa basin was one of only two basins to record an increase in the volume of water in storage, its storages are mainly used for hydroelectricity generation rather than consumptive use. A more relevant statistic than storage levels is the volume of water leaving the Kiewa basin and flowing into the River Murray. Victoria's share of the Kiewa basin outflows fell in proportion to the decline in inflows, with the River Murray receiving approximately 250,000 ML less water from the Kiewa basin compared with recent years.

7.2 Responsibilities for management of water resources

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

Table 7-1 Responsibilities for water resources management within the Kiewa basin, 2006/07

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	Obligation to meet passing flow requirements
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

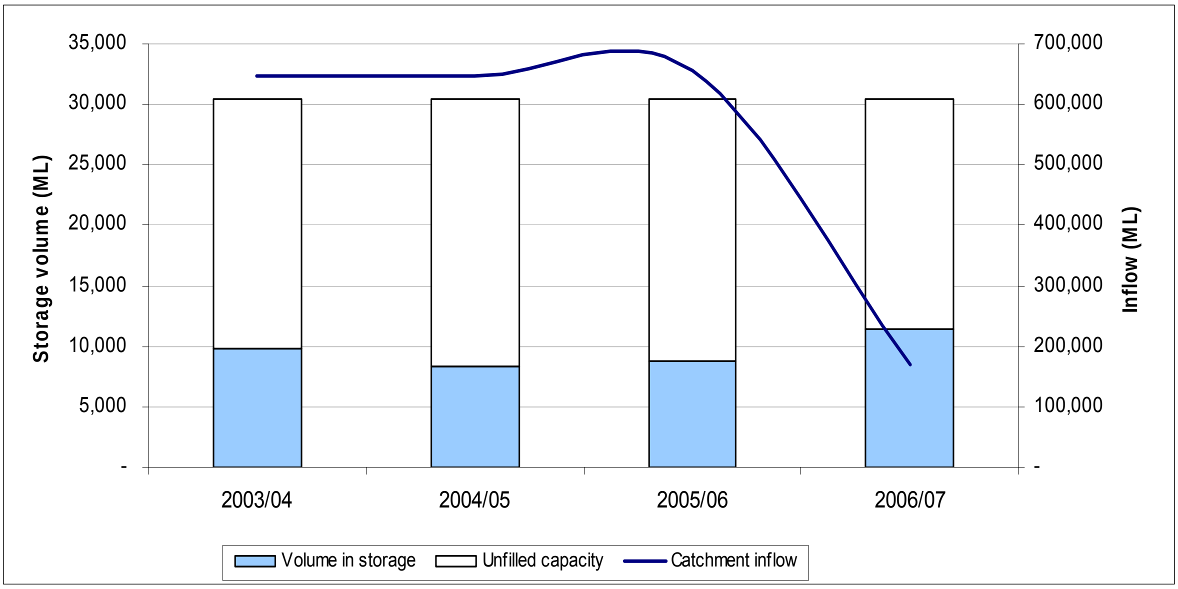
7.3 Rainfall, inflows and storages in 2006/07

In 2006/07, rainfall in the Kiewa basin ranged between 40% and 60% of the long term average. Inflows were 74% less than those estimated in the previous three years when they were close to the long term average (697,000 ML).

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 hydro-power 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 8% during 2006/07 to 10,825 ML, which represents 36% of the total storage capacity of 29,710 ML. The Kiewa basin was one of only two basins where storages increased in 2006/07, the other being the adjacent Ovens basin.

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



7.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Kiewa basin are shown in Table 7-2. Only a small proportion of the surface (6%) and groundwater (11%) resources in the Kiewa basin was extracted for consumptive use. Bushfires still impacted the availability of water from local sources within the Kiewa basin, with a boil water notice issued for Mt Beauty, Tawonga and Tawonga South.

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

Table 7-2 Summary of total water resources and water use in the Kiewa basin, 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	170,000	10,100
Groundwater(2)	7,000	800
Recycled water	90	60

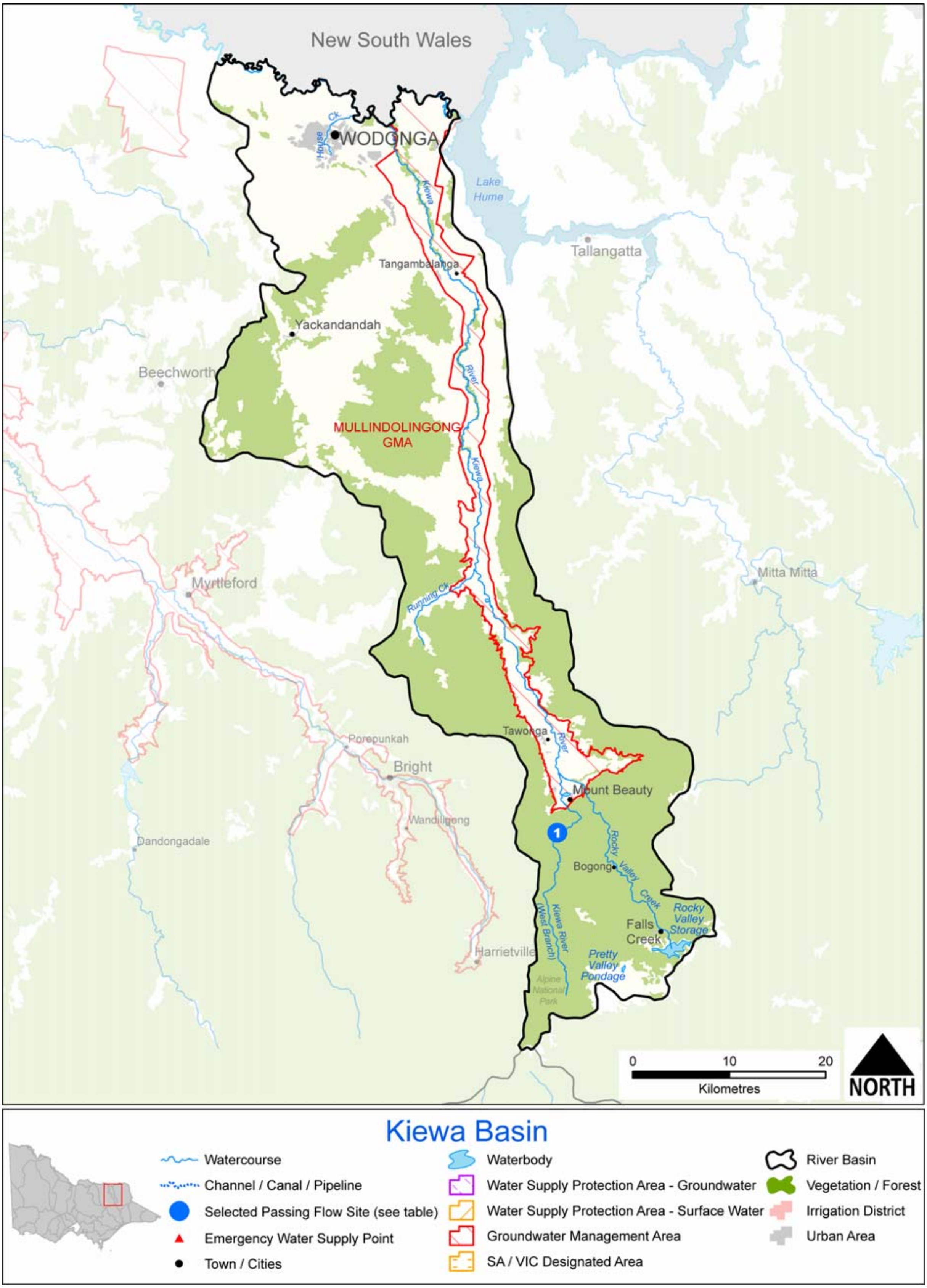
Note:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 7-7.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the State Water Report 2005/2006.

7.5 Location of water resources

Figure 7-2 Map of the Kiewa basin



7.6 Surface water resources

7.6.1 Water balance

A surface water balance for the Kiewa basin is shown in Table 7-3.

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

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

Water account component	2006/07 (ML)	2005/06 (ML)
Major on-stream storage		
Volume in storage at start of year	8,300	7,700
Volume in storage at end of year	10,800	8,300
Change in storage	**2,500**	**600**
Inflows		
Catchment inflow(1)	169,800	651,600
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	150	100
Sub-total	**170,000**	**651,700**
Usage		
Urban diversions	690	660
Licensed diversions from unregulated streams	5,500	3,500
Small catchment dams(2)	3,900	3,900
Sub-total	**10,100**	**8,100**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(2)	2,900	1,100
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	7,400	4,100
Sub-total	**10,300**	**5,200**
Water passed at outlet of basin		
Kiewa basin outflow to River Murray – Victoria share(1)	73,500	318,900
Kiewa basin outflow to River Murray – NSW share(1)	73,500	318,900

Notes:

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

(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

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

7.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2005/06 is not readily available. The values in Table 7-4 are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 7-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	4,000	2,000	n/a
Registered commercial and irrigation	2,300	1,900	n/a
Total	**6,300**	**3,900**	**6,800**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

7.6.3 Water entitlement transfers

A summary of Victorian entitlements transferred into and out of the Kiewa basin is presented in Table 7-5. There were no net imports or exports of permanent water entitlements. Most trades were of a temporary nature and were traded within the basin. North East Water augmented its Yackandandah bulk entitlement by purchasing 7 ML of permanent entitlement from diverters on the Kiewa River.

Table 7-5 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)
North East Water								
Yackandandah	7	0	1	7	0	0	0	0
Licensed Diverters								
Kiewa – – sales	0	7	1	-7	0	0	0	0
Kiewa – licence volume					1,966	1,966	84	0
Total 2006/07	**7**	**7**	**2**	**0**	**1,966**	**1,966**	**84**	**0**
Total 2005/06	**0**	**0**	**0**	**0**	**640**	**640**	**24**	**0**

Notes:

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

7.6.4 Volume diverted

The volume of water diverted under North East Water and AGL Hydro Limited's bulk water entitlements is shown in Table 7-6. 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 2006/07. Licences on unregulated streams are not fully metered and water usage is an estimate provided by Goulburn-Murray Water.

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

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance?[1] [2]
North East Water					
Kiewa – Tangambalanga	1	179	0	0	Yes
Mount Beauty – Tawonga	1	719	0	497	Yes
Yackandandah	1	202	0	163	Yes
AGL Hydro Ltd					
Bogong Village	1	50	0	25	Yes
Kiewa – Southern Hydro Ltd(3)	1	0	0	0	Yes
Total annual volume of bulk entitlements 2006/07		**1,150**	**0**	**685**	
Total annual volume of bulk entitlements 2005/06		**1,150**	**0**	**659**	
Licensed diversions from unregulated streams 2006/07		*18,514*		*5,500*	
Licensed diversions from unregulated streams 2005/06[4]		*18,495*		*3,500*	

Notes:

(1) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited

(2) 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 2006/07.

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

(4) The calculation method for licensed diversions from unregulated streams has changed for the Victorian Water Accounts 2006-2007. The updated methodology has been applied to the 2005/06 licensed volume and diversions in Table 7-6.

7.7 Groundwater resources

Licensed groundwater entitlements and use for the Mullindolingong GMA in the Kiewa basin, excluding domestic and stock use, are shown in Table 7-7. Groundwater extractions increased by 50%, but still represented only 11% of the total licensed entitlement in the GMA.

Table 7-7 Licensed groundwater volumes, Kiewa basin 2006/07

WSPA/GMA(1)	GMA/WSPA depth limits(2) (m)	Entitlement limit(3) (ML/year)	Licensed entitlement(4) (ML/year)	Metered use (ML)	Estimated use in unmetered bores(5) (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Mullindolingong GMA (100%)	≤25	6,980	6,980	0	771	771	514
Total		**6,980**	**6,980**	**0**	**771**	**771**	**514**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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

(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.

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

(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 7-8. Groundwater is not used as an additional source to supply urban customers.

Table 7-8 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores(1)(2)	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Mullindolingong GMA (100%)(3)	27	54
Total	**27**	**54**

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 volume in Table 7-7.

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

7.8 Drought contingency measures

The main drought contingency measure implemented in the Kiewa basin in 2006/07 was the introduction of water restrictions on urban water use and diversions on unregulated streams, discussed in more detail in section 7.9.

No rights were qualified in the Kiewa basin in 2006/07.

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

Water restrictions were imposed on a number of towns in the Kiewa basin in 2006/07. These are listed in Table 7-9 with the most severe being five months of Stage 3 restrictions in Yackandandah. Mount Beauty, Tawonga and Tawonga South moved to Stage 4 restrictions between 23 March and 26 March 2007 due to water quality issues after bushfires resulted in increased turbidity.

A number of bans or restrictions were introduced on licensed diversions in the Kiewa basin during 2006/07. These are listed in Table 7-9 with the most severe being an 11 month irrigation ban on Basin Creek.

Groundwater use was unrestricted in the Kiewa basin during 2006/07.

Table 7-9 Seasonal allocations and restrictions on water use in Kiewa basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Bogong, Falls Creek, Mount Beauty, Baranduda, Tawonga and Tawonga South	Stage 1 introduced November 2006 to June 2007 (excluding 4 days of Stage 4 in March)
	Tangambalanga, Kiewa and Wodonga	Stage 1 introduced November 2006, increasing to Stage 2 in May 2007 and Stage 3 in June 2007
	Yackandandah	Stage 1 in November 2006, increasing to Stage 2 from December 2006 to January 2007 and Stage 3 from February to June 2007
Licensed diversions on unregulated streams	Kiewa River	Stage 2 (25% reduction) in January 2007, increasing to Stage 3 (50% reduction) in March 2007 and unrestricted from April to June 2007
	Kiewa East Branch including Mountain Creek	Stage 2 in February 2007, increasing to an irrigation ban in March 2007 and May 2007. Unrestricted in other months
	Sheepwash Creek (tributary of Hellhole Creek)	Irrigation ban in July 2006, unrestricted August 2006, increasing to Stage 3 in September 2006, and irrigation bans from November 2006 to June 2007
	House Creek and Simmonds Creek	Irrigation ban from November 2006 to June 2007
	Hellhole Creek, Nine Mile Creek, Back Creek (Nine Mile Creek), Back Creek/Yackandandah Creek, Sheep Creek, Cherry Tree Creek and Kiewa River tributary	Irrigation ban from September 2006 to June 2007
	Middle Creek	Irrigation ban in July 2006, unrestricted from August 2006, increasing to an irrigation ban from September 2006 to June 2007
	Basin Creek	Irrigation ban August 2006 to June 2007
	Bay Creek, Glen Creek and Deep Creek	Irrigation Ban October 2006 to June 2007
	Running Creek	Stage 4 (75% reduction) from January to April 2007, increasing to an irrigation ban from May to June 2007

7.10 Recycled water

Four wastewater treatment plants are 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 was similar to 2005/06. Volumes, however, were 60% lower than 2005/06 because less wastewater was delivered to the treatment plants, mainly due to the water restrictions introduced across the basin during the year.

Table 7-10 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Baranduda	0	0	0%	0	0	0	0	0	0
Dinner Plain	28	28	100%	0	28	0	0	0	0
Mount Beauty	36	0	0%	0	0	0	0	36	0
Yackandandah	28	28	100%	0	28	0	0	0	0
Total 2006/07	**92**	**56**	**61%**	**0**	**56**	**0**	**0**	**36**	**0**
Total 2005/06	235	140	60%	0	140	0	0	95	0

Notes:
(1) Volume used to deliver specific environmental flow benefits.
(2) Water reused in sewage treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.
(3) Other refers to a change in on-site effluent storage or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

7.11 Water for the environment

7.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Environmental Water Reserve in the Kiewa basin comprised the following components:

- water set aside for the environment through the operation of 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.

7.11.2 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin.

Table 7-11 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. The location of this compliance point can be seen in Figure 7-2.

Table 7-11 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 (shown as 1 in Figure 7-2)
	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 2006/07.

7.11.3 Water leaving the basin

The volume of water flowing from the Kiewa basin into the River Murray was 147,000 ML in 2006/07. This includes the New South Wales share of Kiewa River flows under the Murray-Darling Basin Agreement. Basin outflows represented 87% of the total inflows into the basin, compared with 97% in 2005/06, with the reduction being caused by lower inflows combined with a relatively stable volume used. 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 to ecologically function.

8 Ovens basin

This chapter sets out the accounts for the Ovens basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

8.1 Ovens basin summary

Lower than average rainfall for the third consecutive year contributed to inflows in the Ovens basin reaching 11% of the long term average in 2006/07. The low inflows created severe water shortages in the basin, particularly over summer, before rain in late March allowed storage levels to recover.

The lack of water led to a number of drought contingency measures being introduced, including pumping dead storage in Lake Buffalo, water carting to Whitfield and Springhurst, drilling new groundwater bores and building a pipeline from Bright to Porepunkah. Irrigators on most unregulated streams either had their licensed extractions heavily restricted or were banned from diverting water altogether for much of the year.

Even though restrictions on urban use caused the volume of wastewater treated in the basin to fall compared with 2005/06, the volume of recycled water increased, mainly to supplement agricultural customers.

8.2 Responsibilities for management of water resources

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

Table 8-1 Responsibilities for water resources management within the Ovens basin, 2006/07

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 Wangaratta, 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

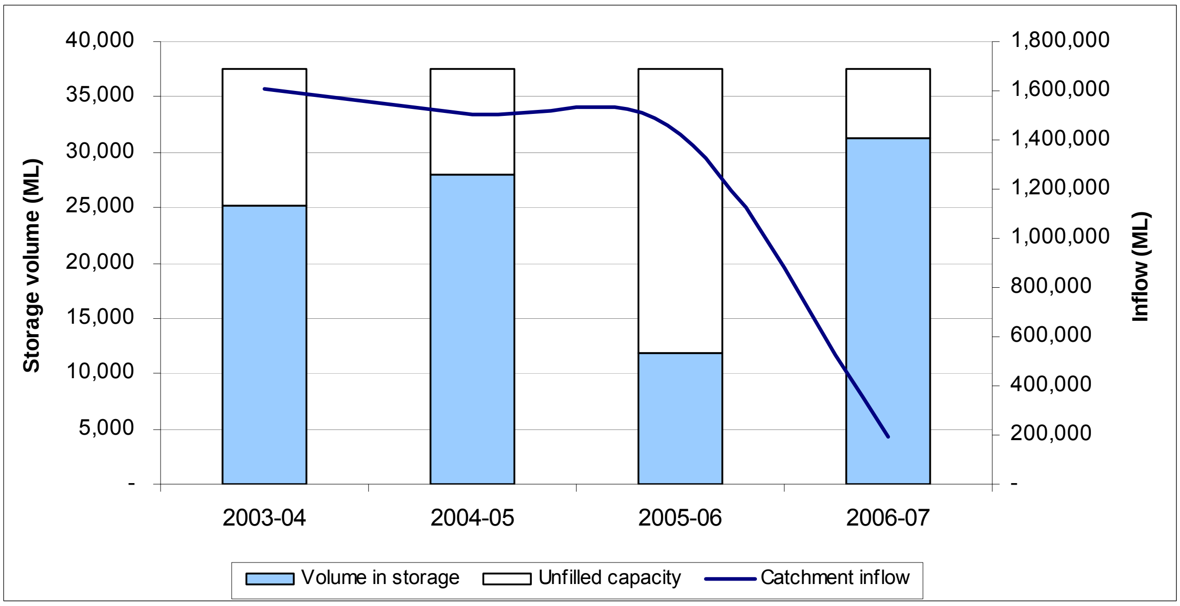
8.3 Rainfall, inflows and storages in 2006/07

In 2006/07, rainfall across the Ovens basin ranged between 40% and 60% of the long term average. Inflows in 2006/07 were 11% of the long term annual average (1,692,000 ML) compared with 84% in 2005/06 and 89% in 2004/05.

The two major storages in the Ovens basin are Lake Buffalo and Lake William Hovell. The Ovens basin was one of only two basins where storage levels increased over the course of the year (the adjacent Kiewa basin being the other). At the end of the year, 31,200 ML was in storage (83% of capacity) compared with 11,900 ML (32%) at the beginning of the year. This increase, however, was only realised in the last three months of the year, when rain in March allowed storages to recover. Over summer, storages fell to critically low levels, forcing a number of contingency measures to be adopted.

The low inflows were likely to be one contributing factor to an outbreak of high alert blue-green algal bloom at Blampieds – Tagells between April and June 2007, effecting recreational use of the watercourse.

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



8.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Ovens basin are shown in Table 8-2. Bushfires affected the quality of water in the Ovens basin, with boil water notices issued for Myrtleford, Bright, Harrietville and Whitfield.

Table 8-2 Summary of total water resources and water use in the Ovens basin, 2006/07

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	191,200	36,000
Groundwater[2]	18,800	7,700
Recycled water	1,820	950

Note:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 8-7.

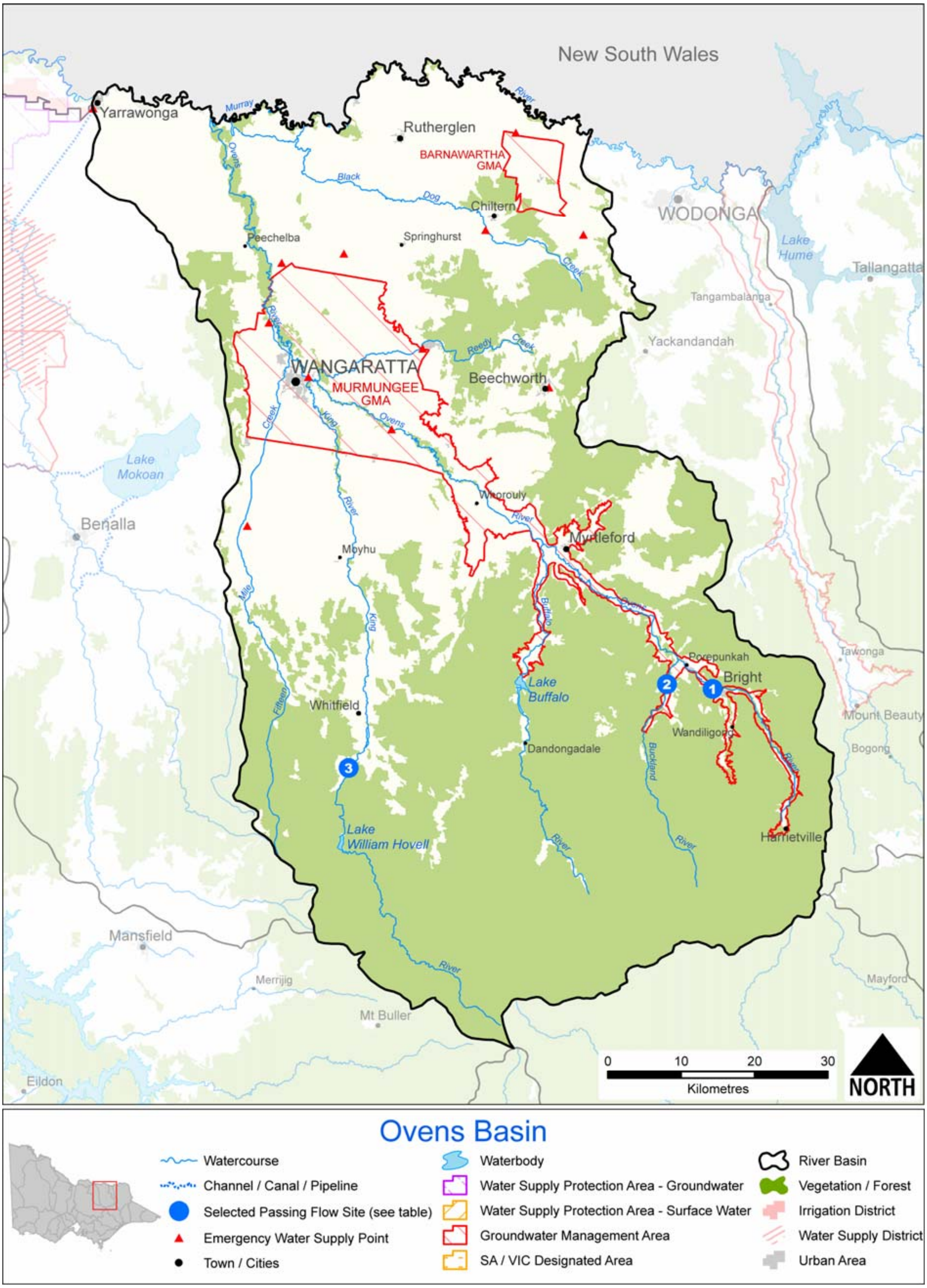
(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the State Water Report 2005/2006.

8.4.1 Infrastructure projects to improve water availability

On 10 March 2007 Goulburn-Murray Water began pumping dead storage from Lake Buffalo to supplement the Wangaratta supply and maintain flows. Pumping continued until later in the month when rain provided useful inflows to Lake Buffalo.

8.5 Location of water resources

Figure 8-2 Map of the Ovens basin



8.6 Surface water resources

8.6.1 Water balance

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

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

Water account component	2006/07 (ML)	2005/06 (ML)
Major on-stream storage		
Volume in storage at start of year	11,900	28,000
Volume in storage at end of year	31,200	11,900
Change in storage	**19,300**	**-16,100**
Inflows		
Catchment inflow(1)	190,400	1,417,100
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	780	2,000
Sub-total	**191,200**	**1,419,100**
Usage		
Urban diversions	6,170	7,250
Licensed diversions from regulated streams	10,000	13,200
Licensed diversions from unregulated streams	4,100	6,600
Small catchment dams(2)	15,700	15,900
Sub-total	**36,000**	**43,000**
Losses		
Net evaporation losses from major storages	1,200	300
Evaporation from small catchment dams(2)	5,900	4,500
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	9,400	9,400
Sub-total	**16,500**	**14,200**
Water passed at outlet of basin		
Ovens basin outflow to River Murray	119,400	1,378,000

Notes:

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

(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(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 2006/07.

8.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 8-4 are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 8-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed) (1)	14,700	7,300	n/a
Registered commercial and irrigation	10,100	8,400	n/a
Total	**24,800**	**15,700**	**21,600**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

8.6.3 Water entitlement transfers

A summary of Victorian entitlements transferred within the Ovens basin is presented in Table 8-5. North East Water made a number of temporary transfers between its water entitlements to manage water supplies and there was a small net temporary transfer into the basin. Four permanent entitlement transactions took place with a net transfer of 60 ML into the Ovens River system.

Table 8-5 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								
Bright	0	0	0	0	34	0	1	34
Chiltern	0	0	0	0	39	0	1	39
Harrietville	0	0	0	0	0	34	1	-34
Ovens River System	100	0	1	100	0	0	0	0
Goulburn-Murray Water								
Ovens River – Water right	60	100	3	-40	3,011	3,011	148	0
Ovens River Sales water					0	0	0	0
Total 2006/07	**160**	**100**	**4**	**60**	**3,084**	**3,045**	**151**	**39**
Total 2005/06	**0**	**0**	**0**	**0**	**1,952**	**1,862**	**122**	**90**

Notes:

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

8.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 8-6. 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 2006/07.

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

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

Table 8-6 Volume of water diverted under surface water entitlements in the Ovens basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)[1]	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance?[2] [3] [4]
North East Water					
Beechworth	1	1,100	0	605	Yes
Bright	1	704	34	738	Yes
Chiltern	1	180	39	219	Yes
Glenrowan	1	90	0	61	Yes
Harrietville	1	91	-34	57	Yes
Myrtleford	2	1,212	0	596	Yes
Ovens (Wangaratta, Oxley, Moyhu)	1	7,832	0	3,774	Yes
Porepunkah	1	166	0	91	Yes
Springhurst	1	36	0	19	Yes
Whitfield	1	34	0	15	Yes
Goulburn-Murray Water					
Ovens River System	1	33,937	0	10,019	Yes
Total annual volume of bulk entitlements 2006/07		**45,382**	**39**	**16,193**	
Total annual volume of bulk entitlements 2005/06[5]		**35,645**	**90**	**20,412**	
Licensed diversions from unregulated streams 2006/07		*24,917*		*4,100*	
Licensed diversions from unregulated streams 2005/06 [6]		*24,814*		*6,600*	

Notes:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one-year) period in the bulk entitlement, divided by the number of years in that period.
(2) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.
(3) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.
(4) 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 2006/07.
(5) The total annual volume of bulk entitlements for 2005/06 was incorrectly stated in the State Water Report 2005/2006.
(6) The calculation method for licensed diversions from unregulated streams has changed for the Victorian Water Accounts 2006-2007. The updated methodology has been applied to the 2005/06 licensed volume and diversions in Table 8-6.

8.7 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 8-7.

The Ovens basin contains all of the Barnawartha GMA and the Murmungee GMA. Groundwater use in the Ovens basin increased as surface water supplies became stressed, particularly over the summer period. Extractions from both GMAs increased by 50% compared with 2005/06.

Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts.

Table 8-7 Licensed groundwater volumes, Ovens basin 2006/07

WSPA/GMA(1)	GMA/ WSPA depth limits(2) (m)	Entitlement limit(3) (ML/year)	Licensed entitlement(4) (ML/year)	Metered use (ML)	Estimated use in unmetered bores(5) (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Barnawartha GMA (100%)	All depths	2,100	2,100	0	291	291	194
Murmungee GMA (100%)	<25	16,710	16,710	0	7,075	7,075	4,717
Total		**18,810**	**18,810**	**0**	**7,366**	**7,366**	**4,911**

Notes:
(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.
(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.
(4) Entitlement volume includes domestic and stock usage in those cases where it is part of an existing licence.
(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 8-8.

Table 8-8 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores(1)(2)	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Barnawartha GMA (100%)	10	20
Murmungee GMA (100%)(3)	165	330
Total	**175**	**350**

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 volume in Table 8-7.
(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(3) The number of stock and domestic bores in the Murmungee GMA has been revised by Goulburn-Murray Water as a result of an improvement in the measurement approach.

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 8-9. North East Water significantly increased its groundwater extractions for Wangaratta as surface water supplies over summer decreased, although groundwater still only accounted for approximately 5% of Wangaratta's supply.

Table 8-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2006/07 (ML)	Metered use 2005/06 (ML)
Moyhu	15	0	0
Myrtleford	75	0	0
Springhurst	20	3	0
Wangaratta	200	198	83
Total	**310**	**201**	**83**

8.8 Drought contingency measures

There was a range of drought contingency measures undertaken in the Ovens basin in 2006/07. These include:

- restricting urban and rural water use (discussed below)
- provision of emergency water supply points
- water carting from Wangaratta to Whitfield and Springhurst
- modifying the off-take pipe that supplies Wahgunyah and Rutherglen to maintain supply at lower river levels
- pumping dead storage from Lake Buffalo to supply Wangaratta
- pumping from dredge holes adjacent to the Ovens River for supply to Bright and Wandiligong
- diverting water from the King River for supply to Whitfield
- construction of a pipeline from Bright to Porepunkah to relieve Porepunkah's falling water supply
- two new groundwater bores being drilled and one bore being recommissioned to augment Wangaratta's supply.

During the year water rights were qualified in the Ovens basin, as presented in Table 8-10.

Table 8-10 Qualifications of rights

Qualification type	Qualification description
New diversion point	Amended the Bulk Entitlement (Ovens System (Mohyu, Oxley and Wangaratta) – North East Water) Conversion Order 2004 to provide for a new diversion point on the King River at Whitfield for an emergency supply to Whitfield Dates: 1 May 2007 ongoing to 30 June 2007

8.9 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. Stage 4 restrictions were in place for 13 days in January at Chiltern after a lightning strike damaged a water treatment plant.

Groundwater use was unrestricted in the Ovens basin during 2006/07.

Table 8-11 Seasonal allocations and restrictions on water use in Ovens basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Barnawartha, Corowa, Dandongadale, Peechelba and Whorouly	Stage 1 from November 2006 to June 2007
	Bundalong	Stage 1 introduced November 2006, increasing to Stage 3 in June 2007
	Oxley, Mohyu, Springhurst	Stage 2 introduced November 2006, increasing to Stage 3 in December 2006 and Stage 4 in February 2007, reducing to Stage 3 in June 2007
	Rutherglen, Wahgunyah, and Yarrawonga	Stage 1 introduced November 2006, increasing to Stage 2 May 2007 and Stage 3 in June 2007
	Beechworth	Stage 1 introduced November 2006, increasing to Stage 2 in February 2007 and Stage 3 from March to June 07
	Bright, Harrietville, Porepunkah and Wandiligong	Stage 1 introduced November 2006, increasing to Stage 3 in December 2006 and Stage 4 in January 2007, reducing to Stage 3 in June 2007
	Chiltern	Stage 1 introduced November 2006, increasing to Stage 2 from December 2006 to June 2007
	Wangaratta	Stage 1 introduced November 2006, increasing to Stage 2 in December 2006 and Stage 4 in January 2007, reducing to Stage 3 in June 2007
	Whitfield	Stage 1 introduced November 2006, increasing to Stage 2 in December 2006 and Stage 4 from February to June 2007
	Myrtleford	Stage 1 introduced November 2006, increasing to Stage 3 in February 2007 and Stage 4 from March to June 2007
Unregulated diversions	Roberts Creek	Irrigation ban July 2006 to June 2007
	Havilah Creek, and Happy Valley Creek	Irrigation ban July 2006, unrestricted from August to October 2006, increasing to an irrigation ban November 2006 and becoming unrestricted in June 2007
	Jackson Creek	Irrigation ban July 2006, unrestricted from August to November 2006, increasing to an irrigation ban December 2006 and becoming unrestricted in June 2007
	Hurdle Creek, Boggy Creek	Irrigation ban October 2006 to May 2007, unrestricted in June 2007
	Fifteen Mile Creek (incl. tributaries and Middle Creek), Barwidgee Creek, Myrtle Creek, Snowy Creek, Morses Creek, Reedy Creek, Black Range Creek	Irrigation ban November 2006 to May 2006, unrestricted in June 2007
	Buffalo Creek	Stage 3 (50% reduction) November 2006, increasing to an irrigation ban January to May 2007, unrestricted in June 2007
	Buckland River	Stage 4 (75% reduction) November 2006, increasing to an irrigation ban February to April 2007, reducing to Stage 4 in May 2007 and unrestricted in June 2007
	Two Mile Creek	Stage 4 November 2006, increasing to an irrigation ban March to April 2007, reducing to Stage 4 in May 2007 and unrestricted in June 2007
	Ovens River Upper	Stage 2 November 2006, increasing to Stage 4 December 2006, and an irrigation ban March to April 2007, reducing to Stage 4 in May 2007 and unrestricted in June 2007
	Hodgsons Creek	Stage 4 November 2006 to May 2007, reducing to unrestricted from June 2007
	Buffalo River (below dam), Ovens River (Myrtleford – Wangaratta), Tea Garden Creek, Maloney's Creek	Stage 4 November 2006, increasing to an irrigation ban December 2006 to April 2007, reducing to Stage 4 May 2007, and unrestricted in June 2007
	Eurobin Creek	Stage 3 November 2006, increasing to Stage 4 December 2006, reducing to unrestricted in June 2007
	Lake Buffalo	Irrigation ban January to May 2007, unrestricted in June 2007
	Ovens River (downstream of Buffalo) tributaries	Irrigation ban February to June 2007
	Upper Ovens River tributaries, Deep Creek, King River tributaries	Irrigation ban February to May 2007, unrestricted in June 2007
	Scrubby Creek	Irrigation ban October 2006 to March 2007

8.10 Recycled water

Wastewater treatment plants in the Ovens basin are operated by North East Water. Approximately 52% of the wastewater passing through treatment plants in the basin was recycled, an increase from 30% in 2005/06. This was largely due to lower production volumes of water from the treatment plants, as the volume of water recycled increased by less than 10% (Table 8-12).

Table 8-12 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Barnawartha	12	12	100%	0	12	0	0	0	0
Beechworth	217	93	43%	0	93	0	0	124	0
Bright / Porepunkah	144	52	36%	52	0	0	0	0	92
Chiltern	68	68	100%	0	68	0	0	0	0
Myrtleford	35	0	0%	0	0	0	0	35	0
Rutherglen / Wahgunyah	123	123	100%	42	81	0	0	0	0
Wangaratta	1,217	599	49%	11	588	0	0	619	0
Total 2006/07	**1,817**	**948**	**52%**	**106**	**842**	**0**	**0**	**778**	**92**
Total 2005/06	**2,863**	**865**	**30%**	**99**	**766**	**0**	**0**	**1,997**	**0**

Notes:

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

(2) Water reused in sewage treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology from the figures presented in the State Water Report 2005/2006.

(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.

8.11 Water for the environment

8.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Ovens basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by North East Water and Goulburn-Murray Water
- water set aside for the environment through the operation of licensed diversions with passing flow conditions (regulated and unregulated waterways)
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

8.11.2 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin.

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. The locations of these compliance points are presented in Figure 8-2.

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 (shown as 1 in Figure 8-2)
	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 (shown as 2 in Figure 8-2)
	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) (shown as 3 in Figure 8-2)
	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 reported that it met all its passing flow requirements under its bulk entitlements in 2006/07. Goulburn-Murray Water reported that it failed to meet a number of passing flow requirements.

8.11.3 Water leaving the basin

The volume of water flowing from the Ovens basin into the River Murray was 119,400 ML in 2006/07. This represents 63% of the total inflows into the basin, compared with 97% in 2005/06, due to lower inflows but similar usage and losses. 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 to ecologically function.

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9 Broken basin

This chapter sets out the accounts for the Broken basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

9.1 Broken basin summary

Inflows to the Broken basin reduced substantially in 2006/07 compared with recent years and reached just 22% of the long term average, in part due to rainfall that was as low as 40% of the long term average in some areas. Relative to other basins, the Broken system seasonal allocation of 77% was high; however it took the whole season to reach that level after beginning the season at 42%. It remained substantially below the previous season (170%).

Unregulated diverters faced irrigation bans on all streams in the basin for at least half the year and urban customers in Glenrowan and Benalla experienced Stage 4 restrictions in the second half of the year.

Lake Mokoan, which is being decommissioned and returned to wetlands, lost over 59,000 ML to evaporation in 2006/07, 22% more than 2005/06 and 60% more than 2004/05. By the end of the year, the storage held approximately 10% of its 360,000 ML storage capacity.

9.2 Responsibilities for management of water resources

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

Table 9-1 Responsibilities for water resources management within the Broken basin, 2006/07

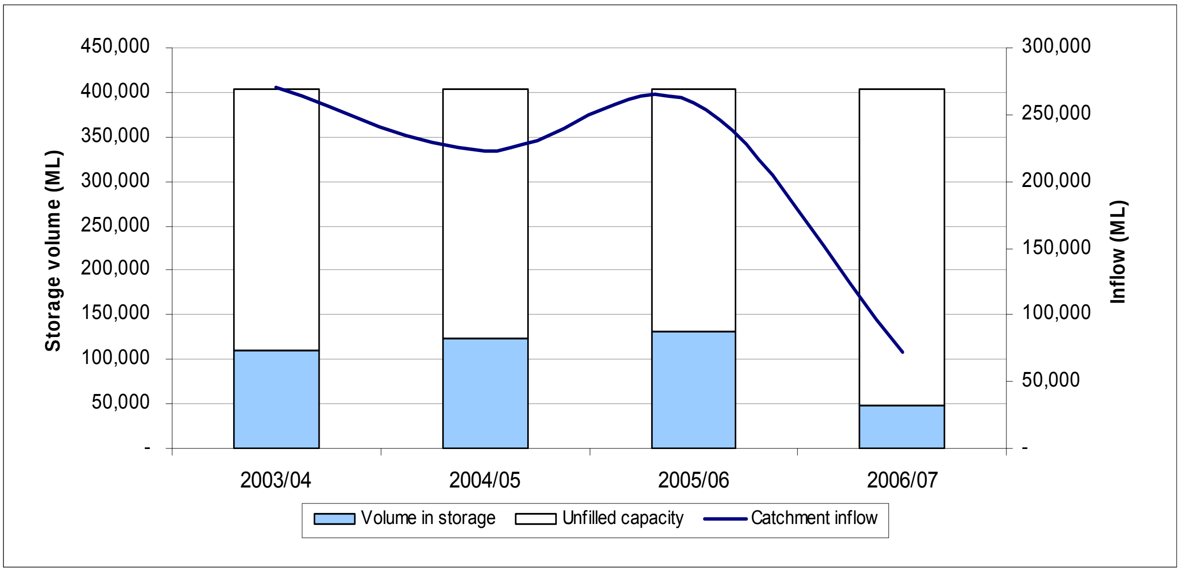
Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Goulburn-Murray Water	Tungamah domestic and stock supply system	Groundwater and surface water licensed diversions	Bulk water supply to Goulburn Valley Water	Major 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	Obligation to meet passing flow requirements
Goulburn Broken Catchment Management Authority				Waterway management in the whole of the Broken basin

9.3 Rainfall, inflows and storages in 2006/07

In 2006/07 rainfall across the Broken basin ranged between 40% and 80% of the long term average. Dry catchment conditions meant total inflows were 22% of the long term average (326,000 ML), and significantly less than the 79% of average experienced in 2005/06.

Storage levels fell by 82,000 ML during 2006/07 to 48,600 ML, which represents 12% of the total storage capacity of 404,213 ML within the Broken basin. Despite drier than average conditions in the previous three years, 2006/07 is the first year in recent times that end-of-year total storage levels have fallen. This is a result of the significant reduction in rainfall across the Broken basin compared with previous years. Lake Mokoan lost 59,300 ML to evaporation, or approximately 44% of its opening storage volume.

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



9.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Broken basin are shown in Table 9-2.

Table 9-2 Summary of total water resources and water use in the Broken basin, 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	71,800	37,800
Groundwater(2)	9,900	3,600
Recycled water	490	430

Note:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 9-7.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the State Water Report 2005/2006.

9.4.1 Infrastructure projects to improve water availability

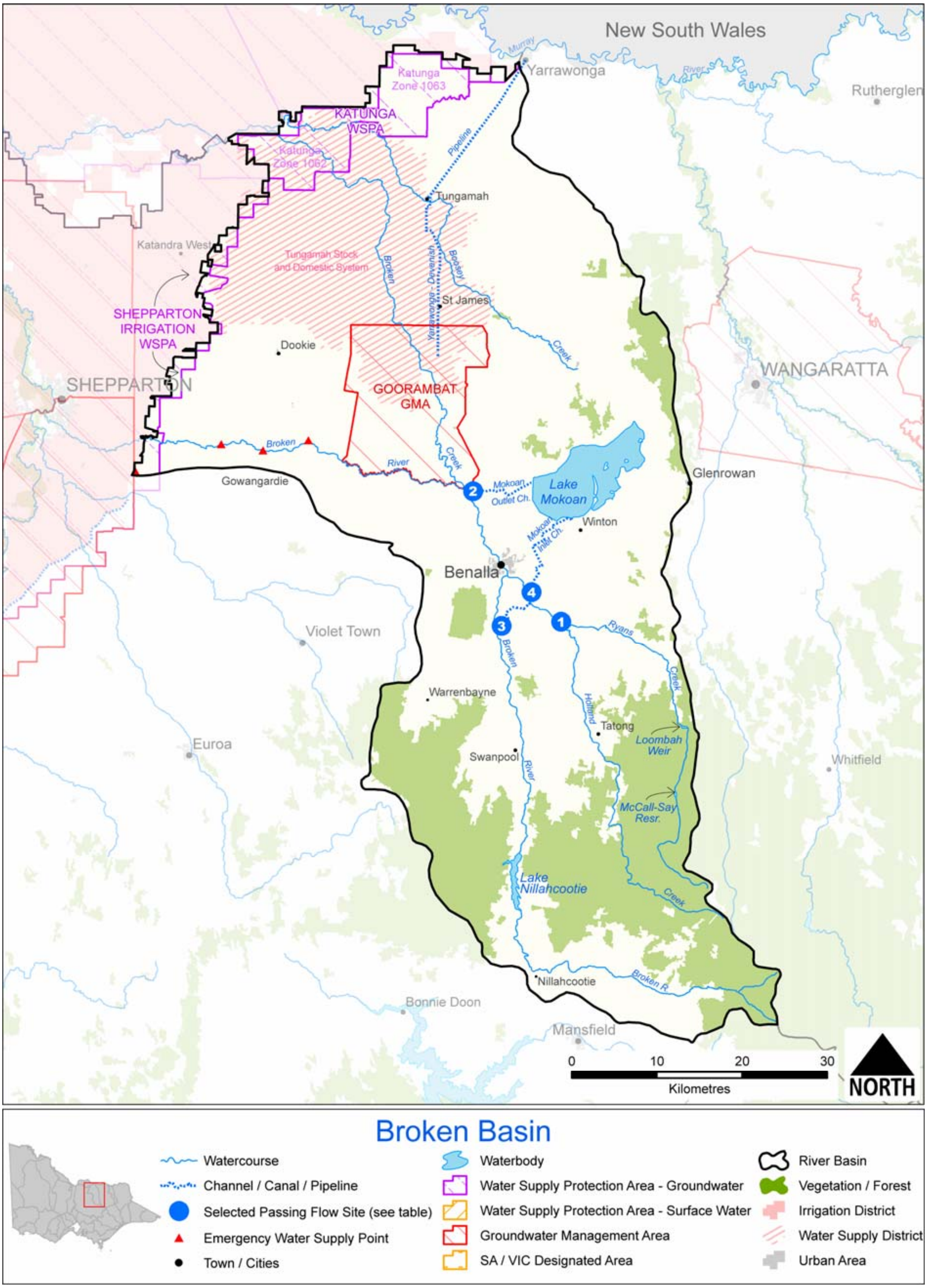
Two major projects are underway to increase water availability in the Broken basin. North East Water is constructing a 45 kilometre pipeline from Yarrawonga to Devenish to improve the security of supply for the townships of Tungamah, St James and Devenish. During 2006/07, work continued on this project and was due for completion in October 2007.

In March 2007 Goulburn-Murray Water finalised the construction of a 360 kilometre pipeline network to supply Tungamah domestic and stock customers. The pipeline replaces 520 kilometres of earthen channels. Water savings from this project will be up to 4,800 ML per annum, with customers being supplied with water from the Goulburn system instead of the Broken system.

In another project, Lake Mokoan is being decommissioned to reduce basin losses and return flows to the River Murray and Snowy River. From 2009 Lake Mokoan will no longer be an active storage as it is being returned to wetland.

9.5 Location of water resources

Figure 9-2 Map of the Broken basin



9.6 Surface water resources

9.6.1 Water balance

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

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

Water account component	2006/07 (ML)	2005/06 (ML)
Major on-stream storage		
Volume in storage at start of year	130,600	123,200
Volume in storage at end of year	48,600	130,600
Change in storage	**-82,000**	**7,400**
Inflows		
Catchment inflow(1)	71,700	259,200
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	60	310
Sub-total	**71,800**	**259,500**
Usage		
Urban diversions	1,580	1,850
Licensed diversions from regulated streams(2)	15,300	21,900
Licensed diversions from unregulated streams(3)	5,500	5,700
Environmental water diversions	0	0
Small catchment dams(4)	15,400	15,800
Sub-total	**37,800**	**45,300**
Losses		
Net evaporation losses from major storages	61,600	49,900
Evaporation from small catchment dams(4)	9,000	7,200
In-stream infiltration to groundwater, flows to floodplain and evaporation(5)	17,300	17,300
Sub-total	**87,900**	**74,400**
Water passed at outlet of basin		
Broken River at Gowangardie to Goulburn basin	26,000	121,500
Boosey Creek at Tungamah to Murray basin	1,000	8,300
Broken Creek at Katamatite to Murray basin	1,100	2,600

Notes:

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

(2) Includes Tungamah domestic and stock system.

(3) Licensed diversions from unregulated streams are derived from an estimate based on the total licensed volume of diversions.

(4) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(5) 2006/07 loss data supplied by the Department of Sustainability and Environment.

9.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 9-4 are based on the estimates provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 9-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)[(1)]	15,400	7,500	n/a
Registered commercial and irrigation	9,600	7,900	n/a
Total	**25,000**	**15,400**	**24,400**

Note:

(1) Estimate of domestic and stock usage for 2006/07 provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam use.

n/a: Information not available.

9.6.3 Water entitlement transfers

A summary of Victorian entitlements transferred into and out of the Broken basin is presented in Table 9-5. North East Water bought water from irrigators on three occasions to provide drought contingency supplies for potential water shortfalls.

Table 9-5 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)
North East Water								
Loombah-McCall Say	0	0	0	0	75	0	2	75
Tungamah	0	0	0	0	50	0	1	50
Goulburn-Murray Water								
Broken River System (Water Right)	0	0	0	0	3,442	3,492	220	-50
Total 2006/07	**0**	**0**	**0**	**0**	**3,567**	**3,492**	**223**	**75**
Total 2005/06	**0**	**0**	**0**	**0**	**1,130**	**1,130**	**30**	**0**

Note:

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

9.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 9-6.

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 2006/07.

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

The Broken River System bulk entitlement volume held by Goulburn-Murray Water is a climatically varying annual cap in which compliance is determined under the Murray-Darling Basin Commission cap compliance process.

Table 9-6 Volume of water diverted under surface water entitlements in the Broken basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)(1)	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance?(1) (2)
North East Water					
Loombah-McCall Say	1	2,324	75	1,477	Yes
Tungamah, Devenish and St James	1	135	50	106	Yes
Goulburn-Murray Water					
Broken River System (3)	1	42,976	-50	12,984	Yes
Broken River System – Tungamah D&S, Urban Supplies	1	6,150		2,295	Yes
Minister for the Environment					
Broken System – Snowy Environmental Reserve	1	990	0	703	Yes
Total annual volume of bulk entitlements 2006/07		**52,575**	**75**	**17,565**	
Total annual volume of bulk entitlements 2005/06		**66,210**	**0**	**23,786**	
Licensed diversions from unregulated streams 2006/07		*10,088*		*5,500*	
Licensed diversions from unregulated streams 2005/06 (4)		*10,204*		*5,700*	

Notes:

(1) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.

(2) Compliance with River Murray bulk entitlements is also assessed against the Murray-Darling Basin annual cap target for the Goulburn, Loddon and Broken basins. Details of this are contained in the MDBC's Water Audit Monitoring Report 2006/07.

(3) The average annual bulk entitlement volume has changed from 2005/06 because a calculation error has been corrected.

(4) The calculation method for licensed diversions from unregulated streams has changed for the Victorian Water Accounts 2006-2007. The updated methodology has been applied to the 2005/06 licensed volume and diversions in Table 9-6.

9.7 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 9-7.

The Broken basin contains all of the Goorambat GMA and 8% of the Katunga WSPA by surface area. Groundwater use in both GMUs increased compared with 2005/06, with the total volume of groundwater extraction 35% higher than 2005/06. The Katunga WSPA has an approved management plan in place.

Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts.

Table 9-7 Licensed groundwater volumes, Broken basin 2005/06

WSPA/GMA(1)	GMA/ WSPA depth limits(2) (m)	Entitlement limit(3) (ML/year)	Licensed entitlement(4) (ML/year)	Metered use (ML)	Estimated use in licensed bores (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Goorambat GMA (100%)	≤25	4,888	4,888	0	926	926	790
Katunga WSPA (8%)	>25	5,038	5,038	2,598	0	2,598	1,823
Total		**9,926**	**9,926**	**2,598**	**926**	**3,524**	**2,613**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water in this table represents the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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

(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.

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

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

Table 9-8 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores[(1)(2)]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Goorambat GMA (100%)	5	10
Katunga WSPA (8%)	20	40
Total	**25**	**50**

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 volume in Table 9-7.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by the surface area percentage in the basin. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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 9-9.

Table 9-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2006/07 (ML)	Metered use 2005/06 (ML)
Goorambat	24	20	20
Total	**24**	**20**	**20**

9.8 Drought contingency measures

A range of drought contingency measures were undertaken in the Broken basin in 2006/07. These include:

- restricting urban and rural water use (discussed below)
- providing access to emergency water supply points.

No rights were qualified in the Broken basin during 2006/07.

9.9 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 9-10. Urban restrictions became more severe as the year progressed and irrigation bans were introduced in several areas during the latter part of the year.

Groundwater use was unrestricted in the Broken basin during 2006/07.

Table 9-10 Seasonal allocations and restrictions on water use in Broken basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Benalla	Stage 2 from November 2006 increasing to Stage 4 in February 2007 before reducing to Stage 3 June 2007.
	Glenrowan	Stage 1 from November 2006 increasing to Stage 4 in June 2007
	St James and Tungamah	Stage 1 from November 2006 increasing to Stage 2 in June 2007.
	Winton	Stage 1 from November 2006 to June 2007.
Regulated diversions	Broken System	Allocation began the year at 42% of entitlement, increasing to 77% in April 2007
Unregulated diversions	Boosey Creek	Irrigation ban December 2006 to June 2007
	Hollands Creek	Irrigation ban October 2006 to June 2007
	Lima East Creek	Irrigation ban January 2007 to June 2007
	Lima Creek	Irrigation ban January 2007 to June 2007
	Other streams in basin	Irrigation ban October 2006 to June 2007

9.10 Recycled water

North East Water operates the sole wastewater treatment plant in the Broken basin at Benalla. The wastewater volume received at the treatment plant was reduced from 632 ML in 2005/06 to 490 ML in 2006/07 due to the impact of restrictions in Benalla. However, as shown in Table 9-11, North East Water recycled 88% of the volume of wastewater passing through the treatment plant in the basin, an increase from 51% in 2005/06. This reflected increased demand for recycled water due to the dry conditions.

Table 9-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Benalla	490	430	88%	0	430	0	0	60	0
Total 2006/07	490	430	88%	0	430	0	0	60	0
Total 2005/06	**632**	**325**	**51%**	**0**	**325**	**0**	**0**	**307**	**0**

Notes:

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

(2) Water reused in sewage treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology from the figures presented in the State Water Report 2005/2006.

(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.

9.11 Water for the environment

9.11.1 Environmental Water Reserve (EWR)

In 2006/07 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
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by North East Water and Goulburn-Murray Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

9.11.2 Entitlements for the environment

The Minister for the Environment holds a 990 ML environmental bulk entitlement. This 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).

9.11.3 Passing flow requirements

Bulk entitlements require passing flow requirements to be met at a number of points in the basin. Table 9-12 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. The locations of these compliance points are presented in Figure 9-2.

Table 9-12 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 (shown as 1 in Figure 9-2)
	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) (shown as 2 in Figure 9-2)
	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 (shown as 3 in Figure 9-2)
	Passing flow rules	• December to May inclusive, the lesser of 22 ML/day or natural flow
	Compliance point	Holland Creek downstream of Holland Weir (shown as 4 in Figure 9-2)
	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/day or natural flow • When water is not being diverted from Broken River 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 in the Broken basin under its bulk entitlements in 2006/07.

Goulburn-Murray Water reported that it failed to comply with two passing flow requirements in the Broken basin during 2006/07.

9.11.4 Water leaving the basin

The amount of water flowing from the Broken basin into the River Murray was 28,100 ML in 2006/07. This represents 39% of the total inflows into the basin, a decline from 51% in 2005/06. 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 located along the River Murray, including the Gunbower Forest and Kerang Wetlands, are dependent on water from the EWR in the Broken basin. These sites are all internationally significant wetlands listed under the Ramsar convention and rely on the freshwater inputs from the Broken basin and River Murray to ecologically function.

10 Goulburn basin

This chapter sets out the accounts for the Goulburn basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

10.1 Goulburn basin summary

Inflows to the Goulburn basin were 23% of the long term average in 2006/07. The 2006/07 inflows were lower than recent years, even though inflows over the past decade have been 62% of the long term average. These low inflows have resulted in Goulburn basin storages being drawn down to record low levels.

Allocations commenced at 0% and gradually increased to a final allocation of 29% in April. This increase, however, was only possible by pumping dead storage from Waranga Basin and drawing down storages to 12% of capacity. Goulburn-Murray Water closed the irrigation season early at the end of April to prevent further distribution losses from its channel network.

The low allocation in the Goulburn basin was the catalyst for a substantial increase in trading activity on the permanent and temporary markets. The number of trades on the temporary market increased by 66%, with over 11,200 transactions importing a net 55,600 ML into the basin. This included 7,000 ML set aside in Goulburn-Murray Water's bulk entitlement to maintain water quality that was instead sold to irrigators on the market. Over 300 trades on the permanent market resulted in 26,500 ML in permanent entitlements leaving the basin.

The water shortage in the basin meant that qualifications of rights were necessary to maintain supplies for Mansfield and Woods Point. Water carting was used to help supply Broadford, Euroa, Violet Town and Mansfield. Irrigation bans on unregulated streams were in force for most of the year and most towns ended the year on Stage 3 or Stage 4 restrictions.

10.2 Responsibilities for management of water resources

Table 10-1 shows the responsibilities of various authorities within the Goulburn basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 10-1 Responsibilities for water resources management within the Goulburn basin, 2006/07

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

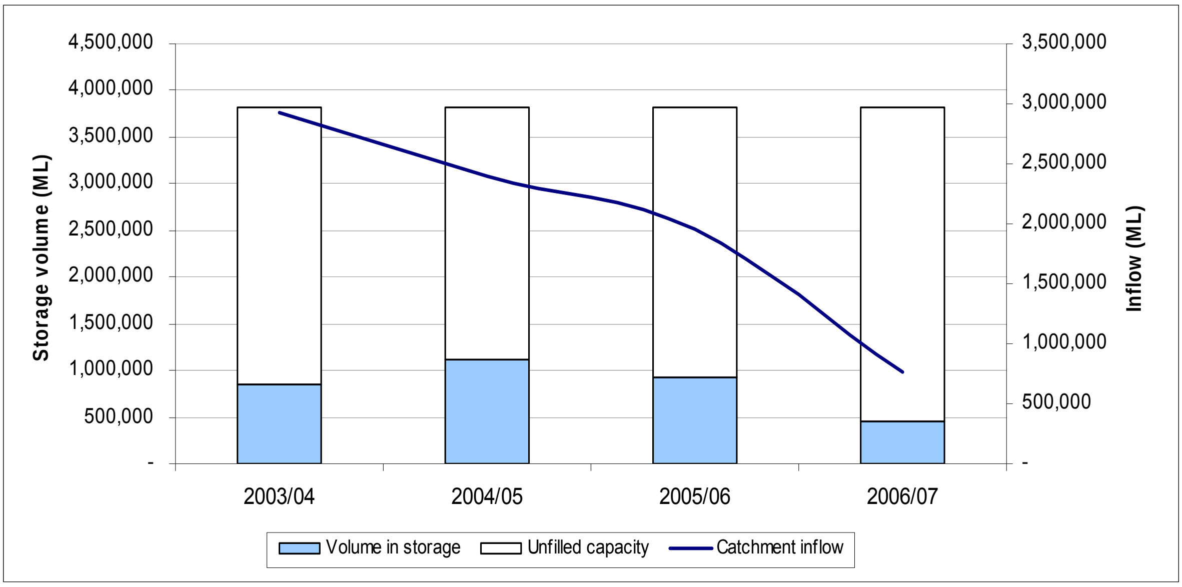
10.3 Rainfall, inflows and storages in 2006/07

In 2006/07, rainfall across the Goulburn basin ranged between 40% and 80% of the long term average. Dry catchment conditions meant total inflows were 23% of the long term average (3,366,000 ML), significantly less than the 58% of average experienced in 2005/06.

Storage levels for all storages in the basin fell by 50% during 2006/07 to 459,000 ML, which comprises 12% of the total storage capacity of 3,826,160 ML. The three major on-stream storages in the basin – Lake Eildon, Lake Nagambie (Goulburn Weir) and Sunday Creek Reservoir – fell by more than 390,000 ML in 2006/07.

Figure 10-1 illustrates the decline in inflows over recent years and the corresponding impact on storage levels. As dry catchment conditions have taken hold in the basin, storage levels have more than halved in last two years.

Figure 10-1 All major storages and catchment inflows in the Goulburn basin



10.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Goulburn basin are shown in Table 10-2. Total use in 2006/07 was significantly less than 2005/06, with 45% reduction in water use; however use in 2006/07 was higher than the amount of inflows to the basin, resulting in a large draw-down of water in storage.

Table 10-2 Summary of total water resources and water use in the Goulburn basin, 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	778,900	843,900
Groundwater(2)	156,000	79,200
Recycled water	7,330	6,220

Notes:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 10-7.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the State Water Report 2005/2006.

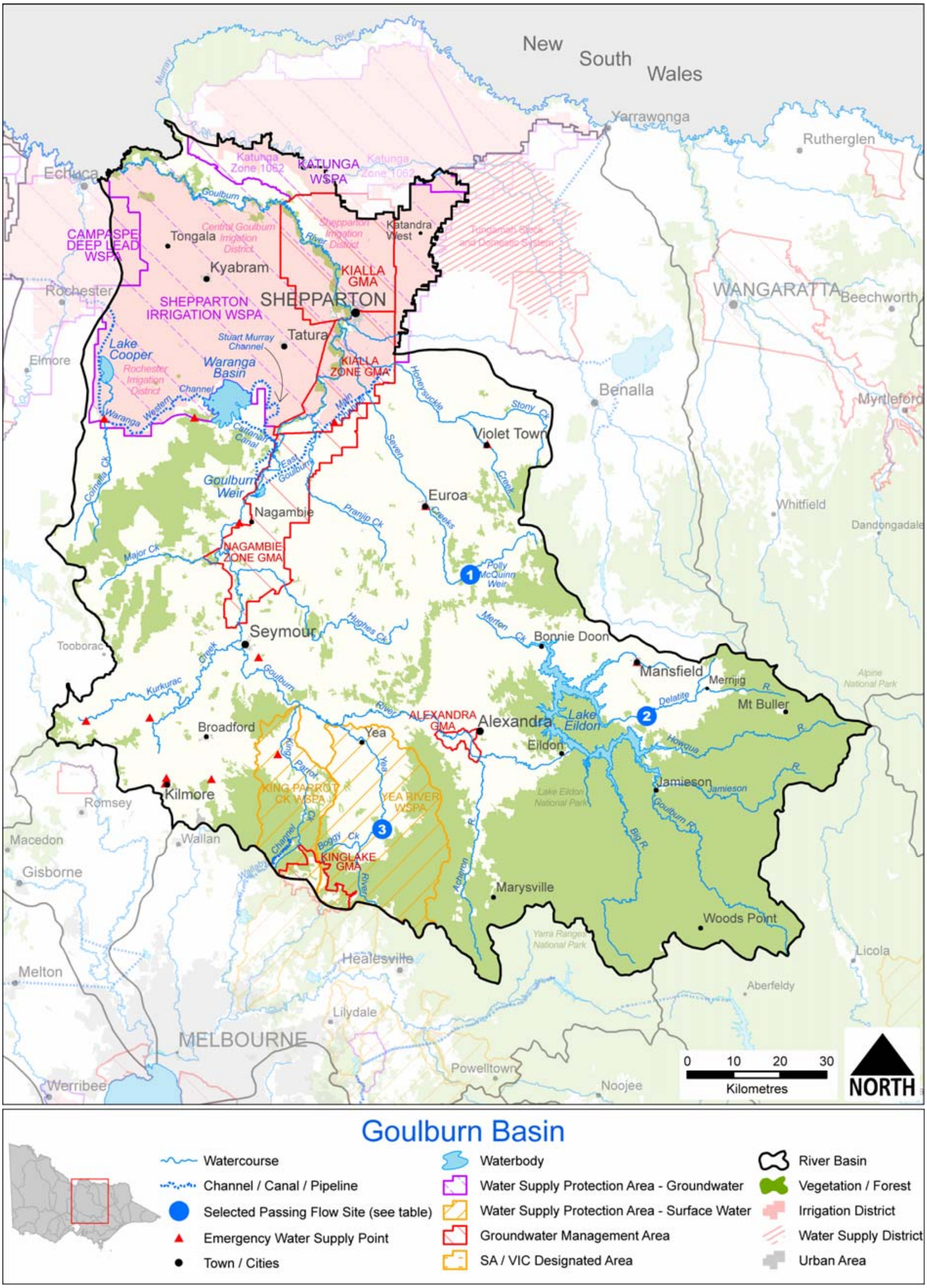
10.4.1 Infrastructure projects to improve water availability

Two major projects are underway to increase water availability in the Goulburn basin. Goulburn-Murray Water is constructing a pipeline and pump station from the Broken River to supply Lake Mokoan diverters, due for completion in 2008. This will free up water in the Goulburn basin, which currently supplies these irrigators.

In May 2007 Goulburn-Murray Water completed the Waranga Basin Pumping Project, which involved installing pumps for 86 GL of dead storage to supplement the Goulburn system allocation. Pump stations have been set up at each of the major and minor outlets of Waranga Basin.

10.5 Location of water resources

Figure 10-2 Map of the Goulburn basin



10.6 Surface water resources

10.6.1 Water balance

A surface water balance for the Goulburn basin is shown in Table 10-3. Note that only those on-stream storages greater than 1,000 ML capacity have been included in the water balance.

Table 10-3 Balance of surface water in the Goulburn basin

Water account component	2006/07 (ML)	2005/06 (ML)
Major on-stream storage		
Volume in storage at start of year	771,400	963,100
Volume in storage at end of year	377,800	771,400
Change in storage	**-393,600**	**-191,700**
Inflows		
Catchment inflow(1)	753,300	1,832,000
Inflow from Broken River at Gowangardie	24,400	121,500
Return flow from irrigation	0	0
Treated effluent discharged back to river(2)	1,240	2,730
Sub-total	**778,900**	**1,956,200**
Usage		
Urban diversions	27,510	27,490
Irrigation district diversions	748,700	1,412,600
Licensed diversions from regulated streams	11,600	30,000
Licensed diversions from unregulated streams	8,400	15,200
Silver and Wallaby Creeks to Yarra basin	1,200	5,300
Environmental water diversions	0	0
Small catchment dams(3)	46,500	47,500
Sub-total	**843,900**	**1,538,100**
Losses		
Net evaporation losses from major storages	28,000	7,200
Losses from small catchment dams(3)	21,700	10,100
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	113,400	113,400
Sub-total	**163,100**	**130,700**
Water passed at outlet of basin		
Goulburn River to Campaspe River via Waranga Western Channel	0	2,000
Goulburn River outflow to River Murray	145,700	471,300
Goulburn River outflow to River Murray via Broken Creek	19,800	5,800

Notes:

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

(2) Includes 129 ML of water returned to rivers within the basin from Alpine Resorts in 2006/07. This information was not available for 2005/06.

(3) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

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

10.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 10-4 are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 10-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	35,900	17,500	n/a
Registered commercial and irrigation	35,200	29,000	n/a
Total	**71,100**	**46,500**	**68,200**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

10.6.3 Water entitlement transfers

A summary of Victorian entitlements transferred into and out of the Goulburn basin is presented in Table 10-5. The year saw a net export of permanent water entitlement from the basin, with 26,554 ML being permanently transferred out of the basin. Conversely, the temporary market brought a net 55,655 ML into the basin, almost double the net temporary trade of 27,576 ML into the basin in 2005/06. The number of permanent and temporary trades increased by 53% and 66% respectively.

Table 10-5 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 (ML)**	**Sold (ML)**	**Number of trans-actions**	**Net transfer to entitlement (ML)**
Coliban Water								
Pyramid Hill	210	0	1	210	0	0	0	0
Rochester	1,533	0	12	1,533	0	0	0	0
Goulburn Valley Water								
Alexandra	0	0	0	0	0	240	2	-240
Eildon	0	0	0	0	0	270	3	-270
Kyabram	0	0	0	0	0	128	2	-128
Mooroopna	0	0	0	0	0	15	1	-15
Murchison	0	0	0	0	0	80	1	-80
Nagambie	0	0	0	0	0	130	1	-130
Seymour	0	0	0	0	0	2,250	10	-2250
Shepparton	0	0	0	0	0	2,700	15	-2,700
Tatura	0	0	0	0	0	2	1	-2
Goulburn-Murray Water								
Goulburn River – Water right	282	175	12	107	7,152	7,277	660	-126
Goulburn River – Sales water					0	0	0	0
Central Goulburn – Water right	662	15,592	153	-14,930	66,564	29,774	5,206	36,791
Central Goulburn – Sales water					0	0	0	0
Rochester – Water right	792	8,154	62	-7,362	25,210	16,145	2,001	9,065
Rochester – Sales water					0	0	0	0
Shepparton Irrigation District – Water right	276	6,388	75	-6,112	31,946	16,206	3,302	15,740
Shepparton Irrigation District – Sales water					0	0	0	0
Total 2006/07	**3,755**	**30,309**	**315**	**-26,554**	**130,872**	**75,218**	**11,205**	**55,655**
Total 2005/06	**1,235**	**15,512**	**206**	**-14,277**	**165,328**	**137,752**	**6,760**	**27,576**

Notes:

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

10.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 10-6. 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 2006/07. For multi-year entitlements, compliance is assessed based on the total volume of water diverted over the term of the entitlement. Therefore it is possible that the volume diverted in any given year may exceed the average bulk entitlement volume.

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

Table 10-6 Volume of water diverted under surface water entitlements in the Goulburn basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)[1]	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance?[2] [3] [4]
Coliban Water					
Boort	1	425	0	192	Yes
Dingee	1	50	0	10	Yes
Lockington	1	130	0	92	Yes
Macorna	1	40	0	7	Yes
Mitiamo	1	60	0	23	Yes
Mysia	1	15	0	7	Yes
Pyramid Hill	1	300	0	236	Yes
Rochester (part)[5]	1	1,400	0	1,276	Yes
Goulburn Valley Water					
Alexandra	1	916	-240	423	Yes
Bonnie Doon	1	112	0	49	Yes
Buxton	1	110	0	0	Yes
Colbinabbin	1	89	0	26	Yes
Corop	1	44	0	12	Yes
Dookie	1	160	0	126	Yes
Eildon	1	480	-270	139	Yes
Euroa System	1	1,990	0	618	Yes
Gigarre	1	100	0	49	Yes
Katandra West	1	64	0	58	Yes
Kyabram	1	2,000	-128	1,361	Yes
Longwood	1	120	0	57	Yes
Mansfield	2	1,300	0	512	Yes
Marysville	1	462	0	264	Yes
Mooroopna	1	300	-15	140	Yes
Murchison	1	350	-80	204	Yes
Nagambie	1	825	-130	550	Yes
Pyalong	1	75	0	68	Yes
Quambatook[6]	1	95	0	81	Yes
Rushworth	1	530	0	343	Yes
Seymour	1	5,340	-2,250	1,796	Yes
Shepparton	1	17,970	-2,700	13,086	Yes
Stanhope	1	200	0	92	Yes
Sunday Creek	10	2,238	0	1,237	Yes
Tatura	1	2,600	-2	1,951	Yes
Thornton	1	120	0	56	Yes
Tongala	1	1,404	0	923	Yes
Upper Delatite	1	235	0	75	Yes
Violet Town	1	270	0	0	Yes
Woods Point	1	21	0	26	No
Yea	1	438	0	226	Yes
Melbourne metropolitan retailers					
Silver and Wallaby Creek	3	22,000	0	1,202	Yes
Minister for the Environment					
Goulburn System – Snowy Environmental Reserve	1	14,812	0	3,555	Yes
Gouburn-Murray Water					
Eildon – Goulburn Weir	10	1,919,000	61,470	760,256	Yes
AGL Hydro Ltd					
Rubicon – Southern Hydro Ltd[7][8]	1	0	0	0	Yes

Total annual volume of bulk entitlements 2006/07(9)		**1,999,095**	**55,655**	**791,404**	
Total annual volume of bulk entitlements 2005/06		**1,958,629**	**27,576**	**1,470,072**	
Licensed diversions from unregulated streams 2006/07		*40,059*		*8,400*	
Licensed diversions from unregulated streams 2005/06 (10)		*39,661*		*15,200*	

Note:

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

(2) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.

(3) Compliance is also assessed against the Murray-Darling Basin annual cap target for the Goulburn, Loddon and Broken basins. Details of this are contained in the MDBC's Water Audit Monitoring Report 2006/07.

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

(5) Diversions under the Rochester bulk entitlement totalling 1,202 ML were inadvertently omitted from the State Water Report 2005/06.

(6) Quambatook is supplied from the Goulburn via the Normanville system. Therefore its volume is included in G-MW's BE volume.

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

(8) The Rubicon – Southern Hydro Ltd bulk entitlement was inadvertently omitted from the State Water Report 2005/2006.

(9) No new bulk entitlements were issued during 2006/07. The reported increase in total annual volumes of bulk entitlements between 2006/07 and the previous year reflects improvements in the approach to data measurement for 2006/07.

(10) The calculation method for licensed diversions from unregulated streams has changed for the Victorian Water Accounts 2006-2007. The updated methodology has been applied to the 2005/06 licensed volume and diversions in Table 10-6.

10.7 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 10-7.

The Goulburn basin contains the whole Nagambie GMA and Alexandra GMA as well as parts of the Campaspe Deep Lead WSPA, Shepparton WSPA, Katunga WSPA, Kialla GMA and Kinglake GMA. Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts.

Water extracted under groundwater licences increased significantly in 2006/07 compared with 2005/06. Every groundwater management unit experienced higher extractions, with the most notable being the Shepparton WSPA whose groundwater use almost doubled to 62,411 ML. By comparison, 54,900 ML of surface water was taken by licensed diverters and urban water authorities. The Shepparton WSPA's water level is exhibiting a long term declining trend and the Department of Sustainability and Environment is preparing a management plan to address salinity control.

Table 10-7 Licensed groundwater volumes, Goulburn basin 2006/07

WSPA/GMA(1)	GMA/ WSPA depth limits(2) (m)	Entitlement limit(3) (ML/year)	Licensed entitlement (4) (ML/year)	Metered use (ML)	Estimated use in unmetered bores(5) (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Alexandra GMA (100%)	≤25	1,714	1,714	0	1,028	1,028	686
Kialla GMA (93%)	>25	2,157	2,157	0	1,294	1,294	982
Kinglake GMA (81%)	All depths	1,636	1,636	0	981	981	784
Nagambie GMA (100%)	All depths	6,648	6,648	4,955	0	4,955	1,340
Campaspe Deep Lead WSPA (10%)	>25	4,576	4,576	3,439	0	3,439	2,320
Katunga WSPA (11%)	>25	6,641	6,641	3,425	0	3,425	2,403
Shepparton WSPA (57%)	≤25	132,627	132,627	62,411	0	62,411	35,848
Total		**155,999**	**155,999**	**74,230**	**3,304**	**77,534**	**44,364**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.
(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.
(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.
(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 10-8. Groundwater does not supplement the urban water supply in the Goulburn basin.

Table 10-8 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores(1)(2)	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Alexandra GMA (100%)	7	14
Kialla GMA (93%)	4	8
Kinglake GMA (81%)	50	100
Nagambie GMA (100%)	43	86
Campaspe Deep Lead WSPA (10%)	9	18
Katunga WSPA (11%)	26	52
Shepparton WSPA (57%)	711	1,422
Total	**850**	**1,700**

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 volume in Table 10-7.
(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

10.8 Drought contingency measures

A range of drought contingency measures were undertaken in the Goulburn basin in 2006/07. These include:

- restricting urban and rural water use (discussed below)
- providing access to emergency water supply points
- use of evaporation retardant on several storage basins
- water carting to Broadford, Euroa, Mansfield and Violet Town
- diverting water from the Goulburn River to supply Woods Point
- pumping Waranga Basin dead storage
- drawing down Goulburn Weir by 2,000 ML to protect pumps at Waranga Basin in the event of rain
- early closure of irrigation season to save losses.

Water rights were qualified on three occasions in the Goulburn basin in 2006/07, summarised in Table 10-9.

Table 10-9 Qualifications of rights

Qualification type	Qualification description
Passing flow	Amended the Bulk Entitlement (Mansfield) Conversion Order 1995 to reduce passing flow requirements on the Delatite River at Tonga Bridge to enable emergency diversions to Mansfield Dates: 4 December 2006 to 16 May 2007
Additional diversion point	Amended the Bulk Entitlement (Woods Point) Conversion Order 1995 to provide for a diversion point on the Goulburn River downstream of the confluence with Brewery Creek for an emergency supply to Woods Point Dates: From 16 April 2007, however this was not exercised
Sale of water	Released 7,000 ML of water assigned in Lake Eildon for management of Goulburn River water quality under the Bulk Entitlement (Eildon-Goulburn Weir) Conversion Order 1995 for sale to Goulburn irrigators on the water market Date: 8 February 2007 to 30 April 2007

10.9 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. Irrigation allocations reached 29% by the end of the season, compared with 100% in 2005/06.

Groundwater use was unrestricted in the Goulburn basin during 2006/07.

Table 10-10 Seasonal allocations and restrictions on water use in Goulburn basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Alexandra, Pyalong	Stage 1 from December 2006, increasing to Stage 2 from May to June 2007
	Broadford, Kilmore, Clonbinane and Wandong-Heathcote Junction	Stage 1 from July 2006, increasing to Stage 2 in November 2006, Stage 3 in December 2006 and Stage 4 February to June 2007
	Euroa and Violet Town	Stage 1 November 2006, increasing to Stage 2 in December 2006, Stage 3 in January 2007 and further to Stage 4 from February to May 2007 before reducing to Stage 3 in June 2007
	Shepparton, Seymour, Nagambie, Murchison, Mooroopna, Girgarre, Eildon, Corop, Katandra West, Stanhope	Stage 1 from December 2006 increasing to Stage 2 in May 2007 and Stage 3 in June 2007
	Buxton, Glenburn, Howqua, Jamieson, Mount Buller Alpine Village and Taggerty	Stage 1 from December 2006 to April 2007
	Thornton, Marysville and Yea	Stage 1 from December 2006 to June 2007
	Tatura, Kyabram and Tongala	Stage 1 from December 2006, increasing to Stage 3 from May to June 2007
	Rushworth and Colbinabbin	Stage 2 from May 2007, increasing to Stage 3 June 2007
	Woods Point, Merrijig and Sawmill Settlement	Stage 4 from December 2006, reducing to Stage 3 in May 2007
	Bonnie Doon	Stage 1 from December 2006, increasing to Stage 2 in February 2007 and Stage 3 in March 2007, reducing to Stage 2 in May 2007 and increasing to Stage 3 in June 2007
	Longwood	Stage 1 in November 2006, increasing to Stage 2 in December 2006, Stage 3 in January 2007 and Stage 4 in March 2007 before reducing to Stage 3 April 2007
	Mansfield	Stage 2 in October, increasing to Stage 3 in November, Stage 4 in December before reducing to Stage 3 May 2007
Irrigation and regulated diversions	Goulburn System	Allocation began the year at 17% of entitlement, increasing to 29% in April 2007
Unregulated diversions	Cummins Creek, Strath Creek, Chyser Creek, Johnstons Creek, Wallaby Creek, Pheasant Creek and Faithfulls Creek	Irrigation ban August 2006 to June 2007
	Sunday Creek and Seven Creek	Irrigation ban October 2006 to June 2007
	Murrindindi Creek, Little Stevensons River and Stevensons River	Irrigation ban February 2007 to May 2007
	King Parrot Creek	Irrigation ban January 2007 to May 2007
	Stony Creek	Irrigation ban August 2006 to May 2007
	Delatite Creek	Irrigation ban October 2006 to May 2007
	Yea River	Irrigation ban December 2006 to June 2007
	Hughes River	Irrigation ban December 2006 to May 2007

10.10 Recycled water

All wastewater treatment plants in the Goulburn basin are operated by Goulburn Valley Water. Approximately 85% of the volume of wastewater passing through treatment plants in the basin was recycled (Table 10-11). This was greater than in 2005/06, although the total volume of recycled water fell due to less wastewater entering the treatment plants. For most treatment plants, 100% of wastewater was recycled.

Table 10-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Alexandra	164	72	44%	0	72	0	0	92	0
Avenel	0	0	0%	0	0	0	0	0	0
Bonnie Doon	5	5	100%	0	5	0	0	0	0
Broadford	72	72	100%	0	72	0	0	0	0
Eildon	94	0	0%	0	0	0	0	94	0
Euroa	224	224	100%	0	224	0	0	0	0
Girgarre	0	0	0%	0	0	0	0	0	0
Kilmore	155	155	100%	0	155	0	0	0	0
Kyabram / Merrigum	206	206	100%	0	206	0	0	0	0
Mansfield	184	184	100%	87	97	0	0	0	0
Marysville	38	38	100%	0	38	0	0	0	0
Mooroopna	388	388	100%	0	388	0	0	0	0
Murchison	0	0	0%	0	0	0	0	0	0
Nagambie	112	112	100%	0	112	0	0	0	0
Seymour	514	514	100%	76	438	0	0	0	0
Shepparton	4,190	3,267	78%	0	3,267	0	0	923	0
Stanhope / Rushworth	0	0	0%	0	0	0	0	0	0
Tatura	705	705	100%	0	705	0	0	0	0
Tongala	208	208	100%	0	208	0	0	0	0
Upper Delatite	16	16	100%	0	16	0	0	0	0
Violet Town	0	0	0%	0	0	0	0	0	0
Yea	50	50	100%	37	13	0	0	0	0
Total 2006/07	**7,325**	**6,216**	**85%**	**200**	**6016**	**0**	**0**	**1,109**	**0**
Total 2005/06	**9,386**	**6,661**	**71%**	**136**	**6,525**	**0**	**0**	**2,726**	**-1**

Notes:

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

(2) Water reused in sewage treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006.

(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.

10.11 Water for the environment

10.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Goulburn basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Coliban Water, Goulburn Valley Water and Goulburn-Murray Water
- water set aside for the environment through the operation of licensed diversions with passing flow conditions (regulated and unregulated waterways)
- water outside the entitlement limit for GMAs and/or WSPAs

- the Goulburn System Snowy Environment Reserve
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

10.11.2 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin.

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. The location of these compliance points is presented in Figure 10-2.

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 (shown as 1 in Figure 10-2)
	Passing flow rules	• The lesser of 10 ML/day 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 (shown as 2 in Figure 10-2)
	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 (shown as 3 in Figure 10-2)
	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-Murray Water reported that it failed to meet some of its passing flow requirements in the Goulburn basin.

Passing flow obligations in Goulburn Valley Water's Mansfield bulk entitlement were qualified between 4 December 2006 and 16 May 2007. The passing flow requirement, which is defined as 18 ML per day, was reduced to 4 ML per day in December 2006 and 9 ML per day thereafter.

10.11.3 Streamflow management plans

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

10.11.4 Water leaving the basin

The volume of water flowing from the Goulburn basin into the River Murray was 165,500 ML in 2006/07. This is around one-third of the 477,100 ML that left the basin in 2005/06, although outflows as a proportion of inflows fell only slightly from 24% to 21%.

A total volume of 2,013 ML was released under the Snowy Environment Reserve. This environmental entitlement was established to release Goulburn River water to the River Murray as a substitute for Snowy River environmental flows that would formerly have been released to the River Murray.

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 to ecologically function.

11 Campaspe basin

This chapter sets out the accounts for the Campaspe basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

11.1 Campaspe basin summary

The Campaspe basin was one of the most drought-affected basins in the state in 2006/07. The basin experienced inflows of 11% of the long term average, continuing the recent trend of declining inflows due to lower than average rainfall. Storage levels, which were 8% full at the beginning of the year, fell even further and ended the year at close to 2% of capacity.

The low inflows resulted in Goulburn-Murray Water announcing an initial zero allocation for Campaspe irrigators which lasted the entire season. Irrigators on many unregulated streams faced bans on diversions for all or the majority of the year. Faced with zero allocation, rural customers relied more heavily on groundwater, with groundwater use increasing by 55% compared with 2005/06. Water rights were qualified in the Coliban system during the year to allow priority customers access to water to provide for business survival and to provide a reserve for consumptive use – ie. critical human need.

Urban water supplies in the Campaspe basin also fell to critically low levels in many cities and towns. Bendigo and surrounds experienced Stage 4 restrictions for the entire year and all other towns ended the year on either Stage 3 or Stage 4 restrictions. A number of entitlements were qualified in order to maintain urban supplies, but in some cases this was not possible and water was carted to smaller towns in the basin.

In order to secure Bendigo's water supply, work is underway on the Goldfields Superpipe, which will transfer 20,000 ML from the Waranga Western Channel in the Goulburn basin to Lake Eppalock, which ended 2006/07 at 1% full. By the end of June, the project was on schedule for a November 2007 completion date, with 28 kilometres of the 47 kilometre pipeline having been constructed.

11.2 Responsibilities for management of water resources

Table 11-1 shows the responsibilities of various authorities within the Campaspe basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 11-1 Responsibilities for water resources management within the Campaspe basin, 2006/07

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	Bulk water supply to Coliban Water	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 Reservoirs 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

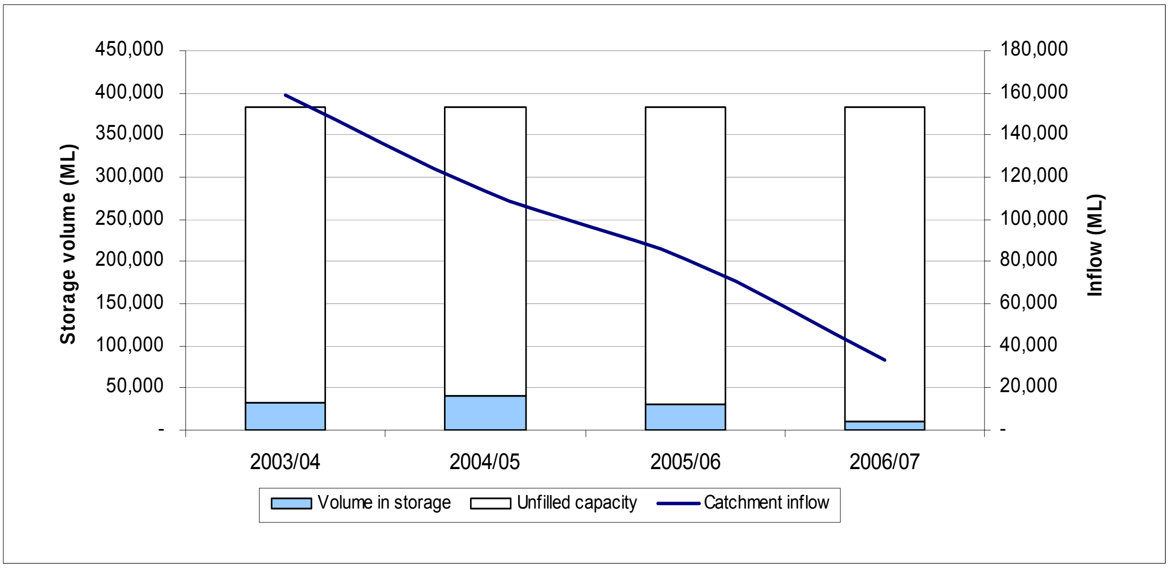
11.3 Rainfall, inflows and storages in 2006/07

In 2006/07, rainfall across the Campaspe basin ranged from 60% to 100% of the long term average. The continued dry conditions meant that catchment inflows reduced from 83,400 ML to 34,500 ML (which is 11% of the long term average) and consequently storage levels fell from 29,300 ML at the start of the year to 7,300 ML at the end of the year. This represents 2.4% of total capacity.

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 low inflows and storage levels were likely a contributing factor to blue-green algal blooms in and round Lake Eppalock in March, affecting irrigation, drinking water and recreational use. There was also an outbreak in the River Murray at Echuca in May that impacted the town's water supply.

Figure 11-1 All major storages and catchment inflows in 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 11-2. Water use as a proportion of water available is one of the highest in the state. The total surface water resource for the Campaspe basin does not include any contribution from Waranga Western Channel.

Table 11-2 Summary of total water resources and water use in the Campaspe basin, 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	34,600	33,100
Groundwater(2)	66,200	42,300
Recycled water	780	690

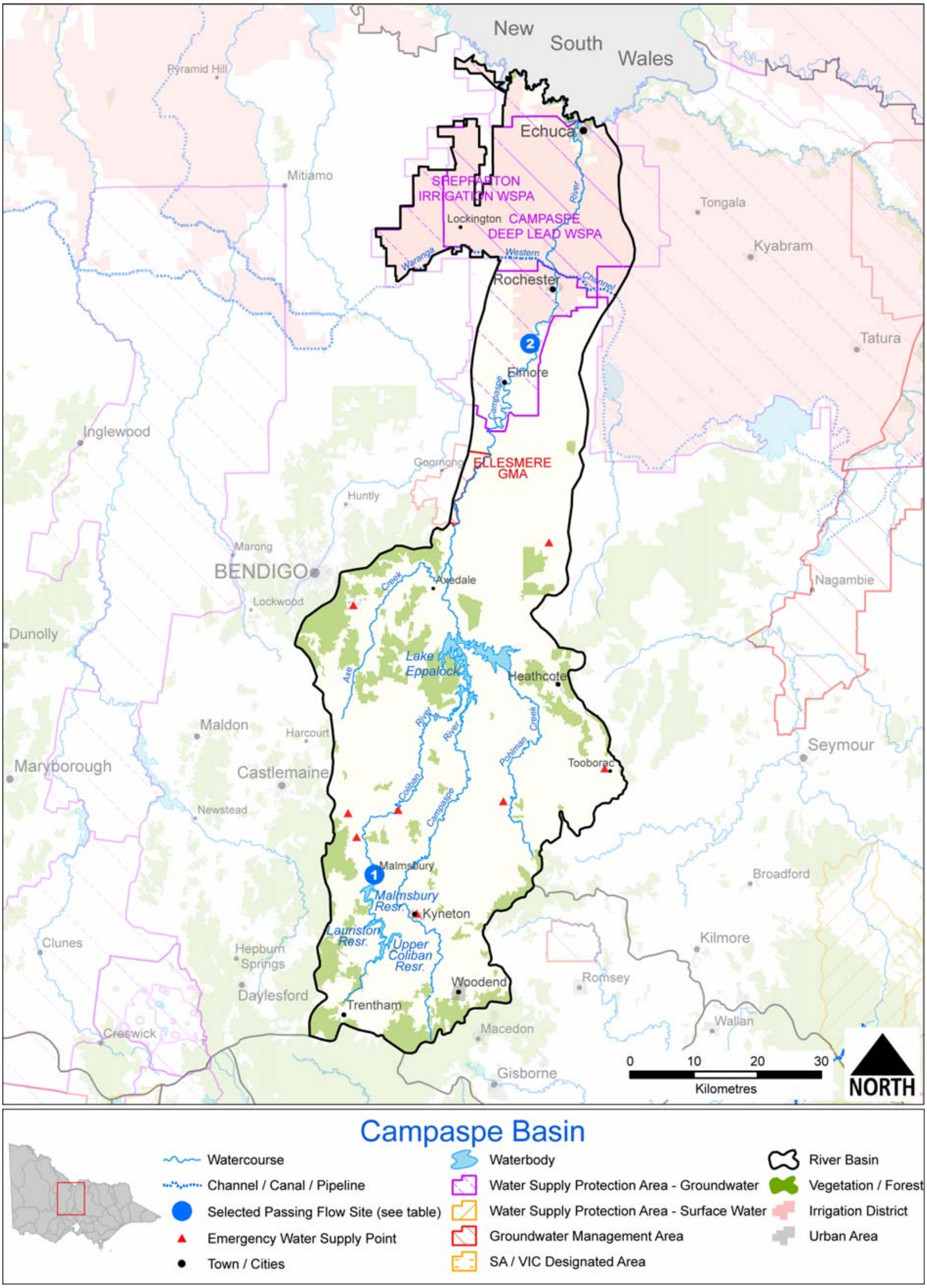
Note:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 11-7.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the State Water Report 2005/2006.

11.5 Location of water resources

Figure 11-2 Map of the Campaspe basin



11.6 Surface water resources

11.6.1 Water balance

A surface water balance for the Campaspe basin is shown in Table 11-3. Note that only those on-stream storages greater than 1,000 ML capacity have been included in the water balance.

Table 11-3 Balance of surface water in the Campaspe basin

Water account component	2006/07 (ML)	2005/06 (ML)
Major on-stream storage		
Volume in storage at start of year	29,300	41,600
Volume in storage at end of year	7,300	29,300
Change in storage	-22,000	-12,300
Inflows		
Catchment inflow(1)	34,500	80,900
Return flow from irrigation	0	0
Waranga Western Channel to Campaspe River	0	1,950
Treated wastewater discharged back to river	90	330
Sub-total	**34,600**	**83,200**
Usage		
Urban diversions	11,470	14,760
Coliban Channel rural diversions	1,600	9,200
Campaspe Irrigation District diversions	600	8,300
Licensed diversions from regulated streams	100	3,300
Licensed diversions from unregulated streams	200	600
Small catchment dams(2)	19,100	28,800
Campaspe River to Waranga Western Channel	0	0
Sub-total	**33,100**	**65,000**
Losses		
Net evaporation losses from major storages	3,500	5,700
Losses from small catchment dams(2)	14,200	14,800
In-stream infiltration to groundwater, flows to floodplain and evaporation (3)	1,500	1,500
Sub-total	**19,200**	**22,000**
Water passed at outlet of basin		
Campaspe River outflow to River Murray	4,300	8,500

Notes-

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

(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

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

11.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values provided in Table 11-4 are based on estimates provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 11-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	15,000	5,000	n/a
Registered commercial and irrigation	25,300	14,100	n/a
Total	**40,300**	**19,100**	**33,300**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

11.6.3 Water entitlement transfers

A summary of the transfer of entitlements into and out of the Campaspe basin is shown in Table 11-5. The trend from previous years of net permanent trade out of the basin and net temporary trade into the basin continued in 2006/07. There were very few temporary trades in 2006/07 compared with 2005/06, reflecting the nil seasonal allocation, i.e. no water was available. The trades occurred only in cases where a Campaspe irrigator had access to Goulburn water from the Waranga Western Channel.

Table 11-5 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)
Goulburn-Murray Water								
Campaspe District – Water right	0	762	6	-762	132	8	5	124
Campaspe District – Sales water					0	0	0	0
Campaspe River – Water right	105	479	6	-374	0	0	0	0
Campaspe River – Sales water					0	0	0	0
Total 2006/07	**105**	**1,241**	**12**	**-1,136**	**132**	**8**	**5**	**124**
Total 2005/06	**617**	**1,188**	**18**	**-571**	**3,684**	**2,515**	**227**	**1,169**

Note:
(1) Entitlements for which no trades were recorded are not shown.
n/a: Information not available.

11.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 11-6.

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 2006/07. For multi-year entitlements, compliance is assessed based on the total volume of water diverted over the term of the entitlement. Therefore it is possible that the volume diverted in any given year may exceed the average bulk entitlement volume.

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

Table 11-6 Volume of water diverted under surface water entitlements in the Campaspe basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)(1)	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance?(2)(3)(4)
Coliban Water					
Axedale, Goornong and Part Rochester	1	215	0	93	Yes
Part Rochester	10	134	0	0	Yes
Coliban System	3	50,260	0	12,885	Yes
Western Water					
Woodend	1	802	0	78	Yes
Goulburn-Murray Water					
Campaspe System(5)	10	83,590	124	670	Yes
Total annual volume of bulk entitlements 2006/07		**135,001**	**124**	**13,726**	
Total annual volume of bulk entitlements 2005/06		**64,737**	**1,169**	**35,602**	
Licensed diversions from unregulated streams 2006/07		*8,710*		*200*	
Licensed diversions from unregulated streams 2005/06(6)		*8,703*		*600*	

Notes:

(1) For multi-year entitlements, average annual bulk entitlement volume is calculated as the total volume of water permitted to be diverted over a given (greater than one-year) period in the bulk entitlement, divided by the number of years in that period.
(2) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.
(3) Compliance is also assessed against the Murray-Darling Basin annual cap target for the Campaspe basin. Details of this are contained in the MDBC's Water Audit Monitoring Report 2006/07.
(4) For multi-year entitlements, the usage can exceed the average annual entitlement volume in a given year provided the average annual use over the specified period does not exceed the average annual entitlement volume.
(5) The difference in average annual bulk entitlement volume from 2005/06 is due to the method of calculation; there was no increase in entitlement.
(6) The calculation method for licensed diversions from unregulated streams has changed for the Victorian Water Accounts 2006-2007. The updated methodology has been applied to the 2005/06 licensed volume and diversions in Table 11-6.

11.7 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 11-7.

The Campaspe basin contains part of the Campaspe Deep Lead WSPA, the Shepparton WSPA and the Ellesmere GMA. Groundwater use in both the Campaspe Deep Lead WSPA and the Shepparton WSPA increased substantially compared with 2005/06, as entitlement holders sought to supplement falling surface water supplies. The Shepparton WSPA's water level is exhibiting a long term declining trend and the Department of Sustainability and Environment is preparing a management plan to address salinity control.

Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts.

Table 11-7 Licensed groundwater volumes, Campaspe basin 2006/07

WSPA/GMA(1)	GMA/ WSPA depth limits(2) (m)	Entitlement limit(3) (ML/year)	Licensed entitlement(4) (ML/year)	Metered use (ML)	Estimated use in unmetered bores(5) (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Ellesmere GMA (29%)	≤25	663	663	n/a	398	398	419
Campaspe Deep Lead WSPA (82%)	>25	37,815	37,815	28,422	n/a	28,422	19,176
Shepparton WSPA (12%)	≤25	27,737	27,737	13,052	n/a	13,052	7,497
Total		**66,215**	**66,215**	**41,474**	**398**	**41,872**	**27,092**

Notes:
(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.
(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.
(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.
(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 11-8.

Table 11-8 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores(1)	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Ellesmere GMA (29%)	4	8
Campaspe Deep Lead WSPA (82%)	70	140
Shepparton WSPA (12%)	149	298
Total	**223**	**446**

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 volume in Table 11-7.
(2) Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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 11-9. Groundwater supplies for these towns increased in response to the falling surface water availability.

Table 11-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2006/07 (ML)	Metered use 2005/06 (ML)
Elmore	284	258	187
Trentham(1)	48	119	114
Total	**332**	**377**	**301**

Note:
(1) The 2006/07 metered use includes 33 ML from a groundwater bore (with a licensed volume of 48 ML) and 86 ML from a spring. The licence for the spring has not yet been finalised.

11.8 Drought contingency measures

A range of drought contingency measures were undertaken in the Campaspe basin in 2006/07. These include:

- qualification of rights
- restricting urban and rural water use (discussed below)
- providing access to emergency water supply points
- water carting to Axedale from Bendigo
- purchasing temporary groundwater entitlement to provide additional supplies at Elmore due higher demand from the water carting program
- connecting Woodend to Macedon storages
- temporary piping of irrigation channels at Harcourt
- construction of pipelines to connect water supply systems.

Construction of the Goldfields Superpipe, which will draw water from the Waranga Western Channel in the Goulburn basin to Lake Eppalock the Campaspe basin, commenced in February 2007. This pipeline will supply 20,000 ML per annum to the Bendigo region from September 2007, and will supply the Ballarat region with 18,000 ML each year from June 2008.

Table 11-10 Qualifications of rights

Qualification type	Qualification description
Amended passing flow	Bulk entitlement qualified to reduce passing flow requirements below Lake Eppalock and hold the environment's water in Lake Eppalock for later release to target environmental objectives. Revoked in November 2006 and new qualification made to allow water in the Lake Eppalock passing flow account to be lent to Coliban Water for supply to Bendigo Dates: 31 October 2006 to June 2007
Amended passing flow	Changed the Bulk Entitlement (Campaspe System – Coliban Water) Conversion Order 1999 to cease passing flow requirements on the Coliban River downstream of Malmsbury Reservoir to provide a reserve for consumptive use. Dates: 14 November 2006 to 30 June 2007
Increased allocation to priority customers	Changed the Bulk Entitlement (Campaspe System – Coliban Water) Conversion Order 1999 to provide for a higher allocation to priority rural customers and provide for business survival Dates: 14 September 2006 to 15 May 2007
Amended passing flow	Changed the Bulk Entitlement (Campaspe System – Goulburn-Murray Water) Conversion Order 2000 to lend 806 ML from Lake Eppalock's environmental passing flow account to provide a supply buffer for Bendigo Date: 14 November 2006 to 30 June 2007

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

Irrigation allocations and restrictions applying to towns and licensed diversions on unregulated streams are shown in Table 11-11. Many towns were on modified or full Stage 4 restrictions during all or part of 2006/07. Towns supplied by groundwater – notably Elmore and Trentham – experienced lower restrictions.

Water availability was too low for any seasonal allocations in the Campaspe Irrigation District in 2006/07. This was the first season that the Campaspe system failed to receive an allocation. The district received water only for essential domestic and stock needs.

In the Coliban rural water supply system, rights were qualified to allow Coliban Water to provide a priority supply to permanent plantings whilst meeting all essential domestic and stock needs.

Groundwater use was unrestricted in the Campaspe basin during 2006/07.

Table 11-11 Seasonal allocations and restrictions on water use in Campaspe basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Daylesford	Stage 2 in November 2006 increasing to Stage 3 from December 2006 to June 2007
	Axedale, Goornong	Modified Stage 4 July and August 2006 increasing to Stage 4 from September 2006 to June 2007
	Echuca, Cohuna, Gunbower and Leitchville	Stage 1 from December 2006, increasing to Stage 2 from February 2007, and Stage 3 from June 2007
	Bendigo region	Modified Stage 4 July and August 2006 increasing to Stage 4 from September 2006 to June 2007
	Boort, Dingee, Lockington, Macorna, Mitiamo, Mysia, Pyramid Hill and Rochester	Stage 1 from December 2006 increasing to Stage 2 from February 2007 and Stage 3 from June 2007
	Elmore and Trentham	Stage 1 from December 2006 to June 2007
	Bridgewater, Inglewood, Laanecoorie, Bealiba, Dunolly, Tarnagulla, Jarklin and Serpentine	Stage 1 from September 2006 increasing to Stage 2 from October 2006, Stage 3 from November 2006 and Stage 4 from January to June 2007.
	Korong Vale, Wedderburn, Borung and Wychitella	Stage 3 from July 2006 increasing to Stage 4 from October 2006 to June 2007
Irrigation and regulated diversions	Campaspe Irrigation District	0% of water right and licence volume
	Coliban rural supply system	Priority supply to permanent plantings
Licensed diversions on unregulated streams	Campaspe River (above Lake Eppalock)	Irrigation ban July 2006 to June 2007
	Coliban River (above Lake Eppalock)	Irrigation ban July 2006 to June 2007
	Lower Campaspe, Wanalta Creek, Axe Creek	Irrigation ban August 2006 to June 2007
	Jones Creek, Little Coliban Creek, Smiths Creek, Stony Creek	Irrigation ban January to June 2007

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 7pm and 8pm on alternate days.

11.10 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 89% of the wastewater discharged from treatment plants in the basin was recycled, mostly for agricultural use (Table 11-12). A large proportion of the wastewater that enters treatment plants in the Campaspe basin is evaporated on site, including at the Rochester and Lockington plants.

Table 11-12 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Axedale	11	11	100%	11	0	0	0	0	0
Elmore	2	2	100%	0	2	0	0	0	0
Heathcote	109	109	100%	109	0	0	0	0	0
Kyneton	426	344	81%	85	259	0	0	83	0
Lockington(4)	0	0	0%	0	0	0	0	0	0
Rochester(5)	52	52	100%	0	52	0	0	0	0
Woodend	182	176	97%	73	103	0	0	6	0
Total 2006/07	**782**	**694**	**89%**	**278**	**416**	**0**	**0**	**89**	**0**
Total 2005/06	**1,305**	**577**	**44%**	**57**	**520**	**0**	**0**	**327**	**401**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006.

(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) All effluent at this treatment plant is evaporated on site.

(5) The volume produced for the Rochester plant is much lower than shown in the State Water Report 2005/2006 due to a change in methodology.

11.11 Water for the environment

11.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Campaspe basin EWR comprised the following components:

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

The Campaspe River Living Murray Environmental Entitlement came into effect on 1 July 2007 and will be reported in the Victorian Water Accounts for 2007/08.

11.11.2 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin.

As noted in Table 11-10, a Ministerial direction issued on 14 November 2006 to Coliban Water required passing flows downstream of Malmsbury Reservoir to be ceased.

A Ministerial direction was issued to Goulburn-Murray Water to cease all passing flows on the Campaspe River from 31 October 2006 with the water held in Lake Eppalock for later release to target environmental objectives. This direction was revoked in November 2006 and a new qualification made to allow Coliban Water to borrow water in the Lake Eppalock passing flow account for supply to Bendigo.

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 (shown as 1 in Figure 11-2)
	Passing flow rules	• The lesser of 8 ML/day or natural inflow
Campaspe River	Instrument where passing flows are specified	Bulk Entitlement (Campaspe System – Goulburn Murray Water) Conversion Order Minimum passing flows were the only flow component delivered Ministerial directive issued on 31/10/2006 to cease all passing flows
	Responsible authority	Goulburn-Murray Water
	Compliance point	Between Lake Eppalock and Campaspe Weir pool (shown as 2 in Figure 11-2)

	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

Goulburn-Murray Water reported that it did not meet some of its passing flow requirements in the Campaspe basin.

11.11.3 Water leaving the basin

The amount of water flowing from the Campaspe basin into the River Murray was 4,300 ML in 2006/07. This represents 12% of the total inflows into the basin, similar to the 11% in 2005/06. This water comprises consumptive water that was not used under entitlements, traded water and the EWR (passing flows and any water above cap).

The Gunbower Forest and Kerang Wetlands are important environmental assets dependent on water from the EWR in the Campaspe basin. These assets located along the River Murray are internationally significant wetlands listed under the Ramsar convention. They rely on the freshwater inputs from the Campaspe basin and River Murray to ecologically function.

12 Loddon basin

This chapter sets out the accounts for the Loddon basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

12.1 Loddon basin summary

The Loddon basin experienced similar conditions to the adjacent Campaspe basin. Inflows fell to 10% of the long term average and, with storage levels already low at the start of the year, water resource management activities focussed on maintaining essential supplies for urban and domestic and stock uses. This was achieved by measures including:

- the qualification of rights including the temporary allocation of water to Maryborough, as well as the cessation of passing flows downstream of major storages
- a zero seasonal allocation of water to irrigators and regulated diverters, with bans on unregulated diversions for most of the year.

Unlike in 2005/06 when drought conditions predominantly affected the lower reaches of the basin, in 2006/07 the entire basin experienced water shortages. For example, while diverters in the Bullarook Creek system received a 190% allocation in 2005/06, a 0% allocation was provided in 2006/07.

12.2 Responsibilities for management of water resources

Table 12-1 shows the responsibilities of various authorities within the Loddon basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 12-1 Responsibilities for water resources management within the Loddon basin, 2006/07

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 southern 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

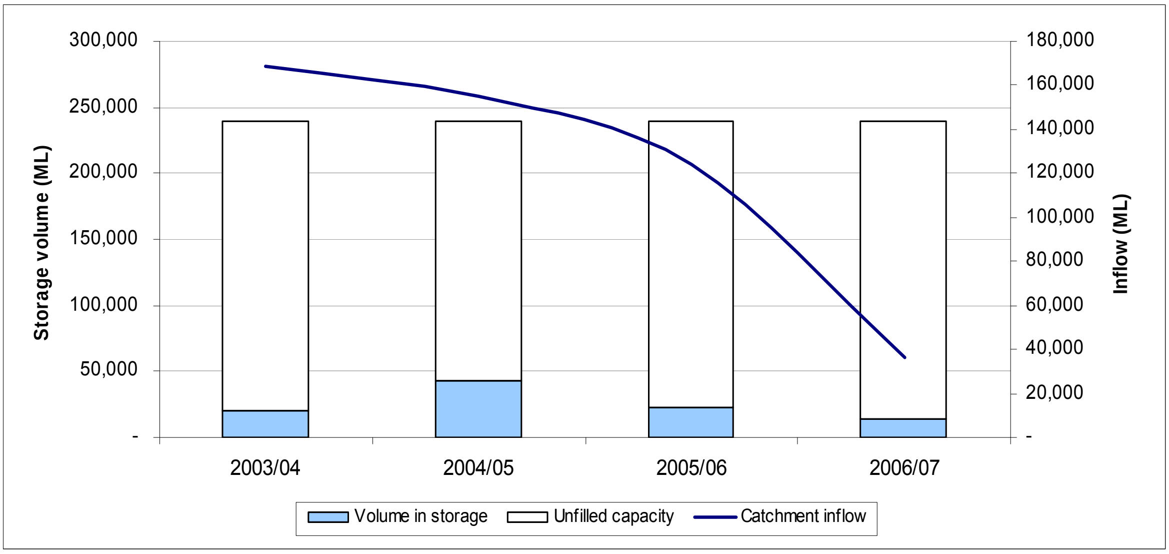
12.3 Rainfall, inflows and storages in 2006/07

In 2006/07, rainfall across the Loddon basin ranged between 60% and 80% of the long term average. However, after successive years of lower than average rainfall, inflows were 10% of the long term average (415,000 ML) compared with 30% in 2005/06 and continued the recent falling trend.

Storage levels, which were 9% of capacity at the beginning of the year, fell further to be 6% full by the end of the year. Cairn Curran Reservoir, which makes up nearly two-thirds of the storage capacity in the basin, finished the year with 3,650 ML in storage – or 2.5% full.

The low inflows and storage levels were likely a contributing factor to a number of outbreaks of blue-green algal blooms in the basin during 2006/07. The blooms were recorded in the Laanecoorie Reservoir, Loddon River, Lake Boga, Tullaroop Reservoir, Reedy Lake, Trentham Reservoir #1 and #2, Centenary Reservoir and the Torrumbarry Irrigation Area. These outbreaks impacted a range of uses, including irrigation, domestic and stock, recreational, environmental and potable use.

Figure 12-1 All major storages and catchment inflows in the Loddon basin



12.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Loddon basin are shown in Table 12-2. Total use in 2006/07 fell by 62,700 ML compared with last year because of the severe water shortage.

Table 12-2 Summary of total water resources and water use in the Loddon basin, 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	44,500	30,600
Groundwater(2)	58,400	34,900
Recycled water	7,850	2,520

Note:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 12-7.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the State Water Report 2005/2006.

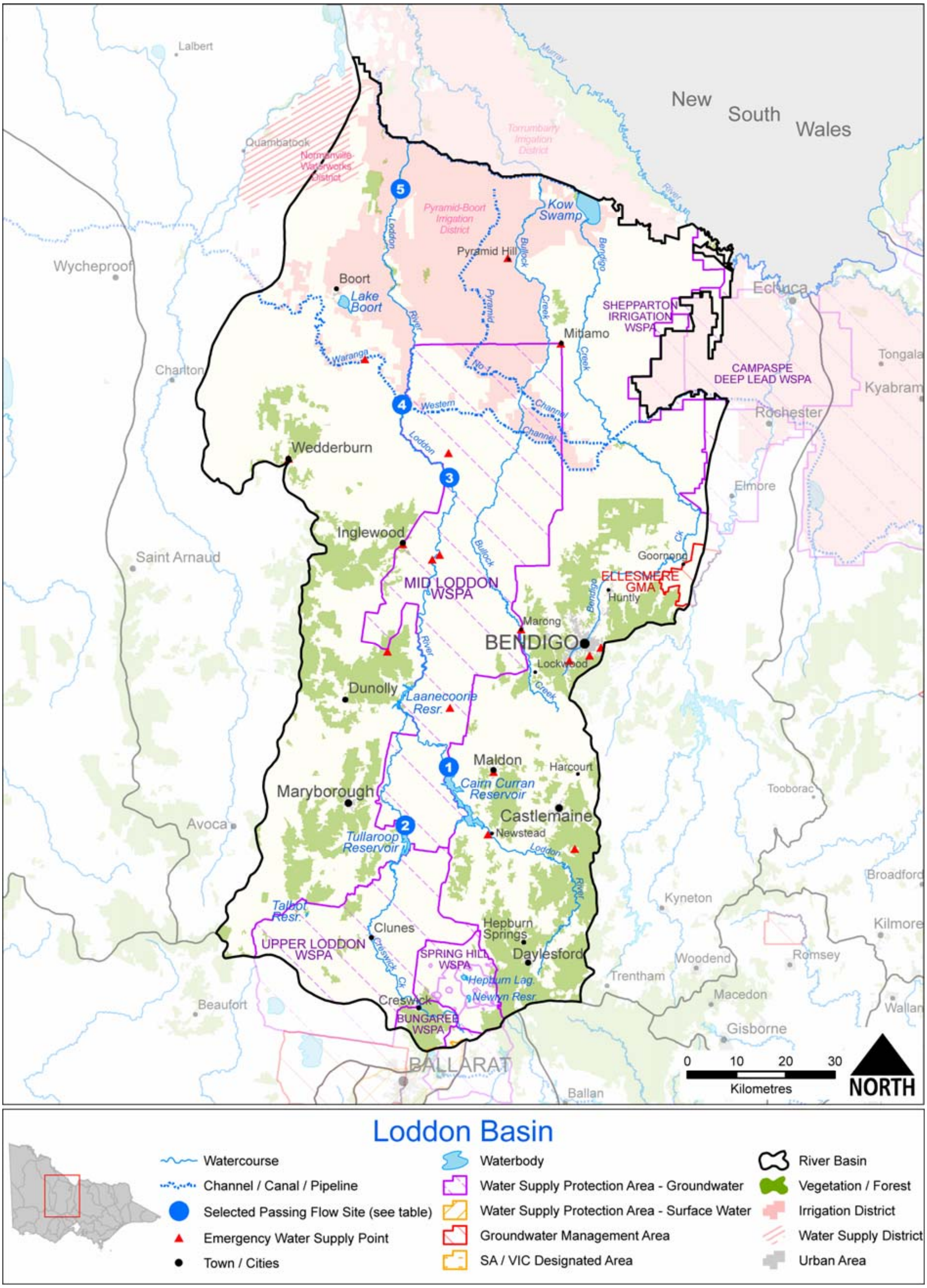
12.4.1 Infrastructure projects to improve water availability

One project is underway to increase water availability in the Loddon basin. Coliban Water is constructing a pipeline to transfer 4,300 ML of recycled water from Epsom Recycled Water Plant to Spring Gully reservoir. The project commenced in August 2006 and is scheduled to be complete in November 2007.

Bendigo's supply is to be secured by the Goldfields Superpipe, currently under construction, bringing water from Waranga Western Channel in the Goulburn basin to Lake Eppalock.

12.5 Location of water resources

Figure 12-2 Map of the Loddon basin



12.6 Surface water resources

12.6.1 Water balance

A surface water balance for the Loddon basin is shown in Table 12-3.

Only 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. Diversions from regulated streams fell by more than 90% as the low inflow and dry conditions forced Goulburn-Murray Water to announce a zero allocation for regulated diverters on the Loddon system.

Table 12-3 Balance of surface water in the Loddon basin

Water account component	2006/07 (ML)	2005/06 (ML)
Major on-stream storage		
Volume in storage at start of year	21,100	40,000
Volume in storage at end of year	11,600	21,100
Change in storage	-9,500	-18,900
Inflows		
Catchment inflow(1)	39,900	124,000
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	4,560	5,000
Sub-total	**44,500**	**129,000**
Usage		
Urban diversions	2,680	2,600
Licensed diversions and irrigation diversions from regulated streams	1,300	17,500
Licensed diversions from unregulated streams	5,100	23,200
Small catchment dams(2)	21,500	50,000
Sub-total	**30,600**	**93,300**
Losses		
Net evaporation losses from major storages	4,500	8,200
Losses from small catchment dams(2)	5,500	29,600
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	10,600	10,600
Sub-total	**20,600**	**48,400**
Water passed at outlet of basin		
Loddon River outflow to River Murray (Appin South)	1,300	3,600
Wandella Creek at Fairlea(4)	n/a	n/a
Mount Hope Creek at Mitiamo	1,500	2,600
Bullock Creek, Calivil and Nine Mile Creek(4)	n/a	n/a

Notes:

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

(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(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).

(4) The outflows at these points are not measured.

12.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 12-4 are based on the methodology outlined in Chapter 5.

Table 12-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)[(1)]	31,600	6,800	n/a
Registered commercial and irrigation	40,700	14,700	n/a
Total	**72,300**	**21,500**	**27,000**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

12.6.3 Water entitlement transfers

A summary of Victorian entitlements transferred into and out of the Loddon basin is presented in Table 12-5. There was a net export of water entitlement from the basin, with 8,856 ML being permanently traded out of the basin and 110 ML being temporarily traded out of the basin. The volume permanently traded out of the basin more than doubled compared with 2005/06.

Table 12-5 Transfer of entitlements in the Loddon basin

<table>
<tr><th rowspan="2">Entitlement[(1)]</th><th colspan="4">Permanent entitlement transfer</th><th colspan="4">Temporary entitlement transfer</th></tr>
<tr><th>Bought (ML)</th><th>Sold (ML)</th><th>Number of trans-actions</th><th>Net transfer to entitlement (ML)</th><th>Bought (ML)</th><th>Sold (ML)</th><th>Number of trans-actions</th><th>Net transfer to entitlement (ML)</th></tr>
<tr><td colspan="9">Goulburn-Murray Water</td></tr>
<tr><td>Loddon River – Water right</td><td rowspan="2">0</td><td rowspan="2">82</td><td rowspan="2">4</td><td rowspan="2">-82</td><td>25</td><td>5</td><td>3</td><td>20</td></tr>
<tr><td>Loddon River – Sales water</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Pyramid-Boort – Water right</td><td rowspan="2">30</td><td rowspan="2">8,804</td><td rowspan="2">34</td><td rowspan="2">-8,774</td><td>25,221</td><td>25,351</td><td>1,549</td><td>-130</td></tr>
<tr><td>Pyramid-Boort – Sales water</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Total 2006/07</td><td>30</td><td>8,886</td><td>38</td><td>-8,856</td><td>25,246</td><td>25,356</td><td>1,552</td><td>-110</td></tr>
<tr><td>Total 2005/06</td><td>75</td><td>4,368</td><td>26</td><td>-4,293</td><td>50,462</td><td>34,047</td><td>1,382</td><td>16,415</td></tr>
</table>

Note:

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

n/a: Information not available.

12.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 12-6. 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 2006/07.

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

Table 12-6 Volume of water diverted under surface water entitlements in the Loddon basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance?[1] [2]
Central Highlands Water					
Creswick	1	500	0	495	Yes
Daylesford	1	916	0	643	Yes
Lexton	1	45	0	21	Yes
Loddon System (part Maryborough)	1	1,200	0	1,124	Yes
Evansford & Talbot System (part Maryborough)	1	3,000	0	39	Yes
Coliban Water					
Loddon system	1	820	0	360	Yes
Goulburn-Murray Water					
Bullarook Creek[3]	1	n/a	n/a	195	No
Loddon[2]	1	112,761	-110	1,056	Yes
Minister for the Environment					
Loddon River – Environmental Reserve	1	2,000	0	0	Yes
Total annual volume of bulk entitlements 2006/07		**121,242**	**-110**	**3,932**	
Total annual volume of bulk entitlements 2005/06[5]		**121,242**	**16,415**	**22,110**	
Licensed diversions from unregulated streams 2006/07		*30,596*		*5,100*	
Licensed diversions from unregulated streams 2005/06[4]		*30,505*		*23,200*	

Notes:

(1) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited

(2) Compliance is also assessed against the Murray-Darling Basin annual cap target for the Goulburn, Loddon and Broken basins – which is reported in the MDBC's Water Audit Monitoring Report 2006/07.

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

(4) The calculation method for licensed diversions from unregulated streams has changed for the Victorian Water Accounts 2006-2007. The updated methodology has been applied to the 2005/06 licensed volume and diversions in Table 12-6.

(5) The 2005/06 bulk entitlement for the Loddon bulk entitlement has been revised from the figure published in the State Water Report 2005/2006 to be consistent with the methodology used for the 2006/07 volume.

n/a: Information not available.

12.7 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 12-7. 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 drought brought into focus the importance of groundwater in the Loddon basin. All GMUs except the Ellesmere GMA experienced an increase in extractions in 2006/07 compared with the prior year, with the largest, the Mid Loddon WSPA, increasing by 44%. Groundwater extractions of 34,200 ML exceeded surface water diversions of 30,600 ML.

Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts.

Table 12-7 Licensed groundwater volumes, Loddon basin 2006/07

WSPA/GMA[1]	GMA/ WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores[5] (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Ellesmere GMA (71%)	≤25	1,617	1,617	0	970	970	1,021
Bungaree WSPA (10%)	All depths	515	515	354	0	354	264
Campaspe Deep Lead WSPA (8%)	>25	3,860	3,860	2,901	0	2,901	1,958
Mid Loddon WSPA (100%)	All depths	37,200	37,200	22,851	0	22,851	15,830
Spring Hill WSPA (100%)	≤70 all zones except Cones	5,062	5,062	2,491	0	2,491	1,850
Upper Loddon WSPA (76%)	All depths	10,184	10,184	4,704	0	4,704	1,808
Total		**58,438**	**58,438**	**33,301**	**970**	**34,271**	**22,730**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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

(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.

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

(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 12-8.

Table 12-8 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Ellesmere GMA (71%)	9	18
Bungaree WSPA (10%)	25	50
Campaspe Deep Lead WSPA (8%)	7	14
Mid Loddon WSPA (100%)[3]	93	244
Spring Hill WSPA (100%)	53	106
Upper Loddon WSPA (76%)	94	188
Total	**281**	**620**

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 volume in Table 12-7.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by the surface area percentage in the basin.

(3) Goulburn-Murray Water has provided an estimate of 2.6 ML per bore in the Mid Loddon WSPA subsequent to a survey of domestic and stock users. Similar surveys will be conducted in WSPAs and GMAs across the state in 2007/08

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 12-9.

Table 12-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2006/07 (ML)	Metered use 2005/06 (ML)
Clunes	350	261	288
Dean	30	17	24
Forest Hill	350	179	215
Learmonth	100	66	56
Waubra	100	34	43
Total	**930**	**557**	**626**

12.8 Drought contingency measures

There was a range of drought contingency measures undertaken in the Loddon basin in 2006/07. These include:

- restricting urban and rural water use (discussed below)
- provision of emergency water supply points
- carting water from Bendigo to Raywood and Sebastian
- commissioning of the Epsom-Spring Gully recycled water pipeline
- ceasing supply to Hepburn Lagoon and Newlyn Reservoir due to low water levels
- pumping dead storage from Tullaroop Reservoir to maintain environmental flows
- application of film on town storages to reduce evaporation loss.

Temporary qualifications of rights were declared a number of times within the Loddon basin in 2006/07. These are summarised in Table 12-10.

Table 12-10 Qualifications of rights

Qualification type	Qualification description
Provide for essential needs	Changed the Bulk Entitlement (Loddon System – Goulburn-Murray Water) Conversion Order 2005 to provide for essential needs (domestic and stock use, firefighting) and 50% allocation to provide for business survival for 13 entitlement holders (permanent plantings) when the Loddon allocation was zero Dates: 1 July 2006 ongoing to 30 June 2007
Passing flows	Changed the Bulk Entitlement (Loddon System – Goulburn-Murray Water) Conversion Order 2005 and the Bulk Entitlement (Loddon River – Environmental Reserve) Conversion Order 2005 to reduce passing flows downstream of Laanecoorie, Cairn Curran and Tullaroop Reservoirs, and Serpentine and Loddon Weirs. This action extended the period over which flows could be released down the Loddon River to allow domestic and stock customers access to water Dates: 31 October 2006 ongoing to 30 June 2007
Increased allocation to priority entitlement holders	Changed the Bulk Entitlement (Loddon System – Part Maryborough – Central Highlands Water) Conversion Order 2005 to temporarily allocate an additional 250 ML to Maryborough from Tullaroop Reservoir to maintain essential reserves in the Maryborough system Dates: 1 June 2007 ongoing to 30 June 2007

12.9 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 Stage 4 restrictions from September 2006.

Groundwater use was unrestricted in the Loddon basin during 2006/07.

Table 12-11 Seasonal allocations and restrictions on water use in Loddon basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Maryborough system (Maryborough, Creswick, Talbot)	Stage 2 from July 2006, increasing to Stage 3 from September 2006 and Stage 4 from November 2006 to June 2007
	Clunes, Learmonth, Waubra, Forest Hill, Dean	Stage 1 from April 2007 to June 2007
	Hepburn Springs, Hepburn	Stage 2 introduced November 2006, increasing to Stage 3 from December 2006 to June 2007
	Lexton	Stage 1 introduced November 2006, increasing to Stage 2 from December 2006, and increasing to Stage 3 from February to June 2007
	Coliban system (Bendigo, Castlemaine)	Stage 4 from July 2006 to June 2007
	Loddon system (Laanecoorie, Dunolly)	Stage 1 from July 2006, increasing to Stage 2 October 2006, Stage 3 November 2006 and Stage 4 from January to June 2007
	Borong, Korong Vale, Wedderburn, Wychitella	Stage 3 from July 2006, increasing to Stage 4 from October 2006 to June 2007
	Boort, Pyramid, Mysia, Mitiamo, Dingee, Macoma	Stage 1 from July 2006 reducing to unrestricted in September 2006 before Stage 1 re-introduced from December 2006, increasing to Stage 2 from February to June 2007
Unregulated diversions	Lake Meran, Lower Loddon River below Fernihurst Weir, Jim Crowe Creek, Campbells Creek, Leitch's Creek, Green Gully Creek, Joyces Creek, Muckleford Creek, Sailers Creek	Irrigation ban August 2006 to June 2007
	Barkers Creek, Bullock Creek – Upper, Upper Loddon River (above Cairn Curran)	Irrigation ban July 2006 to June 2007
	Wallaby Creek, Wombat Creek, Coghills Creek, McCallum Creek	Irrigation ban November 2006 to June 2007
	Rocky Lead Creek, Bullock Creek above Newly, Back Creek, Langdons Creek, Pinchgut Creek, Kangaroo Creek	Suspension of winter-fill pumping from January to June 2007
Irrigation and regulated diversions	Loddon system	Allocation was 0% for the entire season
	Coliban rural	Opening allocation of 0% in September with priority customers receiving 30% of licence volume. These allocations were unchanged over the season
	Bullarook Creek system – Hepburn's Lagoon	Allocation was 0% for the entire season

12.10 Recycled water

The wastewater treatment plants in the Loddon basin are operated by Coliban Water and Central Highlands Water. The proportion of water recycled in the basin increased slightly from 28% in 2005/06 to 32% in 2006/07 (Table 12-12).

Table 12-12 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[(3)]
				Urban & industrial	Agriculture	Beneficial allocation[(1)]	Within process[(2)]		
Bendigo	5,501	1,970	36%	1,282	688	0	0	3,531	0
Boort[(4)]	0	0	0%	0	0	0	0	0	0
Bridgewater / Inglewood	0	0	0%	0	0	0	0	0	0
Castlemaine	924	137	15%	137	0	0	0	788	-1
Clunes	0	0	0%	0	0	0	0	0	0
Creswick	243	0	0%	0	0	0	0	243	0
Daylesford	302	227	75%	26	201	0	0	0	75
Dunolly[(4)]	0	0	0%	0	0	0	0	0	0
Kerang	484	0	0%	0	0	0	0	0	484
Maryborough	399	186	47%	74	112	0	0	0	0
Pyramid Hill[(4)]	0	0	0%	0	0	0	0	0	0
Wedderburn[(4)]	0	0	0%	0	0	0	0	0	0
Total 2006/07	**7,853**	**2,520**	**32%**	**1,519**	**1,001**	**0**	**0**	**4,562**	**559**
Total 2005/06	**8,716**	**2,419**	**28%**	**145**	**2,274**	**0**	**0**	**5,000**	**1,267**

Notes:

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

(2) Water reused in sewage treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology from the figures presented in the State Water Report 2005/2006.

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

12.11 Water for the environment

12.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Loddon basin EWR comprised the following components:

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

12.11.2 Entitlements for the environment

The environment's formal entitlements in the Loddon basin in 2006/07 comprised the Bulk Entitlement (Loddon River Environmental Reserve) held by the Minister for the Environment. Under this entitlement, 11,246 ML was released to meet passing flow obligations. After rights to the environmental entitlement were qualified, flows were provided to ameliorate poor water quality and sustain ecological functions.

12.11.3 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin.

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. The location of these compliance points is presented in Figure 12-2.

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 (shown as 1 in Figure 12-2)

	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 (shown as 2 in Figure 12-2)
	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 (shown as 3 in Figure 12-2)

	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 (shown as 4 in Figure 12-2)

	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 (shown as 5 in Figure 12-2)

	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 it did not meet all of its passing flow requirements in the Loddon basin.

Central Highlands Water reported that it met its passing flow requirements in its bulk entitlements in 2006/07. A Ministerial direction allowed Central Highlands Water to suspend passing flows for the Moorabool and Lal Lal Reservoirs.

12.11.4 Water leaving the basin

The amount of water flowing from the Loddon basin into the River Murray was 2,800 ML in 2006/07, 7% of the total inflows into the basin and approximately half the volume that left the basin in 2005/06. 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 to ecologically function.

13 Avoca basin

This chapter sets out the accounts for the Avoca basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

13.1 Avoca basin summary

The Avoca basin, like much of the west of the state, again experienced dry conditions. Inflows fell to 12% of the long term average and no water reached the basin's terminal lakes. Towns in the basin are either supplied by groundwater or surface water from other basins via the Wimmera Mallee Channel System or Northern Mallee Pipeline.

Irrigation bans were in force on streams in the Avoca basin for most of the year, with domestic and stock customers relying on a water carting service for their water needs.

13.2 Responsibilities for management of water resources

Table 13-1 shows the responsibilities of various authorities within the Avoca basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 13-1 Responsibilities for water resources management within the Avoca basin, 2006/07

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	Obligation to meet passing flow requirements
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:

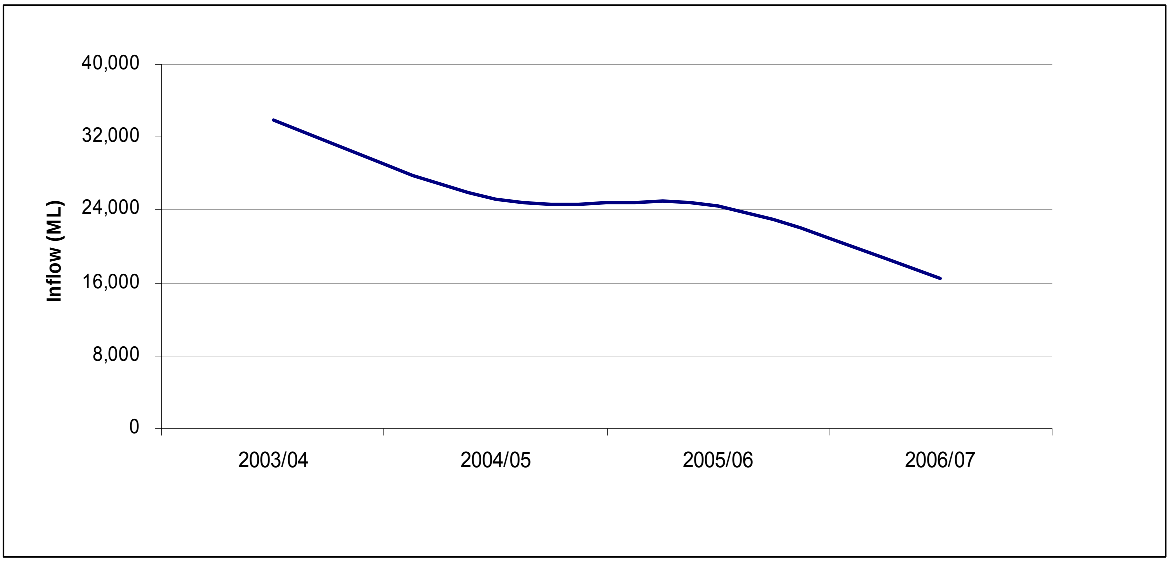
(1) Water for these towns is sourced from outside the Avoca basin.

13.3 Rainfall, storages and inflows in 2006/07

In 2006/07, rainfall across Avoca basin ranged between 60% to 100% of the long term average. The ongoing drought, particularly severe in the west of the state, continued to impact streamflows. Streamflows, which were 18% of the long term average (136,200 ML) in 2005/06, fell by 40% in 2006/07, and recorded just 12% of the long term average with inflows totalling 16,500ML.

There are no storages greater than 1,000 ML in the Avoca basin.

Figure 13-1 Catchment inflows in the Avoca basin



13.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Avoca basin are shown in Table 13-2. Surface water extractions were greater than the basin's inflows.

Table 13-2 Summary of total water resources and water use in the Avoca basin, 2006/07

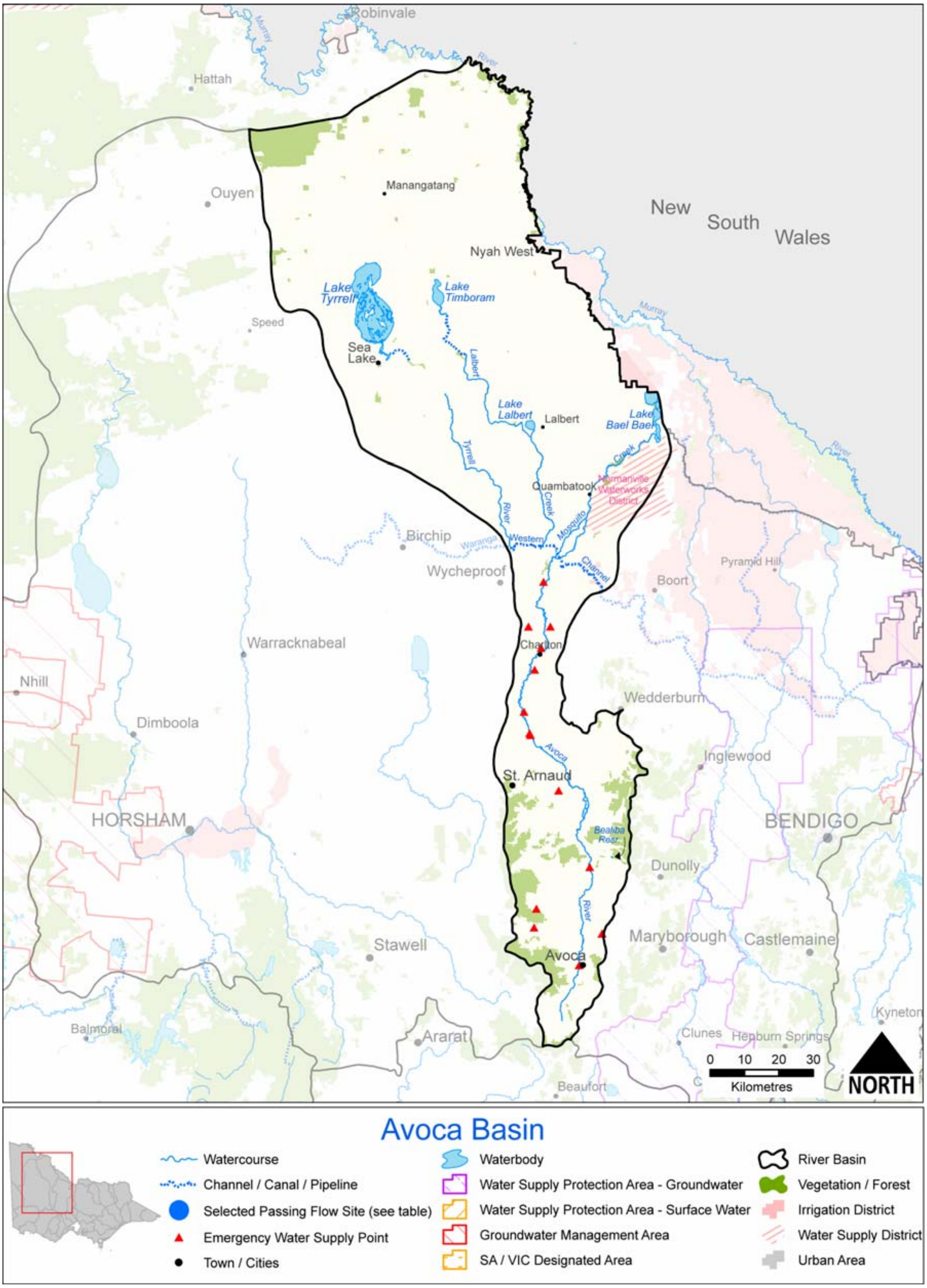
Water source	Total water resource (ML)	Total use (ML)
Surface water	16,500	8,200
Groundwater[(1)]	300	100
Recycled water	200	200

Note:

(1) Although there are no WSPAs or GMAs in the Avoca basin, the towns of Avoca and Redbank are supplied by groundwater located in an unincorporated area. The groundwater resource and use in Table 13-2 reflects the licensed volume and use for these towns.

13.5 Location of water resources

Figure 13-2 Map of the Avoca basin



13.6 Surface water resources

13.6.1 Water balance

A surface water balance for the Avoca basin is shown in Table 13-3. There are no storages greater than 1,000 ML in the Avoca basin. Small catchment dams are the main source of water supply in the catchment.

Table 13-3 Balance of surface water in the Avoca basin

Water account component	2006/07 (ML)	2005/06 (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	16,500	24,500
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	40
Sub-total	**16,500**	**24,500**
Usage		
Urban diversions[(2)]	90	50
Licensed diversions from unregulated streams	1,600	1,400
Small catchment dams[(3)]	6,500	12,700
Sub-total	**8,200**	**14,200**
Losses		
Net evaporation losses from major storages	0	0
Losses from small catchment dams[(3)]	6,200	9,800
In-stream infiltration to groundwater, flows to floodplain and evaporation [(4)]	2,100	500
Sub-total	**8,300**	**10,300**
Water passed at outlet of basin		
Avoca River flow at Quambatook (= outflow to terminal lakes)	0	500
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 entirely sourced from groundwater in 2006/07.

(3) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(4) Losses represent the flow volume at the Avon River gauge at Coonooer that did not enter the Avoca basin's terminal lakes.

13.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values provided in Table 13-4 are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 13-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)[(1)]	10,500	2,700	n/a
Registered commercial and irrigation	8,900	3,800	n/a
Total	**19,400**	**6,500**	**12,700**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

13.6.3 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 2006/07.

13.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 13-5. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2006/07. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 13-5 Volume of water diverted under surface water entitlements in the Avoca basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance? (1)
Central Highlands Water					
Amphitheatre	1	25	0	12	Yes
Avoca(2)	1	233	0	0	Yes
Redbank(2)	1	20	0	0	Yes
Total annual volume of bulk entitlements 2006/07		**278**	**0**	**12**	
Total annual volume of bulk entitlements 2005/06		**278**	**0**	**49**	
Licensed diversions from unregulated streams 2006/07		*3,621*		*1,600*	
Licensed diversions from unregulated streams 2005/06		*3,621*		*1,400*	

Notes:

(1) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.

(2) Urban water supply for the townships of Avoca and Redbank was sourced from groundwater in 2006/07.

13.7 Groundwater resources

There are no groundwater management areas or water supply protection areas located within the Avoca basin. Groundwater from an unincorporated area 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 13-6.

Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts, with the exception of urban use, as shown in Table 13-6.

Table 13-6 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2006/07 (ML)	Metered use 2005/06 (ML)
Avoca	200	124	175
Redbank	50	6	6
Total	**250**	**130**	**181**

13.8 Drought contingency measures

A range of drought contingency measures were undertaken in the Avoca basin in 2006/07. These include:

- restricting urban and rural water use (discussed below)
- provision of emergency water supply points
- water carting to GWMWater domestic and stock customers.

13.9 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 13.7.

Table 13-7 Seasonal allocations and restrictions on water use in Avoca basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Amphitheatre	Stage 2 introduced December 2006, increasing to Stage 3 February 2007 and Stage 4 from May to June 2007
	Avoca	Stage 1 from May to June 2007
	Redbank	Stage 3 (of an 8 stage policy) from July to August 2006, replaced by Stage 2 (of a 4 Stage policy – slightly more severe) from September 2006 to June 2007
	Berriwillock, Charlton, Culgoa, St Arnaud	Stage 3 from July 2006, increasing to Stage 4 from October 2006 to June 2007
	Lalbert, Manangatang, Sea Lake	Stage 1 from January to June 2007
	Quambatook	Stage 2 from December 2006 to June 2007
Unregulated licensed diversions	Avoca River, Mosquito Creek, Lake Bael Bael, Lake Lookout, Lake Marmal, Sand Hill Lake, Tchum Lake North	Irrigation ban September 2006 to May 2007

13.10 Recycled water

GWMWater operates most wastewater treatment plants in the Avoca basin, with the exception of the Avoca plant operated by Central Highlands Water. All wastewater treated in the basin was recycled, predominately for agricultural purposes.

Table 13-8 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Avoca	8	8	100%	0	8	0	0	0	0
Charlton	23	23	100%	0	23	0	0	0	0
Sea Lake	22	22	100%	0	22	0	0	0	0
St Arnaud	130	130	100%	13	116	0	0	0	0
Wycheproof	17	17	100%	0	17	0	0	0	0
Total 2006/07	**199**	**199**	**100%**	**13**	**186**	**0**	**0**	**0**	**0**
Total 2005/06	**254**	**245**	**96%**	**0**	**245**	**0**	**0**	**35**	**0**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006.

(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.

13.11 Water for the environment

13.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Avoca basin EWR comprised the following components:

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

13.11.2 Passing flow requirements

The Avoca River is essentially unregulated with no significant storages in the basin. Central Highlands Water operates several small urban storages in the upper reaches and reported that it has complied with all passing flows.

13.11.3 Water leaving the basin

In 2006/07 no water was recorded flowing at Quambatook and therefore no water flowed into the terminal lakes (Lake Bael Bael and the Marshes) which overflow to the Kerang Lakes during prolonged 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.

14 Mallee basin

This chapter sets out the accounts for the Mallee basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

14.1 Mallee basin summary

Some towns and farms in the Mallee basin experienced a severe water shortage depending on where their water was sourced from. Most of the northern Mallee area is now supplied from the River Murray and towns were subject to Stage 2 restrictions only. Some towns and farms received Goulburn water from the Waranga Main Channel. The remaining areas are supplied from Grampians storages (Wimmera and Glenelg basins). The winter channel run from the Grampians storages was able to fill town dams only and towns were on Stage 4 restrictions. Rural customers received only a basic domestic and stock supply via GWMWater's water carting program.

The shortages of surface water in the basin brought about an increased reliance on groundwater, with the largest GMU in the basin, the Murrayville WSPA, experiencing an 89% increase in use.

14.2 Responsibilities for management of water resources

Table 14-1 shows the responsibilities of various authorities within the Mallee basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 14-1 Responsibilities for water resources management within the Mallee basin, 2006/07

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 Rainfall, inflows and storages in 2006/07

In 2006/07, rainfall across the basin ranged between 60% and 100% of the long term average. This was broadly consistent with rainfall in the previous three years, which recorded similar rainfall. Dry conditions likely contributed to a blue-green algal bloom in the Hattah Lakes in March and April, affecting park users.

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.

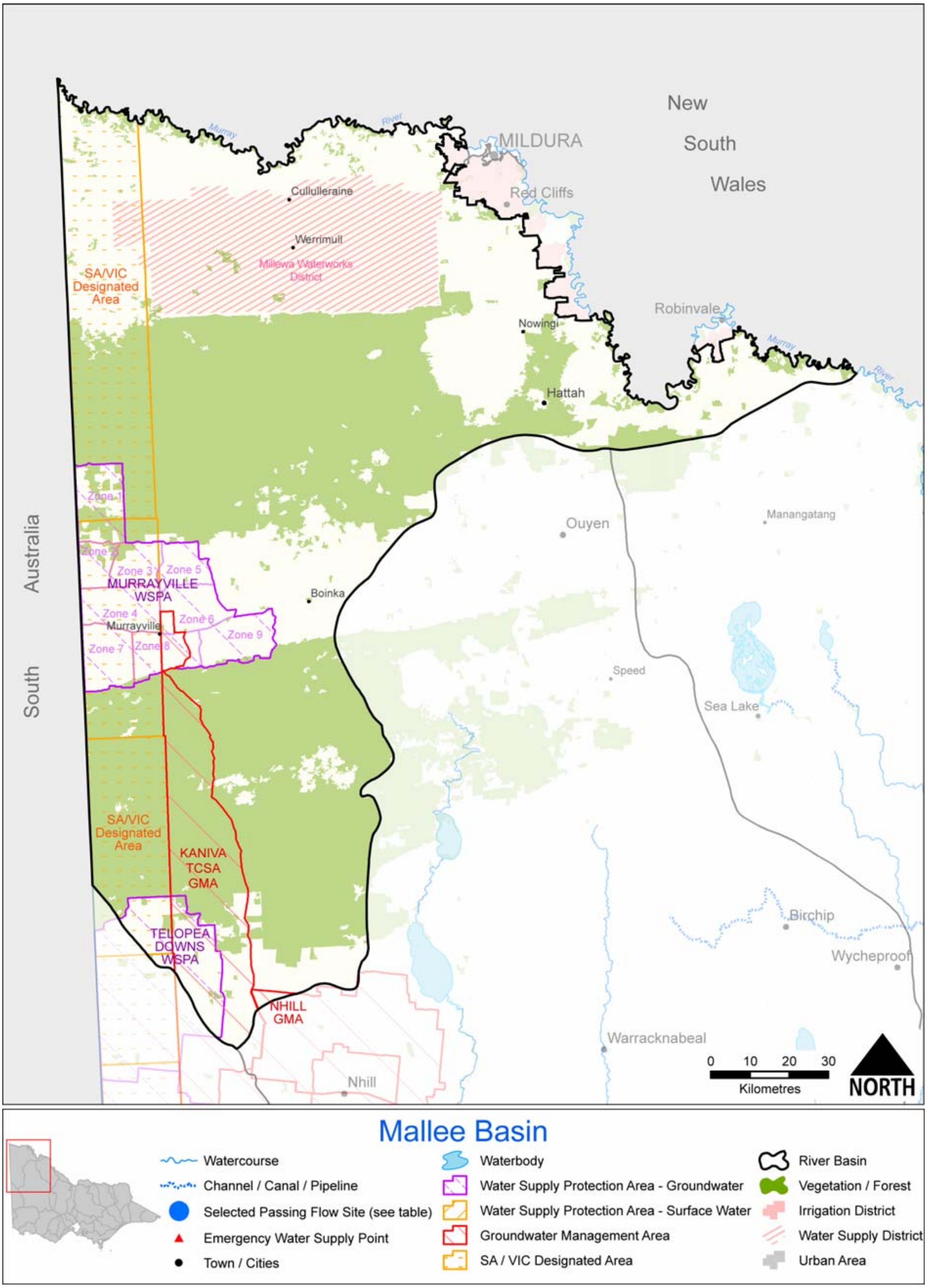
Table 14-2 Summary of total water resources and water use in the Mallee basin, 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	0	0
Groundwater(2)	14,700	7,000
Recycled water	0	0

Note:
(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 14-3.
(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the State Water Report 2005/2006.

14.4 Location of water resources

Figure 14-1 Map of the Mallee basin



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 or across basin boundaries in 2006/07.

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 14-3.

The main water supply in the Mallee basin is groundwater. The Mallee basin contains all of the Murrayville WSPA as well as part of the Telopea Downs WSPA and Kaniva TCSA (Tertiary confined sand aquifer) GMA. Groundwater use in 2006/07 almost doubled in the Murrayville WSPA compared with 2005/06; however extractions in the Telopea Downs WSPA almost halved over the same period.

Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts.

Table 14-3 Licensed groundwater volumes, Mallee basin 2006/07

WSPA/GMA(1)	GMA/ WSPA depth limits(2) (m)	Entitlement limit(3) (ML/year)	Licensed entitlement(4) (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Kaniva TCSA GMA (83%)	Tertiary confined sand aquifer	913	913	0	0	0	0
Murrayville WSPA (100%)	70-200	10,883	10,883	5,423	0	5,423	2,870
Telopea Downs WSPA (39%)	All depths	2,925	2,925	900	0	900	1,611
Total		**14,721**	**14,721**	**6,323**	**0**	**6,323**	**4,481**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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

(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.

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

An estimate of domestic and stock groundwater use is provided in Table 14-4.

Table 14-4 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores(1)(2)	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Kaniva TCSA GMA (83%)	0	0
Murrayville WSPA (100%)	283	566
Telopea Downs WSPA (39%)	39	78
Total	**322**	**644**

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 volume in Table 14-3.
(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by the surface area percentage in the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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 14-5.

Table 14-5 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2006/07 (ML)	Metered use 2005/06 (ML)
Cowangie	40	9	9
Murrayville	475	155	171
Total	**515**	**164**	**180**

14.7 Drought contingency measures

A range of drought contingency measures were undertaken in the Avoca basin in 2006/07. These include:

- restrictions on urban and rural water usage (discussed in section 14.8)
- GWMWater domestic and stock customers having access to a water carting program to provide essential watering needs
- where possible, GMWWater towns were supplied by the winter channel run, with additional water available from the Waranga Western Channel.

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

A summary of the 2006/07 restrictions on water use in the Mallee basin is presented in Table 14-6.

Groundwater use was unrestricted in the Mallee basin during 2006/07.

Table 14-6 Seasonal allocations and restrictions on water use in Mallee basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Towns supplied from the Murray via the Northern Mallee Pipeline	Stage 1 restrictions from January 2007, increasing to Stage 2 in June 2007
	Towns supplied from Grampians via the Wimmera-Mallee channel system	Stage 3 restrictions from July 2006, increasing to Stage 4 from October 2006 to June 2007
	Lower Murray Water customers	Stage 1 restrictions December 2006 to June 2007
Domestic and stock farm supplies	Wimmera-Mallee channel system supplied from the Grampians	Winter channel run only filled town storages. Rural customers received a basic supply from GWMWater's water carting program, but had access to additional water for carting under their own arrangements
	Northern Mallee Pipeline area	Stage 2 restrictions introduced May to June 2007

14.9 Recycled water

There are no wastewater treatment plants within the Mallee basin.

14.10 Water for the environment

14.10.1 Environmental Water Reserve (EWR)

In 2006/07 the Mallee basin EWR comprised water outside the allocation limit for GMAs and WSPAs.

14.10.2 Entitlements for the environment

There were no entitlements for the environment in operation in the Mallee basin in 2006/07. Refer to Chapter 6 for environmental water provided to Red Gums along the River Murray floodplain that borders the Mallee basin.

14.10.3 Passing flow requirements

As all surface water supplies are externally sourced in the Mallee basin, there are no passing flow requirements.

14.10.4 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.

15 Wimmera basin

This chapter sets out the accounts for the Wimmera basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

15.1 Wimmera basin summary

The Wimmera basin experienced another dry year with low inflows (20% of the long term average) and declining storage levels (9% full by year end). There was insufficient water for a winter channel run for rural customers, with the run only filling town storages, and no summer channel run at all. In place of the channel run, GWMWater ran a water carting service for essential household and domestic and stock use. Irrigators again received a zero allocation.

With almost all towns in the basin on Stage 4 restrictions by October and a Ministerial direction withholding environmental water releases to ensure consumptive needs were met, the importance of the Wimmera Mallee Pipeline was highlighted. By the end of the year, 768 kilometres of trunk and distribution pipeline had been laid, with plans for the first towns to be supplied early in 2007/08. The project's water savings will be used for consumptive and environmental purposes.

Groundwater bores were drilled in Horsham to augment supply from Lake Wartook. These bores were also used for the Iluka sand mine for a short period until the mine's drought contingency measures were completed.

15.2 Responsibilities for management of water resources

Table 15-1 shows the responsibilities of various authorities within the Wimmera basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 15-1 Responsibilities for water resources management within the Wimmera basin, 2006/07

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

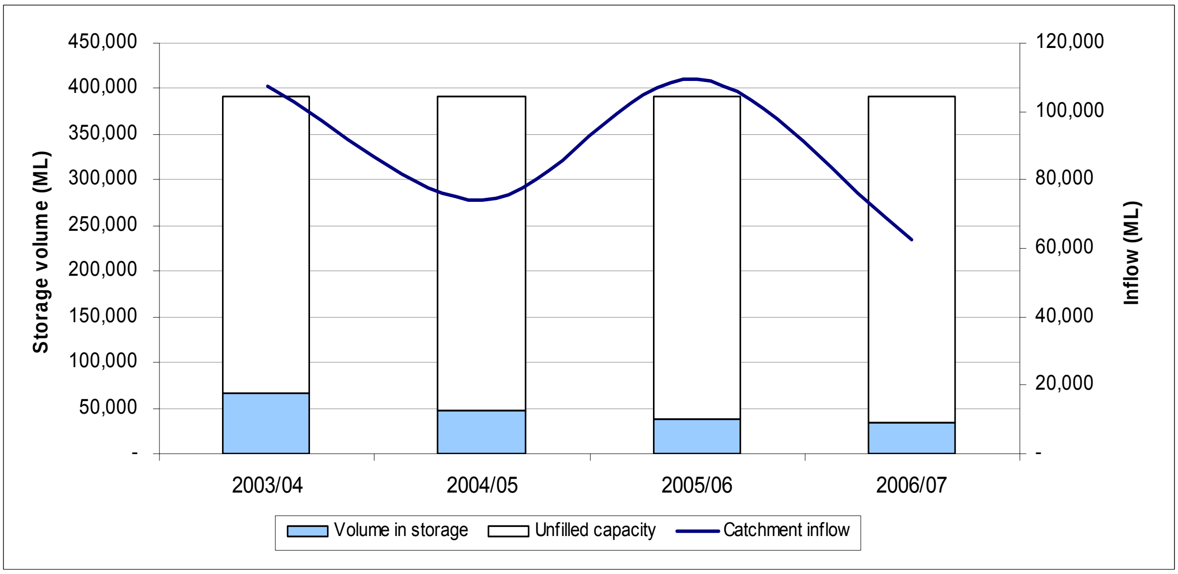
Note:
(1) Also supplies farms located in the Avoca and Mallee basins.

15.3 Rainfall, inflows and storages in 2006/07

In 2006/07, rainfall across the Wimmera basin ranged between 60% and 100% of the long term average. Inflows in 2006/07 halved compared with 2005/06 and were 20% of the long term average.

Most storages in the basin were empty at the end of 2006/07 although Lake Bellfield and Fyans Lake recorded increases in volumes during the year. In total, storages were at 9% of capacity in June 2007, a reduction from 10% in June 2006.

Figure 15-1 All major storages and catchment inflows in the Wimmera basin



15.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Wimmera basin are shown in Table 15-2.

Table 15-2 Summary of total water resources and water use in the Wimmera basin, 2006/07

Water source	Total water resource (ML)(2)	Total use (ML)
Surface water	64,900	36,600
Groundwater(1)	4,100	500
Recycled water	1,540	1,540

Note:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 15-7.

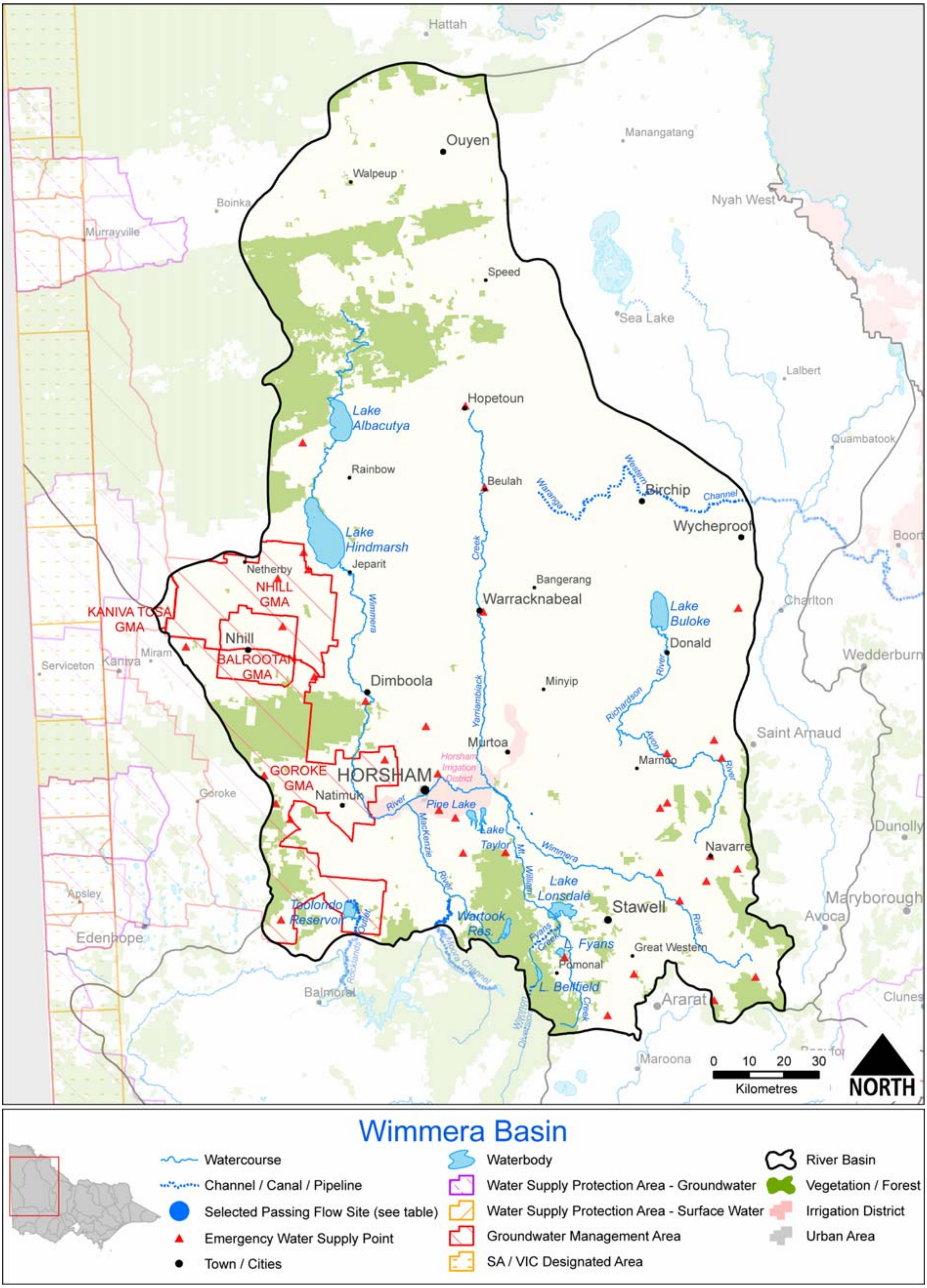
(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the State Water Report 2005/2006.

15.4.1 Infrastructure projects to improve water availability

Construction of the Wimmera Mallee Pipeline is underway. This project will ultimately replace 17,500 kilometres of open earthen channels with a pressurised pipeline system. The first pipes were laid in September 2005 and over 800 kilometres of pipeline had been installed by the end of June 2007.

15.5 Location of water resources

Figure 15-2 Map of the Wimmera basin



15.6 Surface water resources

15.6.1 Water balance

A surface water balance for the Wimmera basin is shown in Table 15-3. The extremely dry conditions required storages to be drawn down and the amount of water available for supply was limited to essential urban and rural use.

Table 15-3 Balance of surface water in the Wimmera basin

Water account component	2006/07 (ML)	2005/06 (ML)
Major on-stream storage		
Volume in storage at start of year	38,200	47,900
Volume in storage at end of year	34,900	38,200
Change in storage	**-3,300**	**-9,700**
Inflows		
Catchment inflow(1)	62,400	109,600
Transfer from Glenelg basin	2,500	5,800
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**64,900**	**115,400**
Usage		
Urban diversions and use	12,800	11,100
Diversions for irrigation and domestic and stock use	14,700	57,300
Licensed diversions from unregulated streams	1,800	1,700
Small catchment dams(2)	7,300	14,400
Sub-total	**36,600**	**84,500**
Losses		
Net evaporation losses from major storages	16,100	18,200
Losses from small catchment dams(2)	14,200	8,600
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	1,200	3,200
Sub-total	**31,500**	**30,000**
Water passed at outlet of basin		
River outflows to Lake Hindmarsh (measured at Lochiel)	100	10,600
River outflows to Lake Buloke	0	0

Notes:

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

(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(3) Losses estimated using loss functions in the Grampians Wimmera Mallee REALM model.

15.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values provided in Table 15-4 are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 15-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	12,900	3,300	n/a
Registered commercial and irrigation	9,400	4,000	n/a
Total	**22,300**	**7,300**	**21,500**

Notes:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

15.6.3 Water entitlement transfers

A summary of Victorian entitlements transferred within the Wimmera basin is presented in Table 15-5. GWMWater reported that two trades occurred within the Wimmera Irrigation Area, totalling 46 ML.

Table 15-5 Transfer of entitlements in the Wimmera 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)
GWMWater								
Wimmera Irrigation Area	0	0	0	0	46	46	2	0
Total 2006/07	**0**	**0**	**0**	**0**	**46**	**46**	**2**	**0**
Total 2005/06	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Note:

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

15.6.4 Volume diverted

The volume of water diverted under each 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 2006/07. For multi-year entitlements, compliance is assessed based on the total volume of water diverted over the term of the entitlement. Therefore it is possible that the volume diverted in any given year may exceed the average bulk entitlement volume.

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 annual bulk entitlement volume (ML)[1]	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance?[2][3][4]
Coliban Water					
Wimmera and Glenelg[5]	1	450	0	285	Yes
Central Highlands Water					
Landsborough – Navarre	1	60	0	0	Yes
GWMWater					
Ararat, Stawell, Great Western and Halls Gap	5	4,094	0	2,291	Yes
Wimmera and Glenelg Rivers – Grampians Water[5]	5	16,109	0	10,045	Yes
Wimmera and Glenelg Rivers – Wimmera Mallee Water[5]	5	149,211	0	14,666	Yes
Wannon Water					
Wimmera and Glenelg Rivers[5]	1	465	0	55	Yes
Minister for the Environment					
Wimmera and Glenelg Rivers[5]	5	40,563	0	0	Yes
Total annual volume of bulk entitlements 2006/07		**210,952**	**0**	**27,342**	
Total annual volume of bulk entitlements 2005/06		**206,793**	**0**	**69,100**	
Licensed diversions from unregulated streams 2006/07		*2,487*		*1,800*	
Licensed diversions from unregulated streams 2005/06		*2,486*		*1,700*	

Notes:

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

(2) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.

(3) Compliance is also assessed against the Murray-Darling Basin annual cap target for the Wimmera and Mallee basins, which is included in the MDBC's Water Audit Monitoring Report 2006/07.

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

(5) These bulk entitlements are also reported in the Glenelg basin.

15.7 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 the majority of the Nhill GMA and Goroke GMA. Groundwater use was confined to the Balrootan (Nhill) GMA in 2006/07 and the volume extracted fell by approximately 70% compared with the prior year.

Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts.

Table 15-7 Licensed groundwater volumes, Wimmera basin 2005/06

WSPA/GMA(1)	GMA/WSPA depth limits(2) (m)	Entitlement limit(3) (ML/year)	Licensed entitlement(4) (ML/year)	Metered use (ML)	Estimated use in unmetered bores(5) (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Balrootan (Nhill) GMA (100%)	60-125	1,522	1,522	413	0	413	1,380
Goroke GMA (63%)	Tertiary sand confined aquifer	1,393	1,393	0	0	0	0
Nhill GMA (100%)	Tertiary sand confined aquifer	1,200	1,200	0	0	0	0
Total		**4,115**	**4,115**	**413**	**0**	**413**	**1,380**

Notes:
(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.
(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.
(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.
(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, 2006/07

WSPA/GMA	No. of domestic and stock bores(1)(2)	Estimated domestic and stock use (assuming 2 ML/bore) (ML)
Balrootan (Nhill) GMA (100%)	51	102
Goroke GMA (63%)	0	0
Nhill GMA (98%)	0	0
Total	**51**	**102**

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 volume 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, multiplied by the surface area percentage in the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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 volume (ML)	Metered use 2006/07 (ML)	Metered use 2005/06 (ML)
Boroka	30	0	0
Kiata	40	4	5
Landsborough	150	27	36
Nhill	1,000	546	445
Total	**1,220**	**577**	**486**

15.8 Drought contingency measures

A range of drought contingency measures were undertaken in the Wimmera basin in 2006/07. These include:

- restricting urban and rural water use (discussed below)
- provision of emergency water supply points for private water carting for farms
- revising normal operations, e.g. no summer channel run for GWMWater customers, and delaying the start of the winter channel run, which was limited to filling town dams only
- water being carted to domestic and stock customers for essential needs. This program commenced in October 2006 and provided a supply of 0.3 ML every second month to 2,300 customers. Water carting from Birchip to Wycheproof urban supplies was also undertaken following a blue-green algae outbreak at Wycheproof
- additional water supplied from Waranga Western Channel under qualification of rights for Goulburn system
- drilling new groundwater bores at Mount Zero to supply Horsham and drilling new bores adjacent to a supply pipe from Rocklands Reservoir for the Iluka sand mine.

No rights were qualified in the Wimmera basin in 2006/07, however the Minister for Water directed GWMWater to retain water in storage that would otherwise been used for environmental purposes.

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

Customers in both the rural and urban areas of the Wimmera basin faced significant restrictions on water use in 2006/07. At the end of 2006/07 all major towns in the basin, including Ararat, Stawell and Horsham, were on Stage 4 restrictions.

Groundwater use was unrestricted in the Wimmera basin during 2006/07.

Table 15-10 Seasonal allocations and restrictions on water use in Wimmera basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	GWMWater customers(Antwerp, Beulah, Birchip, Brim, Donald, Dooen, Glenorchy, Great Western, Halls Gap, Hopetoun, Horsham, Jeparit, Lascelles, Marnoo, Minyip Murtoa, Noradjuha, Nullawil, Pimpinio, Pomonal, Rainbow, Reids Lane, Rupanyup, Stawell, Tarranyurk, Warracknabeal, Watchem, Woomelang, Wycheproof, Yaapeet)	Stage 3 restrictions increasing to Stage 4 from October 2006 to June 2007
	Clear Lake, Dimboola, Jung, Natimuk	Stage 4 restrictions from July 2006 to June 2007
	Yanac	Stage 1 restrictions from December 2006 to June 2007
Domestic and stock and irrigation	Wimmera Mallee system	Irrigation and licensed diverter customers received a nil allocation. Domestic and stock customers served by the Waranga Channel received approximately 30% of supply from July to September. Domestic and stock customers outside this area and not serviced by the Northern Mallee Pipeline received a limited supply under the water carting program
Environment	Wimmera and Glenelg Rivers	Ministerial directive in August 2006 to withhold environmental water meant no environmental releases were made

15.10 Recycled water

GWMWater operates 15 wastewater treatment plants in the Wimmera basin, and reuses all wastewater at nine of these plants for purposes including irrigation of pasture, horticulture and vineyards, and urban and industrial uses (Table 15-11). Wastewater produced at the six other plants is evaporated on-site. Reductions in urban water usage meant that the volume of wastewater available for recycling fell by 25% compared with 2005/06.

Table 15-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Birchip	33	33	100%	0	33	0	0	0	0
Dimboola	80	80	100%	0	65	0	15	0	0
Donald	66	66	100%	0	66	0	0	0	0
Halls Gap	69	69	100%	11	58	0	0	0	0
Hopetoun(4)	0	0	0%	0	0	0	0	0	0
Horsham	761	761	100%	156	605	0	0	0	0
Jeparit(4)	0	0	0%	0	0	0	0	0	0
Minyip(4)	0	0	0%	0	0	0	0	0	0
Murtoa	19	19	100%	0	19	0	0	0	0
Natimuk(4)	0	0	0%	0	0	0	0	0	0
Nhill	96	96	100%	1	95	0	0	0	0
Ouyen(4)	0	0	0%	0	0	0	0	0	0
Rainbow(4)	0	0	0%	0	0	0	0	0	0
Stawell	365	365	100%	231	134	0	0	0	0
Warracknabeal	53	53	100%	53	0	0	0	0	0
Total 2006/07	**1,541**	**1,541**	**100%**	**453**	**1,074**	**0**	**15**	**0**	**0**
Total 2005/06	**2,041**	**2,028**	**99%**	**564**	**1,388**	**0**	**77**	**0**	**13**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report.

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

(4) All wastewater is evaporated on site.

15.11 Water for the environment

15.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Wimmera basin EWR comprised the following components:

- the Wimmera and Glenelg Rivers Flora and Fauna Environmental Reserve bulk entitlement of 40,563 ML
- water set aside for the environment through the operation of 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.

15.11.2 Entitlements for the environment

The formal entitlement for the environment for the Wimmera basin in 2006/07 comprised the Wimmera and Glenelg Rivers Flora and Fauna Environmental Reserve held by the Minister for the Environment. The Inter Catchment Advisory Group (ICAG) determines the share of environmental allocations between the two catchments. The initial allocation for the 2006/07 year to the EWR was 239 ML. By June 2007 this allocation had increased to 260 ML and, when combined with EWR carry-over volumes of 3,419 ML, gave a total allocation of 3,679 ML. However, no water was released due to a Ministerial direction to withhold the entire volume. Construction of the Wimmera Mallee Pipeline will provide increased water for the environment through the EWR. The Lower Wimmera River has not received any significant flows since an environmental water release in summer 2004.

15.11.3 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.

15.11.4 Streamflow management plans (SFMPs)

No work was undertaken on the proposed SFMP for the upper Wimmera River during 2006/07.

15.11.5 Water leaving the basin

The volume of water flowing from the Wimmera basin into the terminal lakes in the basin reduced significantly in 2006/07 to 100 ML. This represents less than 1% of total inflows into the basin, compared with 10% in 2005/06 when the total outflow was 10,600 ML. Lake Albacutya in the Wimmera basin is an internationally significant wetland listed under the Ramsar convention and relies on freshwater inputs from the Wimmera basin to ecologically function. It is therefore dependent on water from the EWR in the Wimmera basin.

16 East Gippsland basin

This chapter sets out the accounts for the East Gippsland basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

16.1 East Gippsland basin summary

Inflows were improved by heavy rain in the last three days of the year and were 70% of the long term average. Compared with other basins, consumptive water use in the East Gippsland basin was relatively unaffected by the drought in 2006/07. This is because consumptive use in the basin is very low compared with stream flow, with less than 1% of inflows being diverted for use.

16.2 Responsibilities for management of water resources

Table 16-1 shows the responsibilities of various authorities within the East Gippsland basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 16-1 Responsibilities for water resources management within the East Gippsland basin, 2006/07

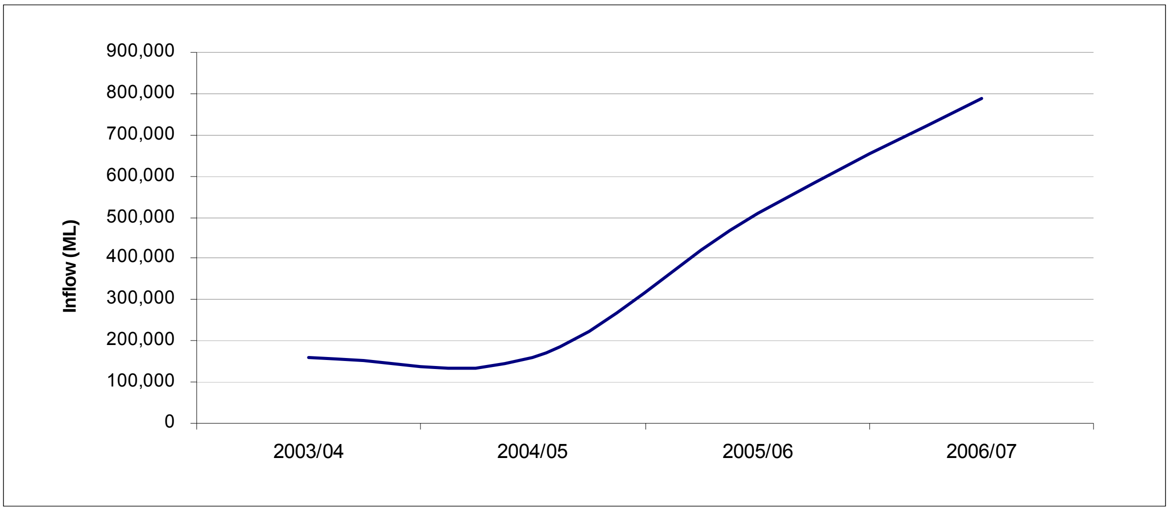
Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water		Licensed diversions from groundwater and surface water sources		
East Gippsland Water			Urban water to towns including Mallacoota, Cann River 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 Rainfall and inflows in 2006/07

In 2006/07, rainfall in the East Gippsland basin ranged between 80% and 100% of the long term average. Inflows were 70% of the long term average (1,122,000 ML), an improvement on previous years. Inflows increased late in the year with heavy rain in East Gippsland, which will also contribute to higher inflows in 2007/08 as flooding from further upstream reaches the basin outlet in early July 2007.

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

Figure 16-1 Catchment inflows in the East Gippsland basin



16.4 Location of water resources

Figure 16-2 Map of the East Gippsland basin

16.5 Total water resources in the basin

The total volumes of water available and supplied from water resources in the East Gippsland basin are shown in Table 16-2. There is very low extraction of surface water (0.2%) relative to the available resource in the basin. All wastewater is recycled for productive purposes.

Table 16-2 Summary of total water resources and water use in the East Gippsland basin, 2006/07

Water source	Total water resource (ML)	Total use (ML)
Surface water	788,600	1,600
Groundwater	0	0
Recycled water	70	70

16.6 Surface water resources

16.6.1 Water balance

The surface water balance for the East Gippsland basin for 2006/07 is presented in Table 16-3.

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 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 16-3 Balance of surface water in the East Gippsland basin

Water account component	2006/07 (ML)	2005/06 (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)	788,600	508,600
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**788,600**	**508,600**
Usage		
Urban diversions	280	300
Licensed diversions from unregulated streams	200	200
Small catchment dams(2)	1,100	1,100
Sub-total	**1,600**	**1,600**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(2)	100	100
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	0	0
Sub-total	**100**	**100**
Water passed at outlet of basin		
River outflows	786,900	506,900

Notes:

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

(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(3) Assumed to be zero because data is not readily available.

16.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 16-4 below have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 16-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	800	400	n/a
Registered commercial and irrigation	900	700	n/a
Total	**1,700**	**1,100**	**1,200**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

16.6.3 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 2006/07.

16.6.4 Volume diverted

The volume of water diverted under East Gippsland Water's bulk water entitlements is shown in Table 16-5.

Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2006/07.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 16-5 Volume of water diverted under surface water entitlements in the East Gippsland basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance?(1)
East Gippsland Water					
Bemm River	1	100	0	33	Yes
Cann River	1	192	0	60	Yes
Mallacoota	1	330	0	185	Yes
Total annual volume of bulk entitlements 2006/07		**622**	**0**	**278**	
Total annual volume of bulk entitlements 2005/06		**622**	**0**	**295**	
Licensed diversions from unregulated streams 2006/07		*757*		*200*	
Licensed diversions from unregulated streams 2005/06		*755*		*200*	

Note:

(1) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water authorities and has not been independently audited.

16.7 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 2006/07 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 the bore was not used in 2006/07.

Table 16-6 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2006/07 (ML)	Metered use 2005/06 (ML)
Mallacoota	70	0	0
Total	**70**	**0**	**0**

16.8 Drought contingency measures

The East Gippsland basin was relatively unaffected by the drought, however there were three emergency water supply points that could be accessed at Mallacoota and Cann River.

No rights were qualified in the East Gippsland basin in 2006/07.

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

There were no urban or rural restrictions on surface water or groundwater use in 2006/07.

16.10 Recycled water

The wastewater treatment plant at Mallacoota is operated by East Gippsland Water. All the wastewater passing through this treatment plant was recycled for applications including pasture and tree plantations. The Cann River sewerage scheme collected wastewater from 169 assessments, but is storing the treated wastewater until there is sufficient volume for pasture irrigation.

Table 16-7 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation (1)	Within process(2)		
Cann River	0	0	0%	0	0	0	0	0	0
Mallacoota	71	71	100%	0	71	0	0	0	0
Total 2006/07	**71**	**71**	**100%**	**0**	**71**	**0**	**0**	**0**	**0**
Total 2005/06	**65**	**65**	**100%**	**0**	**65**	**0**	**0**	**0**	**0**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006.

(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.

16.11 Water for the environment

16.11.1 Environmental Water Reserve (EWR)

In 2006/07 the East Gippsland basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by East Gippsland Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

16.11.2 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin.

Table 16-8 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. The location of this compliance point is presented in Figure 16-2.

Table 16-8 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 (shown as 1 in Figure 16-2)
	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 entitlements in 2006/07.

16.11.3 Water leaving the basin

The amount of water flowing from the East Gippsland basin into Bass Strait was 786,900 ML in 2006/07, compared with 506,900 ML in 2005/06. Basin outflows represented more than 99% of the total inflows into the basin. This water comprises consumptive water that was not used under entitlements and the EWR (passing flows and any water above cap).

17 Snowy basin

This chapter sets out the accounts for the Snowy basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

17.1 Snowy basin summary

Consumptive entitlements are low compared with inflows, and more than 99% of inflows left the basin and flowed into Bass Strait. Towns in the south of the basin did experience temporary water shortages in summer and autumn as low inflows to local catchments brought about Stage 4 restrictions for three months. However rain late in the year returned all towns to permanent water savings measures.

17.2 Responsibilities for management of water resources

Table 17-1 shows the responsibilities of various authorities within the Snowy basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 17-1 Responsibilities for water resources management within the Snowy basin, 2006/07

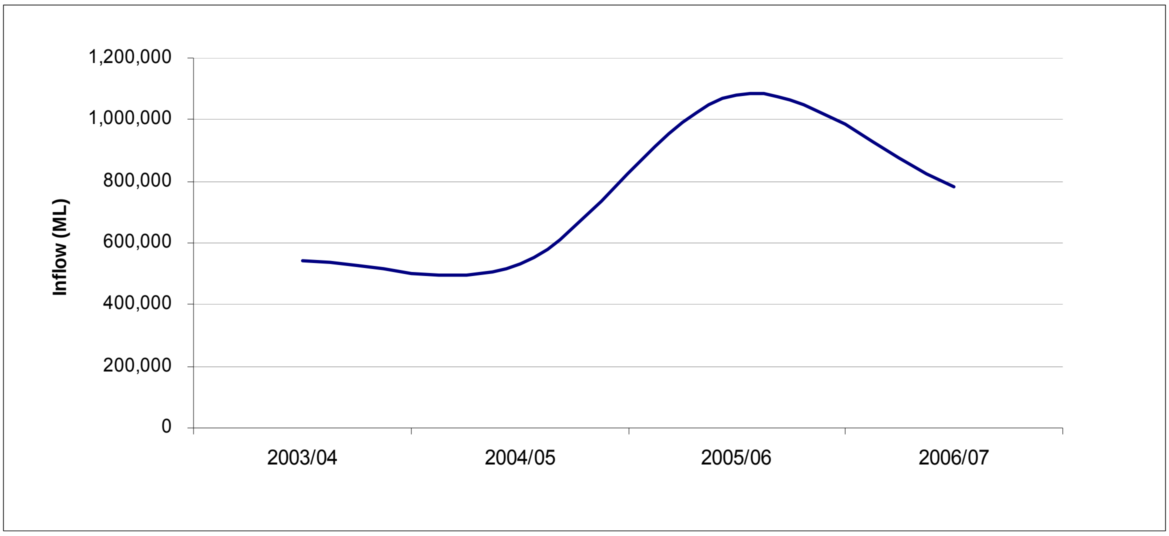
Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water		Groundwater and surface water licensed diversions		
East Gippsland Water			Including the towns of Buchan, Cann River, Genoa, Bonang, Mallacoota 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 Rainfall, inflows and storage levels in 2006/07

In 2005/06, rainfall in the Snowy basin ranged between 80% and 100% of the long term average. Total inflows were 54% of the long term average, compared with 75% in 2005/06. The catchment inflows from Victoria declined to a greater degree than the inflows from New South Wales. The heavy rain and flooding in late June increased streamflows, and will also contribute to higher inflows in 2007/08 as flooding from further upstream reaches the basin outlet in early July 2007.

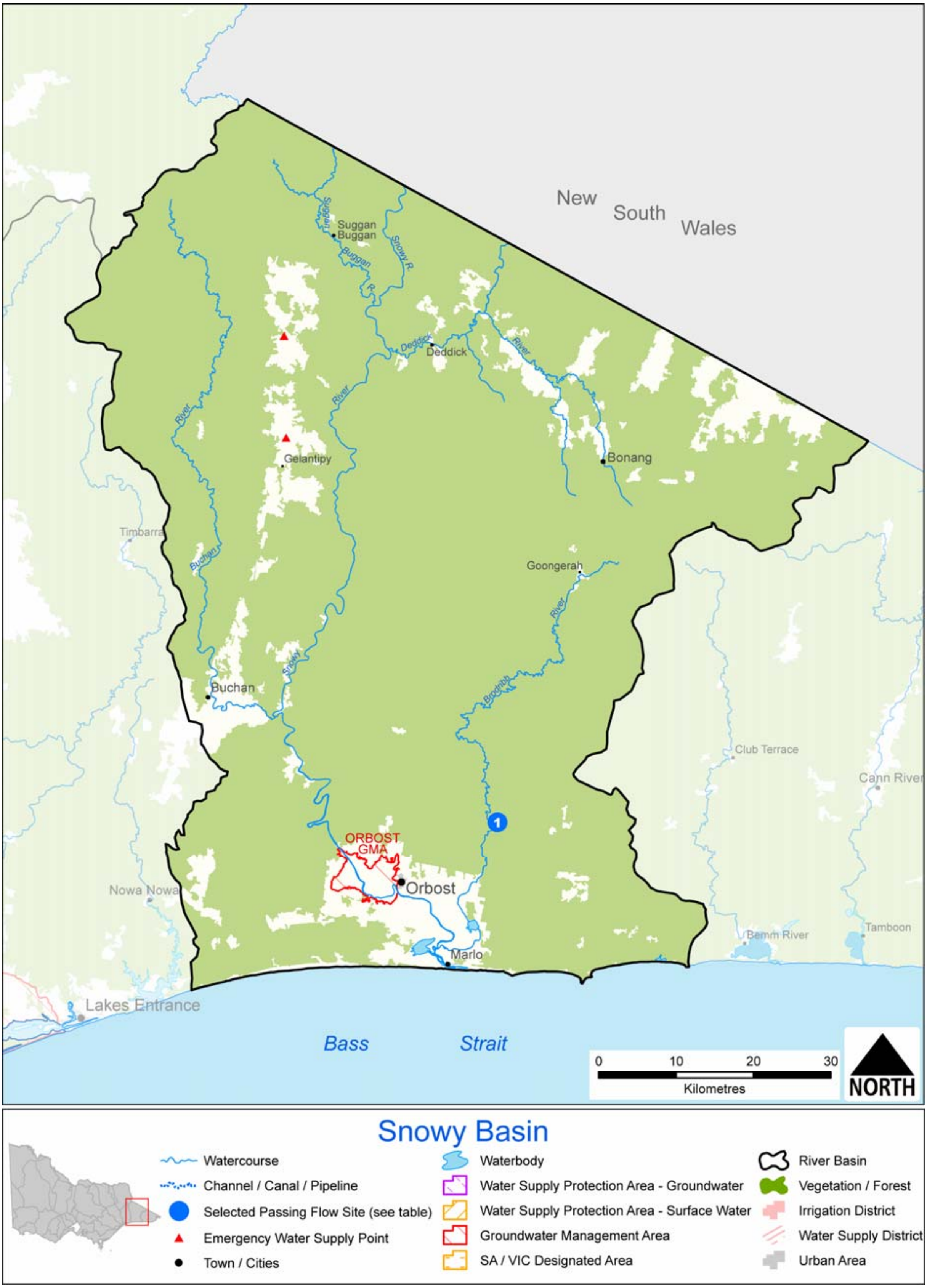
There are no major storages located within the Snowy basin.

Figure 17-1 Catchment inflows in the Snowy basin



17.4 Location of water resources

Figure 17-2 Map of the Snowy basin



17.5 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Snowy basin are shown in Table 17-2. There is a very low consumptive use of surface water relative to the available resource in the basin. All treated wastewater is reused for productive purposes. Approximately 95% of the Snowy basin is an unincorporated area that contains a significant groundwater resource not represented in these totals.

Table 17-2 Summary of total water resources and water use in the Snowy basin, 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	780,800	5,300
Groundwater (2)	1,200	500
Recycled water	200	200

Note:

(1) For groundwater the total water resource is the total entitlement limit as presented in Table 17-6.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

17.6 Surface water resources

17.6.1 Water balance

A surface water balance for the Snowy basin is shown in Table 17-3. As these accounts provide a record of water availability and use across Victoria, this balance considers only the Victorian portion of the Snowy basin.

No reservoir information is recorded in the water balance as there are no storages in the Victorian Snowy basin with a capacity greater than 1,000 ML.

Victorian inflows accounted for 73% of the total inflows to the basin, compared with 78% in 2005/06. Diversions in Victoria from the Snowy basin represent less than 1% of the total inflows, with small catchment dams the largest source of diversions.

Table 17-3 Balance of surface water in the Snowy basin

Water account component	2005/06 (ML)	2005/06 (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)	568,300	843,600
Catchment inflow from NSW(2)	212,500	234,700
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**780,800**	**1,078,300**
Usage		
Urban diversions	1,060	900
Licensed diversions from unregulated streams	800	1,100
Small catchment dams(3)	3,400	3,400
Sub-total	**5,300**	**5,400**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(3)	600	700
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	0	0
Sub-total	**600**	**700**
Water passed at outlet of basin		
River outflows to the ocean	774,900	1,072,200

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) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(4) Assumed to be zero because data is not available.

17.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 17-4 are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 17-4 Catchment dam information, 2006/07 at selected sites

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	3,100	1,600	n/a
Registered commercial and irrigation	2,100	1,800	n/a
Total	**5,200**	**3,400**	**4,000**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

17.6.3 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 2006/07.

17.6.4 Volume diverted

The volume of water diverted under East Gippsland Water's bulk entitlements is shown in Table 17-5. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2006/07.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 17-5 Volume of water diverted under surface water entitlements in the Snowy basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance?(1)
East Gippsland Water					
Buchan	1	170	0	26	Yes
Orbost	1	2,031	0	1,033	Yes
Total annual volume of bulk entitlements 2006/07		**2,201**		**1,059**	
Total annual volume of bulk entitlements 2005/06		**2,201**	**0**	**895**	
Licensed diversions from unregulated streams 2006/07		*3,898*		*800*	
Licensed diversions from unregulated streams 2005/06		*3,858*		*1,100*	

Note:

(1) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited

17.7 Groundwater resources

The Snowy basin contains the entire Orbost GMA. Licensed groundwater entitlements and use for the Orbost GMA in the Snowy basin, excluding domestic and stock use, are shown in Table 17-6. Groundwater extractions increased by 54%, nevertheless the volume was less than half of the licensed entitlements within the basin.

Table 17-6 Licensed groundwater volumes, Snowy basin 2006/07

WSPA/GMA(1)	GMA/ WSPA depth limits(2) (m)	Entitlement limit(3) (ML/year)	Licensed entitlement (4) (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Orbost GMA (100%)	20-45	1,200	1,200	540	0	540	350
Total		**1,200**	**1,200**	**540**	**0**	**540**	**350**

Notes:
(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.
(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.
(4) Includes domestic and stock usage in those cases where this forms part of a licensed volume.

There are no domestic and stock bores in the Snowy basin and groundwater is not used as an urban supply.

17.8 Drought contingency measures

The main drought contingency measure implemented in the Snowy basin in 2006/07 was restricting urban water use in towns in the south of the basin, discussed in more detail in section 17.9.

No rights were qualified in the Snowy basin in 2006/07.

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

Low inflows to local storages brought about water restrictions for a number of months in Marlo, Newmerella and Orbost, as detailed in Table 17-7.

Groundwater use was unrestricted in the Snowy basin during 2006/07.

Table 17-7 Seasonal allocations and restrictions on water use in Snowy basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Marlo, Newmerella, Orbost	Stage 2 restrictions from December 2006 to January 2007, increasing to Stage 4 from February to April 2007, reducing to Stage 2 in May and reverting to permanent water savings measures in June 2007
Licensed diversions from unregulated streams		No restrictions

17.10 Recycled water

The wastewater treatment plant at Orbost is operated by East Gippsland Water. All of the wastewater passing through this treatment plant was recycled and used for a number of applications including pasture and tree plantations (Table 17-8).

Table 17-8 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation [1]	Within process[2]		
Orbost	198	198	100%	0	198	0	0	0	0
Total 2006/07	**198**	**198**	**100%**	**0**	**198**	**0**	**0**	**0**	**0**
Total 2005/06	**276**	**276**	**100%**	**0**	**276**	**0**	**0**	**0**	**0**

Notes:
(1) Volume used to deliver specific environmental flow benefits.
(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology compared with the figures in the State Water Report 2005/2006.
(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.

17.11 Water for the environment

17.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Snowy basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of the Water Licence issued to Snowy Hydro
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by East Gippsland Water
- environmental allocations from outcomes of the Snowy Water Inquiry
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

17.11.2 Entitlements for the environment

The volume of environmental entitlements for the Snowy basin as at June 2007 was 43,000 ML, of which 15,100 ML is permanently committed by Victoria, 23,200 ML permanently committed by New South Wales and 4,700 ML temporarily committed by New South Wales).

The Snowy environmental entitlements were created through the inter-governmental commitment between the Commonwealth, Victorian and New South Wales Governments, often referred to as the Snowy Water Inquiry. The commitment is to provide for the return of 212,000ML (21%) of the original flow to the Snowy River below Jindabyne by 2012, and 28% in the longer term. It is envisaged that the environmental water for the Snowy River will be achieved through the investment in water recovery projects in the Goulburn, Murray and Murrumbidgee basins.

The first interim target of providing 38 ML of entitlements to the Snowy River by 2005 was met. The next interim target under the Snowy Water Inquiry is to provide 142,000 ML of entitlements to the Snowy River by 2009.

17.11.3 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin.

Table 17-9 shows the passing flow requirements in the Snowy basin for a selected bulk entitlement compliance point. While there are other compliance points, the point below has been chosen as it was judged to be of community interest. The location of this compliance point is presented in Figure 17-2.

Table 17-9 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 (shown as 1 in Figure 17-2)
	Passing flow rules	• The lesser of 1 ML/day or natural inflow • Flow greater than 1 ML/day, the authority must pass 1 ML/day

East Gippsland Water reported that it met all passing flow requirements under its bulk entitlements in 2006/07.

17.11.4 Water leaving the basin

The amount of water flowing from the Snowy basin into Bass Strait was 774,900 ML in 2006/07. This represents more than 99% of the total inflows into the basin, which is unchanged from recent years. This water comprises consumptive water that was not used under entitlements and the EWR (passing flows, and any water above cap).

18 Tambo basin

This chapter sets out the accounts for the Tambo basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

18.1 Tambo basin summary

The Tambo basin experienced similar conditions in 2006/07 to the neighbouring Snowy basin. Inflows fell from those recorded in 2005/06 and were 20% of the long term average, but were higher than both 2003/04 and 2004/05. Consumptive diversions of water in the Tambo basin are low compared with inflows – approximately 4% – however low inflows did affect local storages for Swifts Creek and led to urban water restrictions in the second half of the year. By the end of the year, rainfall allowed storages to recover and no water restrictions were in force.

18.2 Responsibilities for management of water resources

Table 18-1 shows the responsibilities of various authorities within the Tambo basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 18-1 Responsibilities for water resources management within the Tambo basin, 2006/07

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

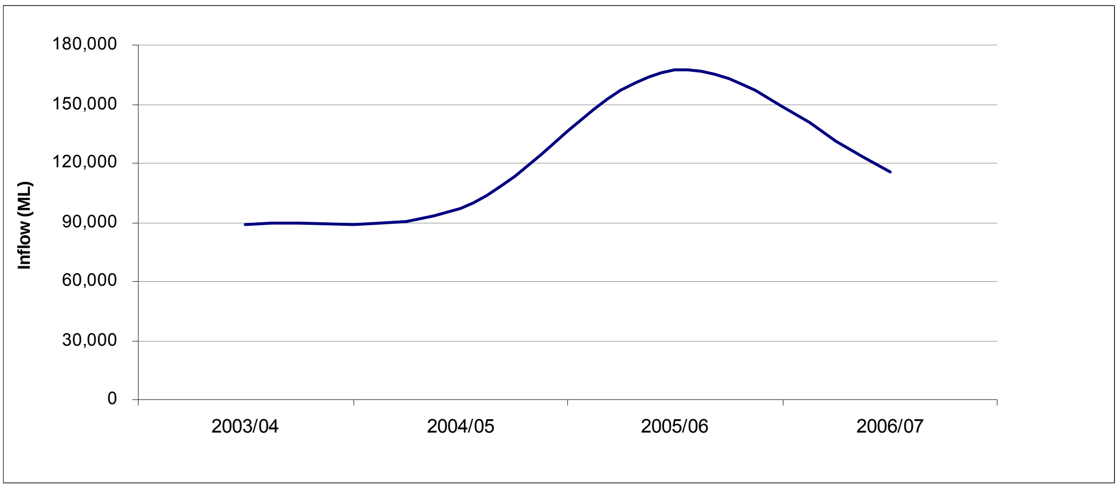
18.3 Rainfall, inflows and storages in 2006/07

In 2006/07, rainfall in the Tambo basin ranged between 60% and 125% of the long term average. The south of the basin experienced heavy rains and flooding in the final days of the year which contributed to the large rainfall variance within the basin. This rain will also contribute to higher inflows in 2007/08 as flooding from further upstream reaches the basin outlet in early July 2007.

Inflows in 2006/07, however, were still lower than the previous year and were 20% of the long term average, the third year out of the past four where inflows did not exceed the 20% mark.

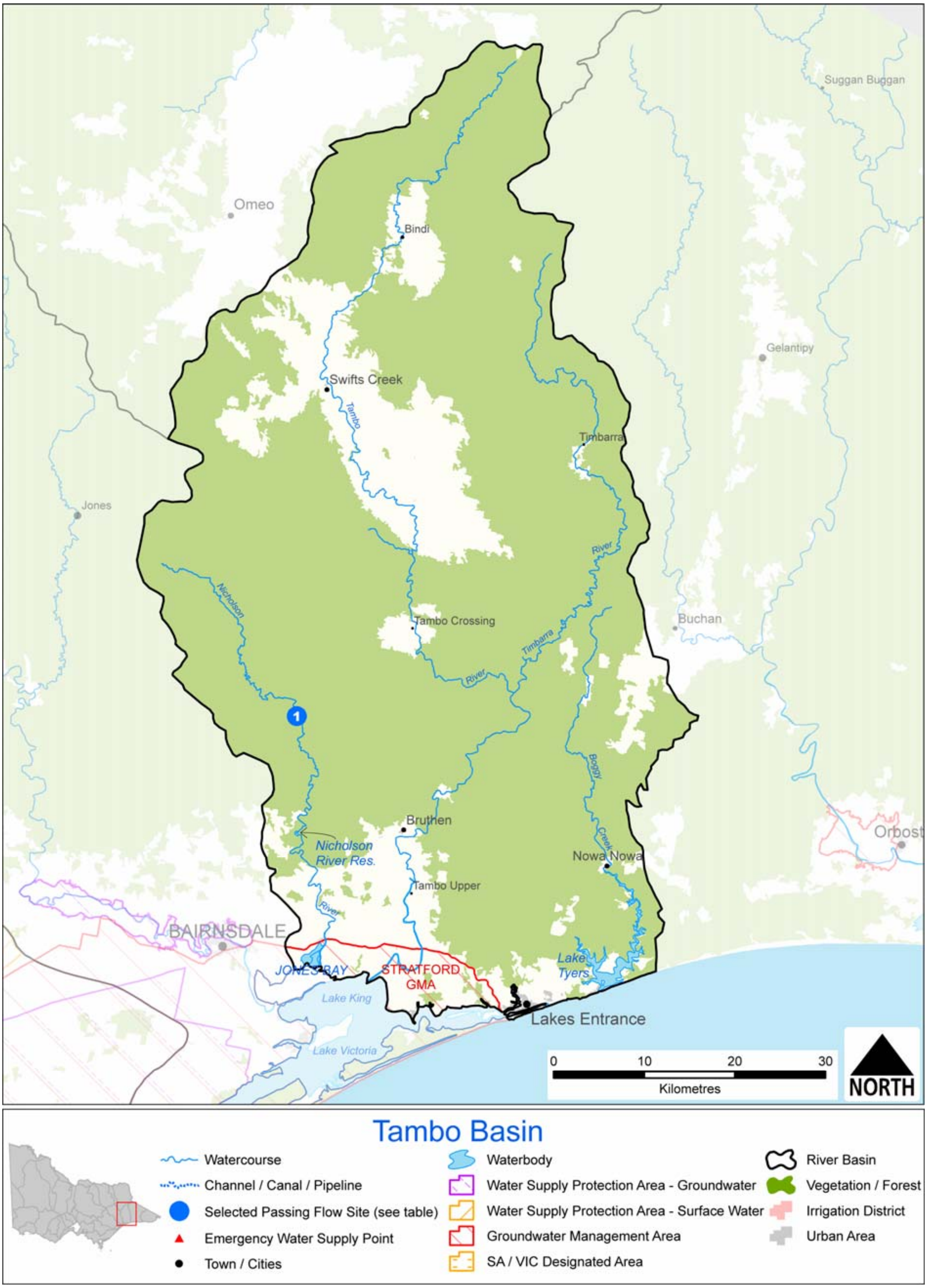
There are no major storages located within the Tambo basin.

Figure 18-1 Catchment inflows in the Tambo basin



18.4 Location of water resources

Figure 18-2 Map of the Tambo basin



18.5 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Tambo basin are shown in Table 18-2.

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 with the available resource in the basin.

Table 18-2 Summary of total water resources and water use in the Tambo basin, 2006/07

Water source	Total water resource (ML)	Total use (ML)
Surface water	115,600	4,800
Groundwater	0	0
Recycled water	740	740

18.6 Surface water resources

18.6.1 Water balance

A surface water balance for the Tambo basin is shown in Table 18-3. Whilst usage and losses were similar to 2005/06, reduced inflows resulted in outflows to the Gippsland Lakes and Bass Strait declining by 32%.

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 18-3 Balance of surface water in the Tambo basin

Water account component	2006/07 (ML)	2005/06 (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)	115,600	167,500
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**115,600**	**167,500**
Usage		
Urban diversions	60	60
Licensed diversions from unregulated streams	1,000	1,400
Small catchment dams(2)	3,700	3,900
Sub-total	**4,800**	**5,400**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(2)	2,000	2,100
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	0	0
Sub-total	**2,000**	**2,100**
Water passed at outlet of basin		
River outflows to the ocean	108,800	160,000

Notes:

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

(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(3) Assumed to be zero because data is not readily available.

18.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 18-4 below are based on the estimates provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 18-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)[(1)]	4,500	2,100	n/a
Registered commercial and irrigation	2,100	1,600	n/a
Total	**6,600**	**3,700**	**5,700**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

18.6.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements or diversion licences within the basin or across basin boundaries in 2006/07.

18.6.4 Volume diverted

The volume of water diverted under East Gippsland Water's bulk entitlements is shown in Table 18-5. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2006/07.

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 18-5 Volume of water diverted under surface water entitlements in the Tambo basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance?[(1)]
East Gippsland Water					
Bruthen	1	313	0	0	Yes
Lakes Entrance	1	2,993	0	0	Yes
Nowa Nowa	1	118	0	28	Yes
Swifts Creek	1	224	0	36	Yes
Total annual volume of bulk entitlements 2006/07		**3,648**	**0**	**64**	
Total annual volume of bulk entitlements 2005/06		**3,648**	**0**	**59**	
Licensed diversions from unregulated streams 2006/07		*4,048*		*1,000*	
Licensed diversions from unregulated streams 2005/06		*3,789*		*1,400*	

Notes:

(1) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.

18.7 Groundwater resources

There are no GMAs or WSPAs located within the Tambo basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2005/06 water accounts.

There is no urban groundwater supply in the Tambo basin.

18.8 Drought contingency measures

The main drought contingency measure implemented in the Tambo basin in 2006/07 was restricting urban water use in Swifts Creek, discussed in more detail in section 18.9. There was limited water carting to Nowa Nowa.

No rights were qualified in the Tambo basin in 2006/07.

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

Urban customers in Swifts Creek were the only customers supplied from the water resources of the basin to experience water restrictions in 2006/07, including three months of Stage 4 restrictions.

Groundwater use was unrestricted in the Tambo basin during 2006/07.

Table 18-6 Seasonal allocations and restrictions on water use in Tambo basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Swifts Creek	Stage 2 restrictions from December 2006 to January 2007, increasing to Stage 4 from February to April 2007, reducing to Stage 2 in May and reverting to permanent water savings measures in June 2007
Unregulated diversions		No restrictions

18.10 Recycled water

The wastewater treatment plants at Lakes Entrance and Metung are operated by East Gippsland Water. All of the wastewater passing through these treatment plants was recycled and used for a number of applications including pasture and tree plantations, racecourses and golf courses (Table 18-7).

Table 18-7 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Lakes Entrance	588	588	100%	0	588	0	0	0	0
Metung	150	150	100%	0	150	0	0	0	0
Total 2006/07	**738**	**738**	**100%**	**0**	**738**	**0**	**0**	**0**	**0**
Total 2005/06	**778**	**778**	**100%**	**0**	**778**	**0**	**0**	**0**	**0**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006.

(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.

18.11 Water for the environment

18.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Tambo basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by East Gippsland Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

18.11.2 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin.

Table 18-8 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. The location of this compliance point is presented in Figure 18-2.

Table 18-8 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 (shown as 1 in Figure 18-2)

	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

East Gippsland Water reported that it met all passing flow requirements under its bulk entitlements in 2006/07.

18.11.3 Water leaving the basin

The amount of water flowing from the Tambo basin into the Gippsland Lakes was 108,800 ML in 2006/07, approximately 94% of the total inflows into the basin. This water comprises consumptive water that was not used under entitlements and the EWR (passing flows, and any water above cap).

A study is currently underway, led by West Gippsland Catchment Management Authority, to describe the role of freshwater inflows in the health of the Gippsland Lakes, their fringing wetlands and the estuarine reaches of their inflowing rivers. The study will also assess the sensitivity of the Gippsland Lakes ecosystems to existing and possible future changes in freshwater inflows, and the feasibility of determining their environmental water requirements. It is due to be completed in the second half of 2008.

The Gippsland Lakes are important environmental assets partially dependent on water from the EWR in the Tambo basin. They are listed as internationally significant wetlands under the Ramsar convention and rely on the freshwater inputs from the Tambo basin to ecologically function.

19 Mitchell basin

This chapter sets out the accounts for the Mitchell basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

19.1 Mitchell basin summary

The Mitchell basin experienced a number of events that impacted water availability and quality in 2006/07. Inflows were approximately one quarter of the long term average, and would have been substantially less without extremely heavy rainfall in the last three days of the year that caused extensive flooding in the south of the basin.

In late 2006 and early 2007, widespread bushfires across the catchment placed water supplies under pressure as property owners and the Country Fire Authority used water in an attempt to control the fires. Continued low inflows and increased water use during this period caused the off-stream storages managed by East Gippsland Water to drop to very low levels.

After the bushfires were brought under control, some heavy rainfall events triggered a deterioration in water quality as silt, ash and other debris washed into the Mitchell River supply system.

As a result, a number of contingency measures were implemented to secure essential water supplies. These included qualifying passing flows on the Mitchell River to secure supplies for Bairnsdale, installation of portable water clarification units, construction of clarification basins and drilling groundwater bores to augment the Mitchell supply system. During this time, urban water restrictions were in place and irrigators on the Mitchell River were banned from diverting water.

19.2 Responsibilities for management of water resources

Table 19-1 shows the responsibilities of various authorities within the Mitchell basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 19-1 Responsibilities for water resources management within the Mitchell basin, 2006/07

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			Towns 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

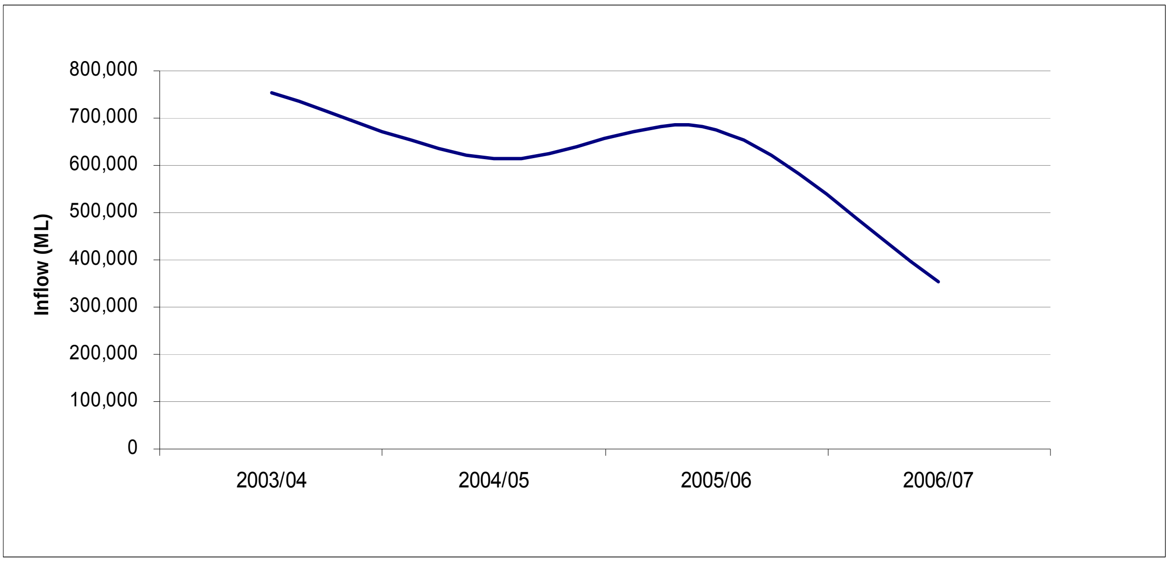
19.3 Rainfall, inflows and storages in 2006/07

In 2006/07, rainfall in the Mitchell basin ranged between 80% and 125% of the long term average. Much of the Mitchell basin's rainfall was recorded in the final days of June 2007, when heavy rain caused severe flooding in the Gippsland region.

Despite heavier rainfall than in previous years, inflows were significantly lower at 26% of the long term average (1,355,000 ML). The 2006/07 inflows were approximately half the annual inflows in each of the previous three years and would have been less if not for the heavy rain. June inflows accounted for approximately two-thirds of the total annual inflows. This rain will also contribute to higher inflows in 2007/08 as flooding from further upstream reaches the basin outlet in early July 2007.

There are no major storages located within the Mitchell basin.

Figure 19-1 Catchment inflows in the Mitchell basin



19.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Mitchell basin are shown in Table 19-2. Consumptive allocations in the Mitchell basin are very low compared with the average inflows. The Mitchell River is the source of supply for the towns of Bruthen, Nicholson, Johnsonville, Swan Reach, Metung and Lakes Entrance in adjacent river basins and supports irrigation on the Lindenow Flats.

Table 19-2 Summary of total water resources and water use in the Mitchell basin, 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	353,900	16,800
Groundwater(2) (3)	12,800	4,800
Recycled water	1,370	1,370

Note:

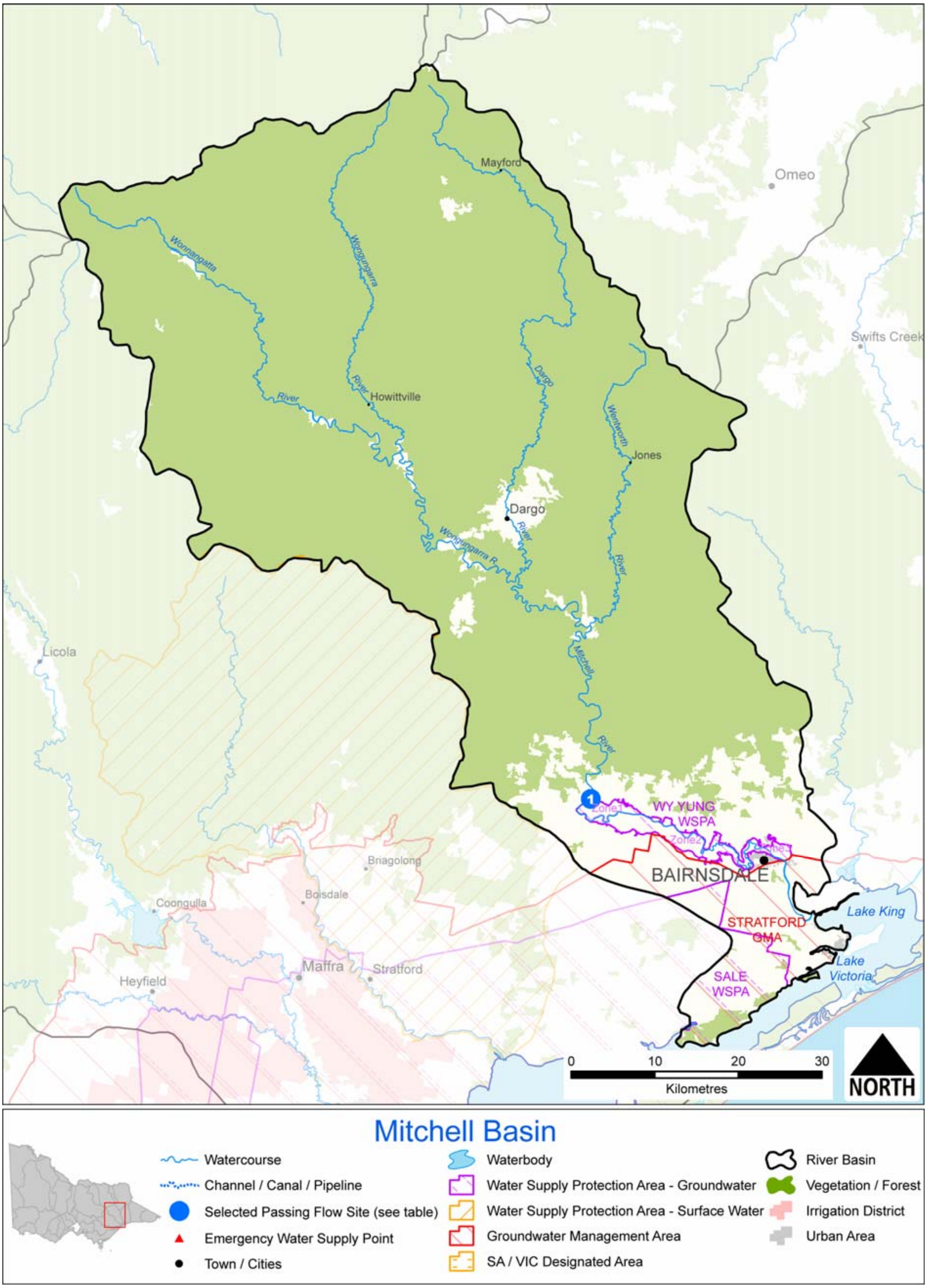
(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 19-6.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

(3) 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 in the unincorporated areas contain a significant groundwater resource.

19.5 Location of water resources

Figure 19-2 Map of the Mitchell basin



19.6 Surface water resources

19.6.1 Water balance

A surface water balance for the Mitchell basin is shown in Table 19-3. Diversions make up a relatively small proportion of total inflows, with approximately 5% of the total basin inflows diverted for consumptive use.

No storage information is recorded in the water balance as there are no on-stream storages in the Mitchell basin with a capacity greater than 1,000 ML.

Table 19-3 Balance of surface water in the Mitchell basin

Water account component	2006/07 (ML)	2005/06 (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)	353,800	675,700
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river(2)	90	0
Sub-total	**353,900**	**675,700**
Usage		
Urban diversions	3,460	4,380
Licensed diversions from unregulated streams	9,000	8,700
Small catchment dams(3)	4,300	4,500
Sub-total	**16,800**	**17,600**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(3)	900	1,100
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	500	400
Sub-total	**1,400**	**1,500**
Water passed at outlet of basin		
River outflows to the ocean	335,700	656,600

Notes:

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

(2) Comprised of water returned to rivers within the basin from Alpine Resorts in 2006/07. This information was not available for 2005/06.

(3) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(4) Losses are calculated from the Wonnangatta River between Waterford and Angusvale and part upstream of Waterford, covering approximately 50% of the basin.

19.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 19-4 have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 19-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	4,200	2,000	n/a
Registered commercial and irrigation	2,900	2,300	n/a
Total	**7,100**	**4,300**	**5,200**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

19.6.3 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 2006/07.

19.6.4 Volume diverted

The volume of water diverted under the single bulk entitlement established for the Mitchell basin is shown in Table 19-5. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2006/07.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 19-5 Volume of water diverted under surface water entitlements in the Mitchell basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance?[1]
East Gippsland Water					
Bairnsdale	1	5,902	0	3,462	Yes
Total annual volume of bulk entitlements 2006/07		**5,902**	**0**	**3,462**	
Total annual volume of bulk entitlements 2005/06		**5,902**	**0**	**4,377**	
Licensed diversions from unregulated streams 2006/07		*22,811*		*9,000*	
Licensed diversions from unregulated streams 2005/06		*15,650*		*8,700*	

Note:

(1) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.

19.7 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 19-6.

The Mitchell basin contains the whole Wy Yung WSPA as well as part of the Sale WSPA and Stratford GMA. As a result of the bushfires described in section 19.1, a temporary licence of 500 ML was granted to East Gippsland Water to supply groundwater to towns normally supplied by the Mitchell River and 38 ML was extracted under this licence by the end of the year. Groundwater use in the Sale and Wy Yung WSPAs increased substantially as surface water supplies became scarce.

Table 19-6 Licensed groundwater volumes, Mitchell basin 2006/07

WSPA/GMA[1]	GMA/ WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Stratford GMA (7%)	Zone 1 >150 Zone 2 >350	2,050	2,629	1,422	0	1,422	1,312
Sale WSPA (8%)	25-200	1,697	1,697	1,069	0	1,069	836
Wy Yung WSPA (100%)	≤25	9,070	9,070	1,895	0	1,895	1,110
Total		**12,817**	**13,396**	**4,385**	**0**	**4,385**	**3,258**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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

(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed volume.

An estimate of domestic and stock groundwater use is provided in Table 19-7.

Table 19-7 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores(1)(2)	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Stratford GMA (7%)	30	60
Sale WSPA (8%)	74	148
Wy Yung WSPA (100%)	116	232
Total	**220**	**440**

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 volume in Table 19-6.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

19.8 Drought contingency measures

A range of drought contingency measures were undertaken by East Gippsland Water in the Mitchell basin in 2006/07. The measures were largely in response to the poor water quality resulting from bushfires, rather than in direct response to drought. The measures included:

- restricting urban and rural water use (discussed below)
- carting water to Lindenow and Lindenow South from the Mitchell River
- drilling groundwater bores in the Mitchell supply system and gaining an additional 500 ML groundwater licence
- connecting to irrigation groundwater bores
- installation of portable water clarification units
- construction of clarification basins and settlement dams.

As shown in Table 19-8, due to the bushfires the Bairnsdale bulk entitlement was qualified effective from December 2006.

Table 19-8 Qualifications of rights

Qualification type	Qualification description
Passing flow	Amended the Bulk Entitlement (Bairnsdale) Conversion Order 2000 to reduce passing flows on the Mitchell River. This qualification was an emergency contingency measure to increase East Gippsland Water's access to water in response to fire risk in the Bairnsdale area Dates: 7 December 2006 to 6 January 2007

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

Unlike 2005/06 when no customers faced water restrictions, East Gippsland Water was forced to introduce restrictions in 2006/07 in response to water shortages. All towns in the basin except Dargo faced restrictions in 2006/07, including three months on Stage 4.

Groundwater use was unrestricted in the Mitchell basin during 2006/07.

Table 19-9 Seasonal allocations and restrictions on water use in Mitchell basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	All East Gippsland customers (e.g. Bairnsdale, Lakes Entrance, Paynesville) except Dargo	Stage 2 introduced in December 2006, increasing to Stage 4 in March 2007, before reducing to Stage 3 in June 2007
Licensed diversions from unregulated streams	Mitchell River	Winterfill ban from August to December 2006, converting to an irrigation ban from January to February 2007

19.10 Recycled water

The wastewater treatment plants at Bairnsdale, Lindenow and Paynesville are operated by East Gippsland Water. All the wastewater passing 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 it is released into the morass as environmentally beneficial water for the deep freshwater marsh. This discharge is considered a beneficial allocation.

Table 19-10 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Bairnsdale	1,150	1,150	100%	0	70	1,080	0	0	0
Lindenow	21	21	100%	0	0	21	0	0	0
Paynesville	200	200	100%	0	200	0	0	0	0
Total 2006/07	**1,371**	**1,371**	**100%**	**0**	**270**	**1,101**	**0**	**0**	**0**
Total 2005/06	**1,486**	**1,486**	**100%**	**0**	**340**	**1,146**	**0**	**0**	**0**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percent recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006.

(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.

19.11 Water for the environment

19.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Mitchell basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by East Gippsland Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

19.11.2 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin.

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. The location of this compliance point is presented in Figure 19-2.

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 (shown as 1 in Figure 19-2)
	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 2006/07.

19.11.3 Water leaving the basin

The amount of water flowing from the Mitchell basin into the Gippsland Lakes was 335,700 ML in 2006/07. This represents 95% of the total inflows into the basin, which is largely unchanged from previous years. The total volume flowing into the Gippsland Lakes is, however, approximately half of what has been recorded in previous years. This water comprises consumptive water that was not used under entitlements and the EWR (passing flows, and any water above cap).

The majority of outflows occurred in June as a result of the heavy rains and associated flooding. June outflows in the Mitchell basin totalled 222,000 ML, or 66% of the total outflows for the year.

The Mitchell, Tambo, Latrobe and Thomson basins are capped at the current level of diversions plus a volume of 2,000 ML. This extra 2,000 ML allows for new diversions in the period until the findings of an investigation of the freshwater needs of the Gippsland Lakes (refer to the Tambo basin chapter) are completed.

The Gippsland Lakes are important environmental assets partially dependent on water from the EWR in the Mitchell basin. The lakes are listed as internationally significant wetlands under the Ramsar convention and rely on the freshwater inputs from the Mitchell basin to ecologically function.

20 Thomson basin

This chapter sets out the accounts for the Thomson basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

20.1 Thomson basin summary

The Thomson basin was one of only two basins in Victoria that experienced an increase in inflows in 2006/07 compared with 2005/06. Much of this streamflow, however, was due to heavy rain and flooding in the last few days of the year. For the rest of the year, the Thomson basin experienced a water shortage.

Seasonal allocations in the Macalister Irrigation District were less than 50% for most of the season, only reaching 60% in part of the district towards the end of the season.

The Thomson Reservoir's role as a drought management reserve for Melbourne and irrigators was realised in 2006/07. Melbourne Water transferred 219,000 ML to the Yarra Basin to supply Melbourne and Southern Rural Water called on its drought reserve to supply irrigators. The Thomson River environmental bulk entitlement was qualified so that additional water remained in storage for use by Melbourne if needed.

Bushfires late in 2006 burned a significant percentage of the Macalister River catchment within the Thomson basin.

The bushfires and associated high levels of turbidity in the Macalister River and Lake Glenmaggie caused a number of drought contingency measures to be implemented. Gippsland Water carted water from Heyfield to Coongulla and Glenmaggie, and upgraded the treatment plant at Maffra to treat water affected by high levels of turbidity. Southern Rural Water's Thomson/Macalister bulk entitlement was qualified to allow passing flows to be reduced in an effort to lower the turbidity in Maffra's water supply.

20.2 Responsibilities for management of water resources

Table 20-1 shows the responsibilities of various authorities within the Thomson basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 20-1 Responsibilities for water resources management within the Thomson basin, 2006/07

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 Macalister Irrigation District 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	
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 Rainfall, inflows and storages in 2006/07

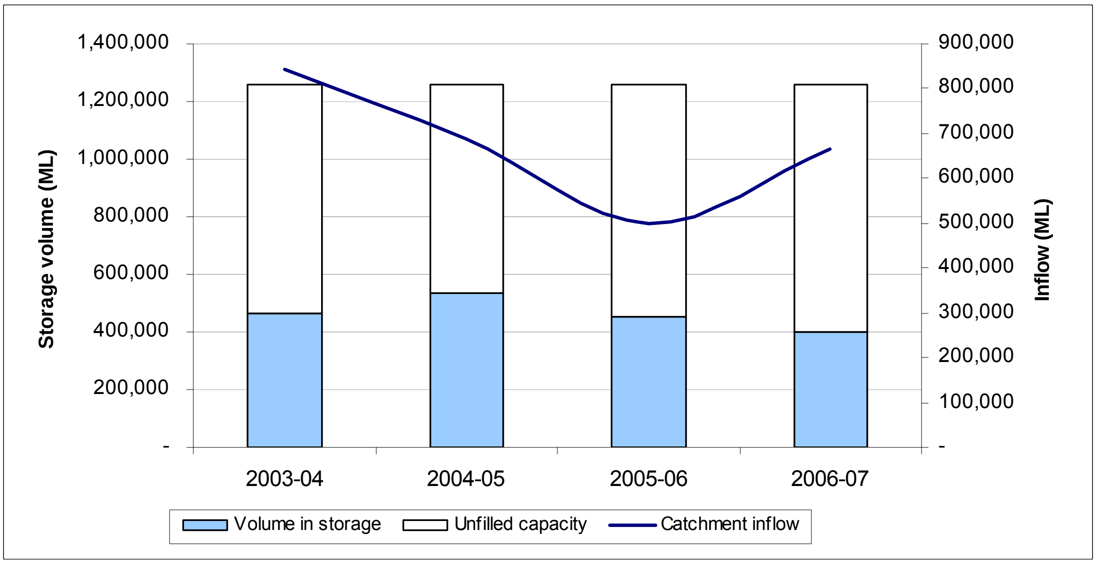
In 2006/07, rainfall in the Thomson basin ranged between 60% and 125% of the long term average with the majority falling in the final days of June 2007. The heavy rainfall resulted in flooding and accounted for a large percentage of the annual basin outflows.

The Thomson basin was one of only two basins in the state to experience improved inflows compared with 2005/06 (East Gippsland basin being the other). Inflows in the Thomson basin totalled 665,200 ML, which is 47% of the long term average, compared with 35% in the previous year. The increase in inflow was entirely due to the heavy rainfall and floods in the final days of June 2007, with June inflows accounting for 86% of the 2006/07 total. This rain will also contribute to higher inflows in 2007/08 as flooding from further upstream reaches the basin outlet in early July 2007.

There are two major storages in the Thomson basin – Thomson Reservoir (capacity 1,068,000 ML) and Lake Glenmaggie (capacity 190,230 ML). Lake Glenmaggie began the year with 30,100 ML in storage, reached its highest level of 38% in October, and was drawn down as low as 6% in June. However, the heavy rain in late June filled the storage in just a few days. By comparison, Melbourne's biggest water storage, the Thomson Reservoir, began the year 39% full and was gradually drawn down to 17% in late May, before ending the year 19% full after rain in June. This is the first time that Thomson Reservoir has dropped below 20%.

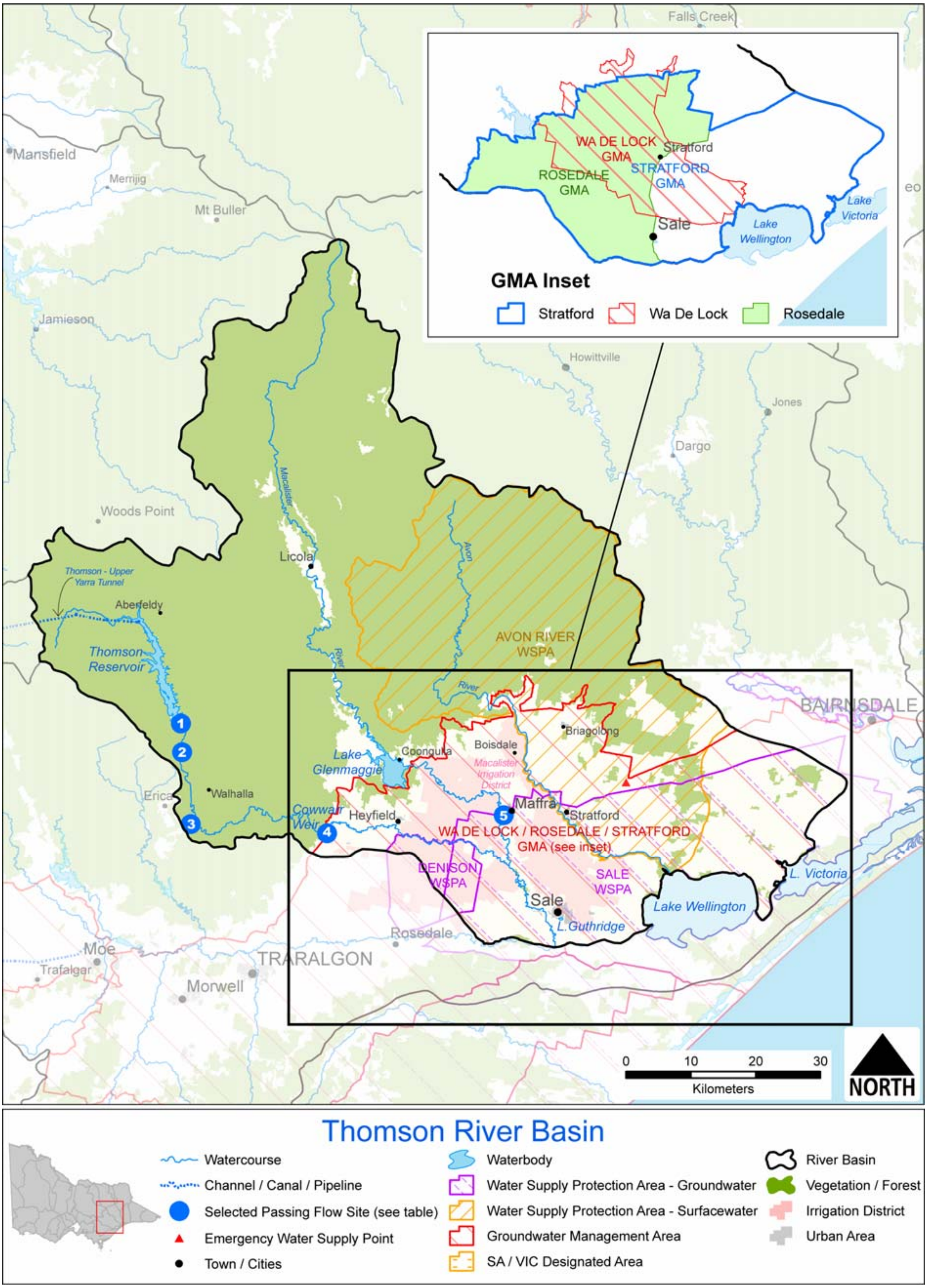
A blue-green algal bloom occurred in the Gippsland Lakes in April 2007, affecting recreational users of the lakes.

Figure 20-1 All major storages and catchment inflows in the Thomson basin



20.4 Location of water resources

Figure 20-2 Map of the Thomson basin



20.5 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Thomson basin are shown in Table 20-2.

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

Table 20-2 Summary of total water resources and water use in the Thomson basin, 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	676,900	365,000
Groundwater(2)	74,600	39,700
Recycled water	330	300

Note:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 20-7.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5.

20.6 Surface water resources

20.6.1 Water balance

A surface water balance for the Thomson basin is shown in Table 20-3. The Macalister Irrigation District is normally responsible for the majority of diversions within the basin. In 2006/07, however, Melbourne Water transferred 219,050 ML of water from the Thomson Reservoir to the Upper Yarra Reservoir to maintain a restricted supply to Melbourne and to reduce the risk of a water quality problem arising in the event that the 2006 bushfires had burned large areas of the Thomson catchment. In the event, the Thomson catchment largely escaped the bushfires. The amount transferred to Melbourne compares with the 131,900 ML used for a restricted supply to irrigators in the basin.

The volume diverted for irrigation purposes has fallen significantly over the past few years. In 2004/05, irrigators received a 140% allocation and the volume of water taken into the Macalister Irrigation District was 274,600 ML. In 2005/06, the allocation was 115% and the volume was 166,900 ML. In the 2006/07 season the allocation was 60% and the volume was 131,900 ML.

Table 20-3 Balance of surface water in the Thomson basin

Water account component	2006/07 (ML)	2005/06 (ML)
Major on-stream storage		
Volume in storage at start of year	450,100	533,400
Volume in storage at end of year	399,000	450,100
Change in storage	**-51,100**	**-83,300**
Inflows		
Catchment inflow(1)	665,200	489,000
Transfers from other basins	0	0
Return flow from irrigation	11,700	40,000
Treated wastewater discharged back to river	40	30
Sub-total	**676,900**	**529,000**
Usage		
Urban diversions to towns in Thomson River basin	1,700	1,750
Transfers to Yarra River basin for urban use	219,050	129,090
Irrigation district diversions	131,900	166,900
Licensed diversions from unregulated streams	5,800	11,600
Small catchment dams(2)	6,500	7,000
Sub-total	**365,000**	**316,300**
Losses		
Net evaporation losses from major storages(3)	6,400	6,000
Evaporation from small catchment dams(2)	2,300	2,500
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	27,700	19,700
Sub-total	**36,400**	**28,200**
Water passed at outlet of basin		
River outflows to the Latrobe River	299,200	216,700
River outflows direct to Lake Wellington	27,400	51,100

Notes:
(1) Inflows have been back-calculated from outflows plus diversions.
(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.
(3) Evaporation for the Thomson Reservoir was inadvertently reported as gross evaporation in the State Water Report 2005/2006. The 2005/06 evaporation presented in Table 20-3 has been re-stated as net evaporation.
(4) Losses estimated based on loss functions within the Thomson-Macalister REALM.

20.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 20-4 have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 20-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)[1]	5,600	2,600	n/a
Registered commercial and irrigation	5,000	3,900	n/a
Total	**10,600**	**6,500**	**8,800**

Note:
(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.
n/a: Information not available.

20.6.3 Water entitlement transfers

A summary of entitlements transferred within the Thomson basin is presented in Table 20-5.

Table 20-5 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 (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)
Gippsland Water								
Thomson/ Macalister	0	0	0	0	84	0	6	84
Southern Rural Water								
Thomson/ Macalister	371	371	6	0	8,407	8,491	263	-84
Total 2006/07	**371**	**371**	**6**	**0**	**8,491**	**8,491**	**269**	**0**
Total 2005/06	**603**	**603**	**14**	**0**	**13,733**	**13,733**	**318**	**0**

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

20.6.4 Volume diverted

In October 2006, the Melbourne metropolitan retailers, City West Water, South East Water and Yarra Valley Water, were granted a pooled bulk entitlement on the Thomson River, replacing Melbourne Water's bulk entitlement. The volume of water diverted under each bulk water entitlement in the basin is shown in Table 20-6.

Bulk entitlements held by the Melbourne retailers and Southern Rural Water in the basin are applied over a multi-year period, where the average usage over a defined rolling period (15 years for the Melbourne retailers and five years for Southern Rural Water) must be less than the average bulk entitlement volume. The compliance method for the Melbourne bulk entitlements is currently under review and a new method may be implemented in future years.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 20-6 Volume of water diverted under surface water entitlements in the Thomson basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)(1)	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance? (2) (3)(4)
Gippsland Water					
Thomson/Macalister towns	1	2,335	84	1,701	Yes
Melbourne metropolitan retailers					
Thomson River	15	171,800	0	219,054	Yes
Southern Rural Water					
Thomson/Macalister	5	274,800	0	131,919	Yes
Minister for the Environment					
Thomson River – Environment(2)	1	10,000	0	4,587	Yes
Total annual volume of bulk entitlements 2006/07		**458,935**	**84**	**357,261**	
Total annual volume of bulk entitlements 2005/06		**458,935**	**0**	**307,299**	
Licensed diversions from unregulated streams 2006/07		*7,102*		*5,800*	
Licensed diversions from unregulated streams 2005/06		*13,833*		*11,600*	

Notes:

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

(2) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.

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

(4) Compliance for the entire Melbourne supply system is assessed against a long term (15 year) average volume limit of 555,000 ML. The corresponding long term average annual diversions for 2006/07 was 469,687 ML.

20.7 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 20-7. The Thomson basin contains all of the Wa De Lock GMA as well as part of the Denison WSPA, Sale WSPA, Stratford GMA and Rosedale GMA.

Groundwater use in the Wa De Lock GMA and the Denison and Sale WSPAs increased by approximately 2,000 ML each. Extractions of groundwater in the Sale WSPA have increased markedly over the last few years. In 2004/05, entitlement holders used 5,369 ML of groundwater from this aquifer, a volume that has increased by more than 170% in just two years. Southern Rural Water declared a water shortage to impose a restricted trading zone within the Sale WSPA known as the Clydebank Restriction Zone. Its effect is to reduce the risk of saline intrusion from Lake Wellington by limiting the total licence extraction in the zone by preventing any temporary transfer of licence entitlements from other areas of the WSPA into the zone. The original declaration was made in November 2003 until July 2004 and was completed by public notice. In July 2004, Southern Rural Water issued an indefinite declaration. This was carried out before amendments to the *Water Act 1989* which allows only for the Minister for Water to undertake this process.

The Stratford and Rosedale GMAs are exhibiting declining long term water levels and DSE is in the process of determining the best management response.

Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts.

Table 20-7 Licensed groundwater volumes, Thomson basin 2006/07

WSPA/GMA[(1)]	GMA/WSPA depth limits[(2)] (m)	Entitlement limit[(3)] (ML/year)	Licensed entitlement[(4)] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Rosedale GMA (36%)	Zone 1 50-150 Zone 2 25-350 Zone 3 200-300	7,972	4,660	2,694	0	2,694	3,880
Stratford GMA (45%)	Zone 1 >150 Zone 2 >350	12,318	15,797	8,548	0	8,548	7,883
Wa De Lock GMA (100%)	≤25	30,084	26,735	10,509	0	10,509	8,059
Denison WSPA (53%)	≤25	9,396	7,336	5,377	0	5,377	3,538
Sale WSPA (70%)	25-200	14,829	14,829	9,338	0	9,338	7,305
Total		**74,600**	**69,358**	**36,465**	**0**	**36,465**	**30,665**

Notes:
(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.
(2) This column indicates the aquifer depth limits for which the GMA/WSPA applies.
(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.
(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.

An estimate of domestic and stock groundwater use is provided in Table 20-8.

Table 20-8 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores[(1)(2)]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Rosedale GMA (36%)	146	292
Stratford GMA (45%)	183	366
Wa De Lock Zone GMA (100%)	482	964
Denison WSPA (53%)	157	314
Sale WSPA (70%)	642	1,284
Total	**1,610**	**3,220**

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 volume in Table 20-7.
(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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 20-9.

Table 20-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2006/07 (ML)	Metered use 2005/06 (ML)
Boisdale	37	0	11
Briagolong	160	122	81
Sale	3,500	1,975	2,041
Total	**3,697**	**2,097**	**2,132**

20.8 Drought contingency measures

A range of drought contingency measures were taken in the Thomson basin in 2006/07. While water shortage was the issue for most of the year due to the record low inflows, this was overtaken by severe water quality problems from April. The water quality problems were the result of bushfires which swept through the Macalister River catchment in early summer, followed by autumn storms causing high silt loads in the river.

The contingency measures include:

- restricting urban and rural water use (discussed below)
- provision of an emergency water supply point north-east of Stratford
- Gippsland Water purchasing 83.5 ML of water from irrigators in the Macalister Irrigation District to augment the Coongulla, Glenmaggie, Heyfield, Maffra and Stratford supply systems
- carting 0.1 ML of water per day from Heyfield to Coongulla and Glenmaggie from February to the end of the year
- Melbourne Water recommissioning Swingler Weir, increasing the amount of water available for transfer and harvesting
- upgrading the Maffra water treatment so that water with a higher turbidity following the bushfires could be treated.

There were two qualifications of rights in the Thomson basin in 2006/07, as presented in Table 20-10.

Table 20-10 Qualifications of rights

Qualification type	Qualification description
Passing flow	Reduced the passing flow requirements in the Bulk Entitlement (Thomson/Macalister – Southern Rural Water) Conversion Order 2001. Qualified passing flows on the Macalister River as an emergency measure to reduce high turbidity levels at Maffra Weir for Gippsland Water's Maffra supply Dates: 8 March 2007 ongoing to 30 June 2007
Modified operating rule	Qualified the Bulk Entitlement (Thomson River – Environment) Order 2005 to modify the operating tolerance for releases to the Thomson River from Thomson Reservoir. This qualification provided savings to be retained in storage for Melbourne Dates: 29 March 2007 ongoing to 30 June 2007

20.9 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. Gippsland Water customers, who only faced six months of Stage 1 restrictions in 2005/06, were all experiencing Stage 3 or Stage 4 restrictions by the end of 2006/07.

Irrigation allocations, which reached 115% in the 2005/06 season, were 60% at the end of the 2006/07 season. Southern Rural Water introduced channel rostering in December in some areas in response to low irrigation demand and the need to reduce losses.

Table 20-11 Seasonal allocations and restrictions on water use in Thomson basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Boisdale, Coongulla, Glenmaggie, Maffra, Stratford	Stage 1 introduced October 2006, increasing to Stage 2 in November 2006, Stage 3 in December 2006 and Stage 4 from February to June 2007
	Cowwarr, Glenmaggie Point	Stage 1 introduced October 2006, increasing to Stage 2 in November 2006, Stage 3 in January 2007 and Stage 4 from February to June 2007
	Heyfield	Stage 1 introduced October 2006, increasing to Stage 2 in November 2006 and Stage 3 from December 2006 to June 2007
	Briagolong, Rawson, Sale, Wurruk	Stage 1 introduced October 2006, increasing to Stage 2 in November 2006 and Stage 3 from January to June 2007
Licensed diversions on unregulated streams	Valencia Creek	Stage 1 (roster) from September to October 2006, increasing to an irrigation ban from November 2006 to June 2007
	Avon River	Irrigation ban from October 2006 to January 2007
Irrigation	Macalister Irrigation District and regulated licensed diversions	Opening allocation 35% from August 2006, increasing to 60% in May 2007

20.10 Recycled water

Gippsland Water operates four wastewater treatment plants in the Thomson basin. Recycled water is mainly used to irrigate pasture and for watering facilities such as the Maffra Recreational Reserve. A total of 89% of wastewater was reused in the basin (Table 20-12), with a slight reduction in volume due to lower water deliveries to customers.

Table 20-12 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Heyfield	59	59	100%	0	59	0	0	0	0
Maffra	166	166	100%	8	158	0	0	0	0
Rawson	37	0	0%	0	0	0	0	37	0
Stratford	70	70	100%	0	70	0	0	0	0
Total 2006/07	**332**	**295**	**89%**	**8**	**287**	**0**	**0**	**37**	**0**
Total 2005/06	**378**	**345**	**91%**	**8**	**338**	**0**	**0**	**33**	**0**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006.

(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.

20.11 Water for the environment

20.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Thomson basin EWR comprised the following components:

- a bulk entitlement for the environment of 10,000 ML
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Melbourne Water and Southern Rural Water
- all other water in the basin not allocated under entitlements.

20.11.2 Entitlements for the environment

A 10,000 ML bulk entitlement for the environment on the Thomson River was provided from water saving initiatives implemented through the *Our Water Our Future* action plan. This bulk entitlement order 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 Cowwarr Weir on the Thomson River, which were previously specified as an obligation in Melbourne Water's bulk entitlement. A total of 4,587 ML was released from Thomson Reservoir from 7 to 18 October 2006 under this entitlement. Further releases were scheduled, however the Minister qualified the Thomson bulk entitlement so that these releases be kept within storage at Thomson Reservoir to help keep the reservoir above minimum operating levels, as well as provide back up provisions for Melbourne.

20.11.3 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin.

Table 20-13 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. The location of these compliance points is presented in Figure 20-2.

Table 20-13 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 (shown as 1 in Figure 20-2)
	Passing flow rules	• From November to February, 75 ML/day • From March to October, 25 ML/day
	Compliance point	The Narrows Gauging Station (shown as 2 in Figure 20-2)
	Passing flow rules	• From November to February, 120 ML/day • From March to October, 80 ML/day
	Compliance point	Coopers Creek Gauging Station (shown as 3 in Figure 20-2)
	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 (shown as 4 in Figure 20-2)
	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 (shown as 5 in Figure 20-2)

	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.

In March 2007 passing flows under the Thomson River environmental bulk entitlement were temporarily qualified, enabling savings of up to 4,000ML per year for the Melbourne system.

Southern Rural Water and Melbourne Water (as storage operator) reported full compliance with their passing flow requirements under their bulk entitlements in 2006/07.

20.11.4 Streamflow management plans (SFMPs)

The Avon River was declared a WSPA in 2006/07, which is the first step towards developing a SFMP Background work on the technical aspects of the Avon SFMP began.

20.11.5 Water leaving the basin

Basin outflows increased by 22% in 2006/07 compared with 2005/06. Whilst the volume of water flowing from the Thomson basin directly into the Gippsland Lakes (Lake Wellington) via the Perry and Avon rivers declined from

51,100 ML in 2005/06 to 27,400 ML in 2006/07, the amount of water flowing from the basin into the Latrobe River increased from 216,700 ML to 299,200 ML over the same period.

Combined, the total outflow was 326,600 ML which represents 49% of the total inflows into the basin, compared with 54% in 2005/06. 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 majority of outflows occurred in June as a result of the heavy rains and associated flooding. June outflows in the Thomson basin totalled 279,800 ML, making up 86% of the total outflows for the year.

The Mitchell, Tambo, Latrobe and Thomson basins are capped at the current level of diversions plus a volume of 2,000 ML. This extra 2,000 ML allows for new diversions in the period until. the findings of an investigation of the freshwater needs of the Gippsland Lakes (refer to the Tambo basin chapter) are completed.

The Gippsland Lakes are important environmental assets partially dependent on water from the EWR in the Thomson basin. The lakes are listed as internationally significant wetlands under the Ramsar convention and rely on the freshwater inputs from basins including the Thomson to ecologically function.

21 Latrobe basin

This chapter sets out the accounts for the Latrobe basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

21.1 Latrobe basin summary

Inflows to the Latrobe basin were 35% of the long term average in 2006/07, significantly lower than inflows of recent years. The effect of low rainfall and declining inflows has been a draw-down of the water held in storage, although storages still ended the year 62% full. Only storages in the Ovens basin and the neighbouring Bunyip basin ended the year with proportionally higher storage levels.

For the first time, however, shortages of water became a key concern for the power generators in the Latrobe Valley. Some of the government's unused water in Blue Rock Lake sold on the water market. Power stations, Gippsland Water and irrigators purchased the water to supplement their normal surface water supplies.

As a result of the water shortages in the south of the Latrobe Basin, Thorpdale received water via a carting program and the Thorpdale bulk entitlement was qualified to reduce passing flows and allow emergency diversions to the town.

Heavy rain in the last few days of the year helped to improve the water supply situation; however urban customers still ended the year on Stage 3 restrictions.

21.2 Responsibilities for management of water resources

Table 21-1 shows the responsibilities of various authorities within the Latrobe basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 21-1 Responsibilities for water resources management within the Latrobe basin, 2006/07

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:

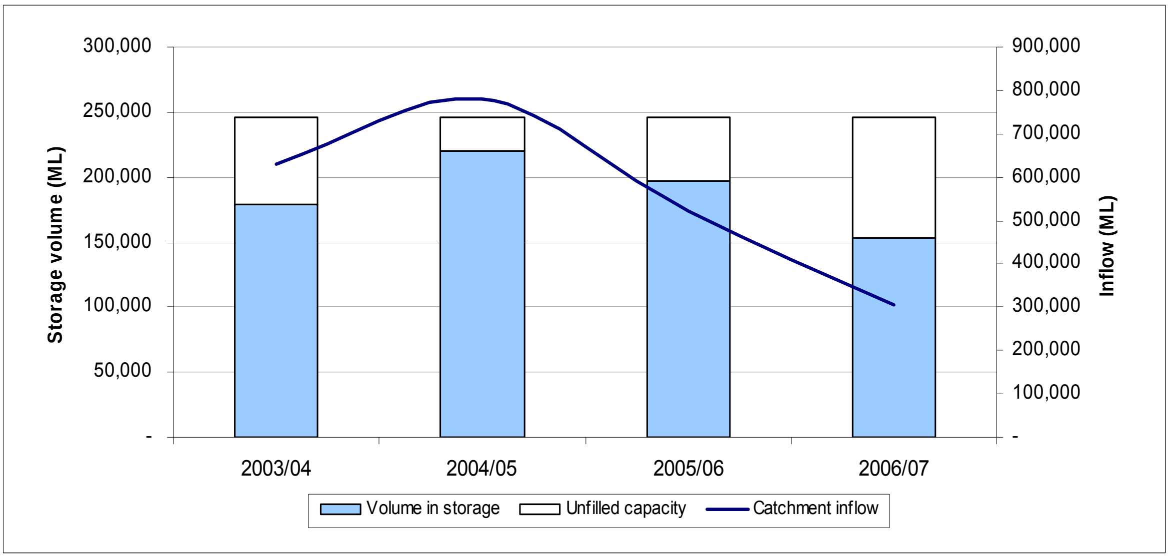
(1) Three power stations – Loy Yang A, Loy Yang B and Yallourn – are responsible for their own water supply from the Latrobe system (Blue Rock Dam and Lake Narracan)

21.3 Rainfall, inflows and storages in 2006/07

In 2006/07, rainfall in the Latrobe basin ranged between 60% and 100% of the long term average. The low rainfall and drought contributed towards inflows that were 35% of the long term average (875,000 ML), compared with 59% in 2005/06 and 89% in 2004/05.

The largest storage in the basin is the Blue Rock Lake operated by Southern Rural Water, with a capacity of approximately 208,000 ML. The volume of water held in Blue Rock Lake fell from 169,100 ML at the start of the year to 116,800 ML at year end. The other main storage is the Moondarra Reservoir operated by Gippsland Water, which ended the year at close to full capacity (29,400 ML) after heavy rain in the Latrobe basin at the end of June.

Figure 21-1 All major storages and catchment inflows in the Latrobe basin



21.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Latrobe basin are shown in Table 21-2.

Table 21-2 Summary of total water resources and water use in the Latrobe basin, 2006/07

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	348,200	184,900
Groundwater[2]	45,800	23,400
Recycled water	20,860	660

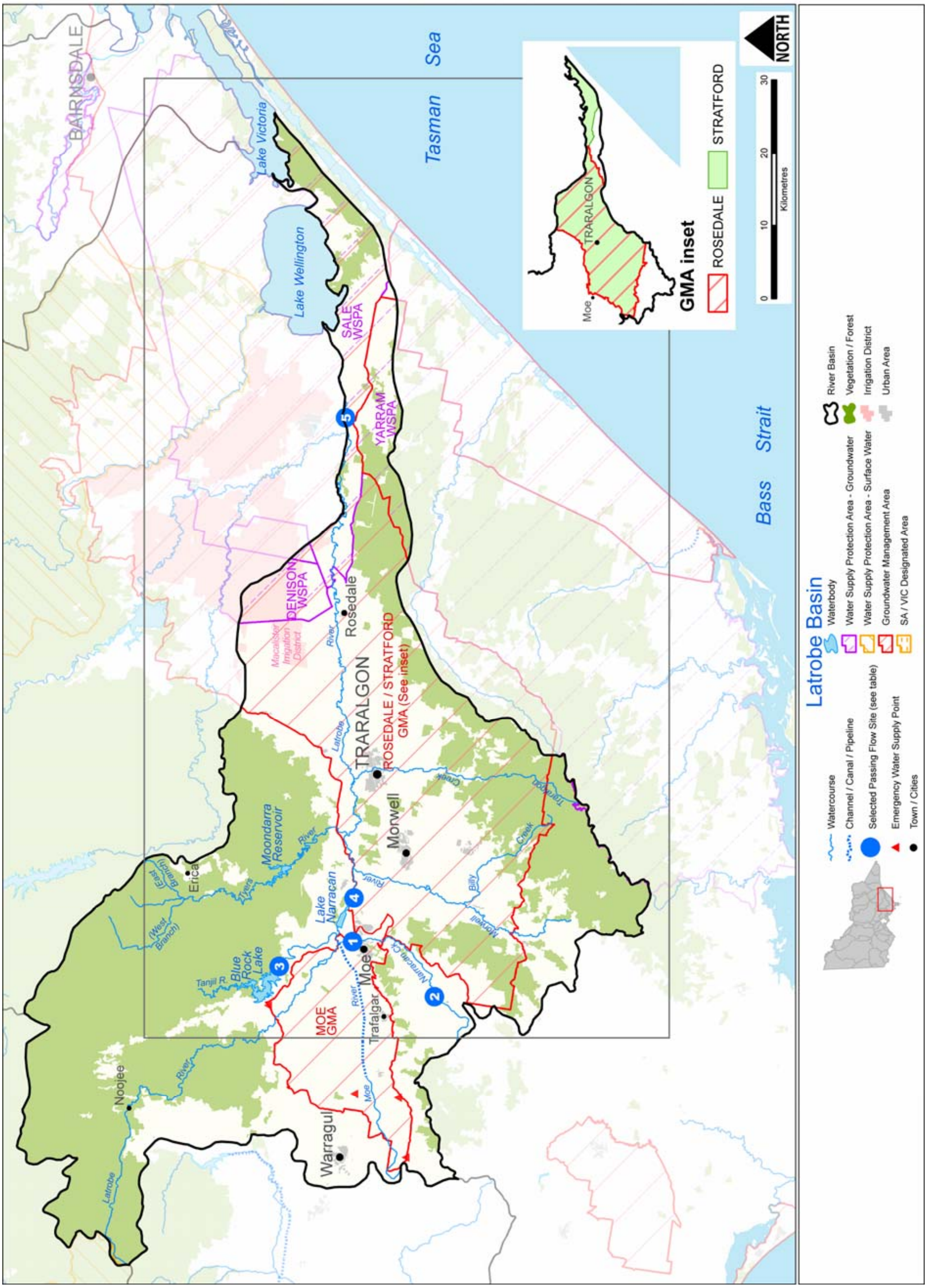
Notes:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 21-7.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the State Water Report 2005/2006.

21.5 Location of water resources

Figure 21-2 Map of the Latrobe basin



21.6 Surface water resources

21.6.1 Water balance

The major industrial water users in the basin include a number of electricity generators and Australian Paper. In 2006/07, these entities accounted for more than half of the surface water diversions in the Latrobe basin, drawing 106,900 ML from river diversions and groundwater and returning approximately 39,000 ML to the Latrobe river system.

Table 21-3 Balance of surface water in the Latrobe basin

Water account component	2006/07 (ML)	2005/06 (ML)
Major on-stream storage		
Volume in storage at start of year	197,600	220,200
Volume in storage at end of year	153,800	197,600
Change in storage	**-43,800**	**-22,600**
Inflows		
Catchment inflow(1)	306,500	520,200
Transfers from other basins	0	0
Return flow from power stations and major industry	39,000	48,000
Return flow from irrigation	0	0
Treated wastewater discharged back to river	2,740	4,110
Sub-total	**348,200**	**572,300**
Usage		
Urban and industrial diversions(2)	143,000	138,000
Licensed diversions from regulated streams	7,400	6,700
Licensed diversions from unregulated streams	14,000	13,000
Small catchment dams(3)	20,500	20,500
Sub-total	**184,900**	**178,200**
Losses		
Net evaporation losses from major storages	9,800	10,200
Evaporation from small catchment dams(3)	3,300	5,700
In-stream infiltration to groundwater, flows to floodplain and evaporation	0	0
Sub-total	**13,100**	**15,900**
Water passed at outlet of basin		
River outflows to the Gippsland Lakes (excluding Thomson River)	194,000	400,800
River outflows to the Gippsland Lakes (including Thomson River)	493,200	617,500

Notes:

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

(2) Urban and industrial diversions were understated in the State Water Report 2005/2006.

(3) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

21.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 21-4 below have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 21-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	13,000	6,500	n/a
Registered commercial and irrigation	16,700	14,000	n/a
Total	**29,700**	**20,500**	**23,800**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

21.6.3 Water entitlement transfers

A summary of the transfer of entitlements in the Latrobe basin is shown in Table 21-5. To overcome water shortages, the government provided Latrobe entitlement holders access via the water market to unused water in the SECV entitlement held in Blue Rock Lake. Water was purchased by power stations, Gippsland Water and irrigators.

Table 21-5 Transfer of 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 (ML)	Sold (ML)	Number of trans-actions	Net transfer to entitlement (ML)
Gippsland Water								
Boolarra	0	0	0	0	11	11	1	0
CGRWA – Blue Rock	0	0	0	0	5,500	1,000	4	4,550
Southern Rural Water								
Latrobe licensed diverters	0	0	0	0	800	0	16	800
Yallourn Energy Ltd for SRW (Loy Yang B)	0	0	0	0	5,550	0	3	5,500
TRUenergy								
Yallourn Energy Ltd	0	0	0	0	3,700	0	2	-1,850
Minister for the Environment (on behalf of the Treasurer)								
Yallourn Energy Ltd for SECV	0	0	0	0	0	14,600	n/a	-14,600
Total 2006/07	**0**	**0**	**0**	**0**	**15,612**	**15,612**	**27**	**0**
Total 2005/06	**0**	**0**	**0**	**0**	**2,716**	**2,716**	**33**	**0**

Note:
(1) Entitlements for which no trades were recorded are not shown.
n/a: Information not available.

21.6.4 Volume diverted

The volume of water diverted under each bulk entitlement is shown in Table 21-6. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2006/07. For multi-year entitlements, compliance is assessed based on the total volume of water diverted over the term of the entitlement. Therefore it is possible that the volume diverted in any given year may exceed the average bulk entitlement volume.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 21-6 Volume of water diverted under surface water entitlements in the Latrobe basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)(1)	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance?(2) (3)
Gippsland Water					
Boolarra	1	145	0	90	Yes
CGRWA – Blue Rock	3	15,150	4,550	16,753	Yes
Erica	1	340	0	98	Yes
Mirboo North	1	270	0	187	Yes
Moe – Narracan Creek	1	3,884	0	1,241	Yes
Moondarra Reservoir	2	62,000	0	50,450	Yes
Noojee	1	73	0	0	Yes
Thorpdale	1	80	0	20	Yes
Southern Rural Water					
Yallourn Energy Ltd for SRW (Loy Yang B power station)	1	17,071	5,550	18,652	Yes
Latrobe licensed diverters	2	6,700	800	7,399	Yes
Great Energy Alliance Corporation Pty Ltd					
Yallourn Energy Ltd for Loy Yang Power Ltd	1	34,143	0	24,942	Yes
TRUenergy					
Yallourn Energy Ltd	1	31,166	3,700	30,580	Yes
Minister for the Environment (on behalf of the Treasurer)					
Yallourn Energy Ltd for SECV	1	21,714	-14,600	0	
Total annual volume of bulk entitlements 2006/07(4)		**192,736**	**0**	**150,411**	
Total annual volume of bulk entitlements 2005/06		**216,842**	**0**	**144,722**	
Licensed diversions from unregulated streams 2006/07		*18,044*		*14,000*	
Licensed diversions from unregulated streams 2005/06		*18,397*		*13,000*	

Notes:

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

(2) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.

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

(4) The difference from 2005/06 is caused by an improvement in the approach to data mangement.

21.7 Groundwater resources

The Latrobe basin contains the entire Moe GMA as well as part of the Sale WSPA, Yarram WSPA, Denison WSPA, Stratford GMA and Rosedale GMA. A summary of the licensed entitlements and use for groundwater management units that overlap the Latrobe basin, excluding domestic and stock use, is presented in Table 21-7.

Groundwater use has increased in recent years with licence holders seeking to supplement their surface water supplies as surface water inflows have declined. The Stratford and Rosedale GMAs are exhibiting declining long term water levels and the Department of Sustainability and Environment is in the process of determining the best management response.

Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts.

Table 21-7 Licensed groundwater volumes, Latrobe basin 2006/07

WSPA/GMA[1]	GMA/ WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement [4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Moe GMA (100%)	>25	8,200	3,864	1,447	0	1,447	990
Rosedale GMA (58%)	Zone 1 50-150 Zone 2 25-350 Zone 3 200-300	13,003	7,601	4,394	0	4,394	6,329
Stratford GMA (41%)	Zone 1 >150 Zone 2 >350	11,274	14,458	7,823	0	7,823	7,215
Denison WSPA (47%)	≤25	8,347	6,517	4,776	0	4,776	3,142
Sale WSPA (17%)	25-200	3,515	3,515	2,213	0	2,213	1,732
Yarram WSPA (5%)	Zone 1 >200 Zone 2 all depths	1,419	1,419	860	0	860	595
Total		**45,758**	**37,374**	**21,513**	**0**	**21,513**	**20,002**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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

(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed volume.

An estimate of domestic and stock groundwater use is provided in Table 21-8. Groundwater is not used to supplement town supplies in the Latrobe basin.

Table 21-8 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Moe GMA (100%)	197	394
Rosedale GMA (58%)	239	478
Stratford GMA (41%)	167	334
Denison WSPA (47%)	140	280
Sale WSPA (17%)	152	304
Yarram WSPA (5%)	52	104
Total	**947**	**1,894**

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 volume in Table 21-7.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by the surface area percentage within the basin.

21.8 Drought contingency measures

A range of drought contingency measures were undertaken in the Latrobe basin in 2006/07. These include:

- restricting urban and rural water use (discussed below)
- provision of emergency water supply points
- water carting to Thorpdale from Trafalgar
- Gippsland Water buying water on the market for the Boolarra, Maffra and Moondarra supply systems
- drilling groundwater bores to augment the Thropdale supply system
- offering unallocated water in Blue Rock Lake on the water market, which was purchased by Gippsland Water, irrigators and power generators.

Rights to water were qualified on two occasions within the Latrobe basin in 2006/07. These are summarised in Table 21-9.

Table 21-9 Qualifications of rights

Qualification type	Qualification description
Passing flow	Change the Bulk Entitlement (Thorpdale) Conversion Order 1997 to reduce the passing flow requirements on Easterbrook Creek to enable emergency diversions to Thorpdale Dates: 2 January 2007 to 18 June 2007
Modify cap	Change the Bulk Entitlement (Yallourn Energy for SECV Ltd) Conversion Order 1996 to increase the cap on releases from Blue Rock Lake to enable water to be transferred for use by power generators Dates: 4 May 2007 ongoing to 30 June 2007

21.9 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. Gippsland Water's customers, who only faced six months of Stage 1 restrictions in 2005/06, were experiencing Stage 3 restrictions by the end of 2006/07.

Groundwater use was unrestricted in the Latrobe basin during 2006/07.

Table 21-10 Seasonal allocations and restrictions on water use in Latrobe basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	All Gippsland Water customers (e.g. Erica, Moe, Traralgon, Warragul, Yallourn North)	Stage 1 introduced October 2006, increasing to Stage 2 in November 2006 and Stage 3 from January to June 2007
	Boolarra, Thorpdale	Stage 1 introduced October 2006, increasing to Stage 2 in November 2006, Stage 4 in December 2006 and reducing to Stage 3 in June 2007
Irrigation and regulated diversions	Macalister Irrigation District(1)	Opening allocation 35% from August 2006, increasing to 60% in May 2007
	Latrobe system – river diverters	100% of licensed volume from July 2006 to June 2007
	Lower Latrobe River	Orders restricted to 45 ML per day November 2006 to January 2007, restricted to Blue Rock unregulated flow (approximately 23%) from February to June 2007
Licensed diversions from unregulated streams	Upper Latrobe River	Irrigation ban February to March 2007
	Moe River	Irrigation ban November 2006 to May 2007
	Morwell River	Stage 2 (25% reduction) February to March 2007
	Narracan Creek	Irrigation ban February to March 2007
	Ten Mile Creek	Irrigation ban February to May 2007

Note:
(1) The Macalister Irrigation District is supplied from the Thomson basin.

21.10 Recycled water

Gippsland Water treats over 20,000 ML of wastewater in the Latrobe basin, the majority of which (84%) is highly saline treated wastewater unsuitable for recycling and which is discharged to Bass Strait. Gippsland Water increased the volume of water recycled from 41 ML in 2005/06 to 660 ML in 2006/07, largely due to the Morwell treatment plant using recycled water to supplement flows to wetlands.

Table 21-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Mirboo North	96	96	100%	31	66	0	0	0	0
Moe	1,550	0	0%	0	0	0	0	1,550	0
Morwell	556	556	100%	0	0	556	0	0	0
Warragul	1,193	0	0%	0	0	0	0	1,193	0
Willow Grove	8	8	100%	0	8	0	0	0	0
Dutson Downs (regional outfall sewer)	9,498	0	0%	0	0	0	0	0	9,498
Saline wastewater outfall pipeline	7,957	0	0%	0	0	0	0	0	7,957
Total 2006/07	**20,859**	**660**	**3%**	**31**	**74**	**556**	**0**	**2,743**	**17,455**
Total 2005/06	**19,982**	**41**	**0%**	**20**	**20**	**0**	**0**	**4,110**	**15,832**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006.

(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.

21.11 Water for the environment

21.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Latrobe basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Southern Rural Water and Gippsland Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

21.11.2 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin.

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. The location of these compliance points is presented in Figure 21-2.

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 (shown as 1 in Figure 21-2)
	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/day, 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 (shown as 2 in Figure 21-2)
	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) (shown as 3 in Figure 21-2)
	Passing flow rules	• From January to April, 90 ML/day • From May to July, 100 ML/day • August to November, 150 ML/day • December, 100 ML/day
	Compliance point	Yallourn Weir (shown as 4 in Figure 21-2)
	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) (shown as 5 in Figure 21-2)
	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

Gippsland Water reported it met all passing flow requirements under its bulk entitlements in 2006/07. Southern Rural Water reported it failed to meet its passing flow requirements on the Latrobe River.

21.11.3 Streamflow management plans (SFMPs)

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

21.11.4 Water leaving the basin

The amount of water flowing from the Latrobe basin into the Gippsland Lakes (excluding the Thomson River) was 194,000 ML in 2006/07, a significant reduction from both 2005/06 (400,800 ML) and 2004/05 (621,200 ML). Since usage and losses remained largely the same as 2005/06 and inflows decreased markedly, the percentage of total inflows leaving the basin declined from 77% in 2005/06 to 63% in 2006/07. 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 partially dependent on water from the EWR in the Latrobe basin. The lakes are listed as internationally significant wetlands under the Ramsar convention and rely on the freshwater inputs from basins including the Latrobe basin to ecologically function.

22 South Gippsland basin

This chapter sets out the accounts for the South Gippsland basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

22.1 South Gippsland basin summary

Low rainfall across the South Gippsland basin contributed to very low inflows, which were 16% of the long term average and resulted in large storage draw-downs over the course of the year. Many towns within the basin rely on relative small storages that are dependent on rain over winter and spring. When this rainfall failed to eventuate, the towns' water supplies were threatened.

Wonthaggi's storage levels began the year lower than normal due to unavoidable outlet works at the South Gippsland Water-operated Lance Creek Reservoir. This was compounded later in the year, when Westernport Water's Candowie Reservoir required a transfer of 613 ML from Lance Creek to maintain essential supplies for its customers.

A number of drought contingency measures were implemented to manage the falling water supply in the region. A number of rights were qualified to provide emergency supplies to towns across the basin. Both South Gippsland Water and Westernport Water sought alternative surface water and groundwater sources. They drilled a number of groundwater bores with varying degrees of success. They achieved better results by obtaining access to alternative surface water sources through temporary diversion licences and qualification of rights. Recycled water use increased by 7% even though the volume of wastewater available for recycling fell by 26%. Every town in the basin experienced Stage 4 restrictions for at least four months and, in some cases, the entire year. Irrigators were banned from diverting water for most of the year.

22.2 Responsibilities for management of water resources

Table 22-1 shows the responsibilities of various authorities within the South Gippsland basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 22-1 Responsibilities for water resources management within the South Gippsland basin, 2006/07

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 Leongatha, 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

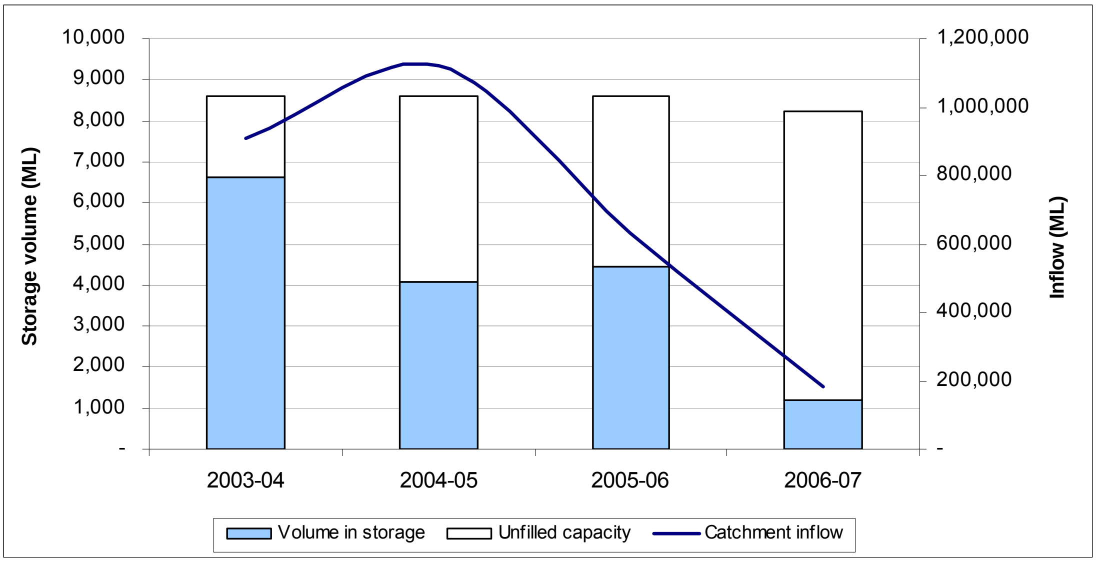
22.3 Rainfall, inflow and storages in 2006/07

In 2006/07, rainfall across the South Gippsland basin ranged between 40% and 80% of the long term average. Inflows were just 16% of the long term average (1,157,000 ML), and dropped considerably compared with the previous two years. In 2004/05, inflows were approximately average at 1,120,300 ML, and then almost halved in 2005/06 when inflows were 632,600 ML. Since usage has remained relatively stable, the reduction in inflow has resulted in decreased outflows to Bass Strait and Westernport.

Storage levels for all storages in the basin fell by 3,200 ML in 2006/07 and ended the year with 1,200 ML in storage, 14% of the total storage capacity of 8,615 ML. To address the water shortages, government and water authorities undertook a range of drought contingency measures, discussed in more detail in section 22.8.

The low inflows and storage levels likely contributed to outbreaks of blue-green algal blooms in the Korrumburra No. 1 Storage (March) and Lance Creek Reservoir (June), affecting the towns that rely on the storages for potable water.

Figure 22-1 All major storages and catchment inflows in the South Gippsland basin



22.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the South Gippsland basin are shown in Table 22-2.

Table 22-2 Summary of total water resources and water use in the South Gippsland basin, 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	192,700	39,500
Groundwater(2)	45,600	26,700
Recycled water	3,690	370

Note:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 22-6.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the State Water Report 2005/2006.

22.4.1 Infrastructure projects to improve water availability

Several major projects were brought forward by the 2006/07 water shortages to increase water availability in the South Gippsland basin.

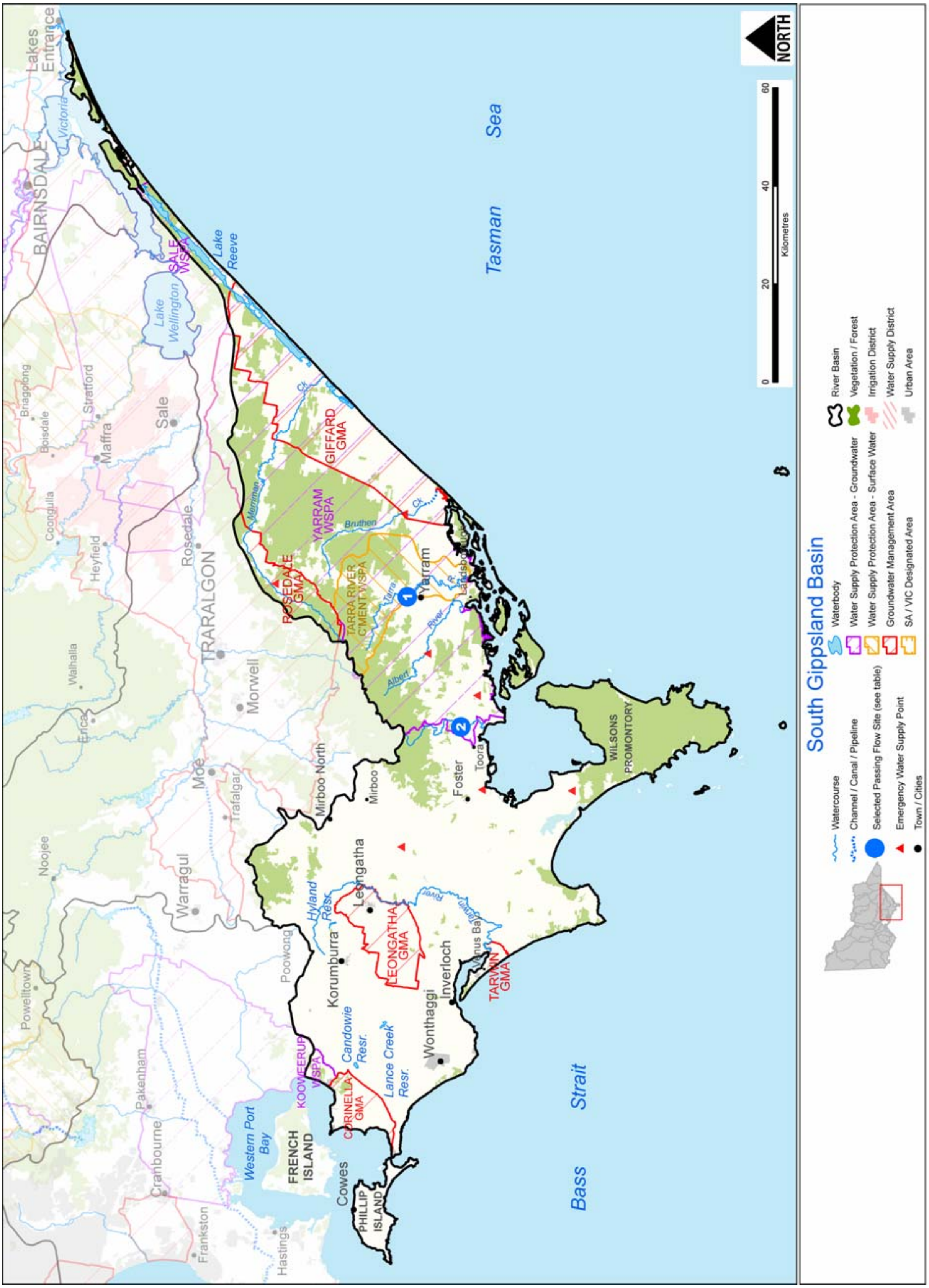
South Gippsland Water reinstated a disused pipeline to connect Tarwin River to the Leongatha and Korumburra systems. The pipeline enables South Gippsland Water to transfer 4.5 ML per day from Tarwin River at Koonwarra to the water treatment plants at Leongatha and Korumburra. The project was completed in March 2007.

South Gippsland Water also completed construction of two groundwater bores in Leongatha. The groundwater bores provide up to 2 ML per day to supplement the Leongatha system.

Westernport Water commenced construction of a pipeline to transfer water from its new groundwater bores in the Corinella aquifer to its Candowie Reservoir via the new Bass River pump station.

22.5 Location of water resources

Figure 22-2 Map of the South Gippsland basin



22.6 Surface water resources

22.6.1 Water balance

A surface water balance for the South Gippsland basin is shown in Table 22-3.

Diversions to service urban customers are relatively minor in the South Gippsland basin. The majority of usage is sourced from small catchment dams, nevertheless they accounted for less than 13% of the total inflows. Most inflows leave the basin and flow into Bass Strait or Westernport.

Table 22-3 Balance of surface water in the South Gippsland basin

Water account component	2006/07 (ML)	2005/06 (ML)
Major on-stream storage		
Volume in storage at start of year	4,400	4,100
Volume in storage at end of year	1,200	4,400
Change in storage	**-3,200**	**300**
Inflows		
Catchment inflow(1)	191,100	632,600
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	1,570	1,240
Sub-total	**192,700**	**633,800**
Usage		
Urban diversions	7,820	8,440
Licensed diversions from unregulated streams	7,600	5,900
Small catchment dams(2)	24,100	24,300
Sub-total	**39,500**	**38,600**
Losses		
Net evaporation losses from major storages	300	700
Evaporation from small catchment dams(2)	8,900	5,100
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	0	0
Sub-total	**9,200**	**5,800**
Water passed at outlet of basin		
River outflows to Bass Strait and Westernport	147,200	589,100

Notes:

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

(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(3) Assumed to be zero because data is not readily available.

22.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 22-4 below have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 22-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	23,000	11,400	n/a
Registered commercial and irrigation	15,200	12,700	n/a
Total	**38,200**	**24,100**	**33,000**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

22.6.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements or diversion licences within the basin or across basin boundaries in 2006/07.

22.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 22-5. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2006/07.

Westernport Water diverted only 731 ML under its bulk entitlement due to a shortage of available water. It was supplied with water from South Gippsland Water's Lance Creek Reservoir and drilled emergency groundwater bores to secure enough water to supply customers.

Licensed diversions from unregulated streams were almost equivalent to urban diversions and are estimated based on irrigation demand modelling and climate information.

Table 22-5 Volume of water diverted under surface water entitlements in the South Gippsland basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance?(1)
Gippsland Water					
Seaspray	1	61	0	33	Yes
South Gippsland Water					
Devon North, Alberton, Yarram and Port Albert	1	853	0	463	Yes
Dumbalk	1	100	0	25	Yes
Fish Creek	1	251	0	182	Yes
Foster	1	326	0	231	Yes
Korumburra	1	1,000	0	552	Yes
Leongatha	1	2,476	0	1,566	Yes
Loch, Poowong and Nyora	1	420	0	333	Yes
Meeniyan(2)	1	1,800	0	697	Yes
Toora, Port Franklin, Welshpool and Port Welshpool	1	1,617	0	614	Yes
Wonthaggi – Inverloch	1	3,800	0	2,389	Yes
Westernport Water					
Westernport	1	2,911	0	731	Yes
Total annual volume of bulk entitlements 2006/07		**15,615**	**0**	**7,816**	
Total annual volume of bulk entitlements 2005/06		**14,015**	**0**	**8,438**	
Licensed diversions from unregulated streams 2006/07		*13,181*		*7,600*	
Licensed diversions from unregulated streams 2005/06		*11,955*		*5,900*	

Notes:

(1) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.

(2) Entitlement temporarily increased (normally 100 ML) by a qualification of rights to enable South Gippsland Water to supply Leongatha and Korumburra from the Tarwin River West Branch.

22.7 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 22-6.

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. Groundwater use increased in 2006/07 as low surface water inflows resulted in bans on rural diversions from unregulated streams.

The most notable increase occurred in the Yarram WSPA, where groundwater extractions in 2006/07 totalled 15,149 ML, an increase of 47% from the prior year and more than double the volume used in 2004/05. Water levels in the Yarram WSPA are showing signs of a deteriorating long term trend and a management plan is being developed for the WSPA. The Stratford and Rosedale GMAs are also exhibiting declining long term water levels and the Department of Sustainability and Environment is in the process of determining the best management response.

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

Table 22-6 Licensed groundwater volumes, South Gippsland basin 2006/07

WSPA/GMA(1)	GMA/ WSPA depth limits(2) (m)	Entitlement limit(3) (ML/year)	Licensed entitlement(4) (ML/year)	Metered use (ML)	Estimated use in unmetered bores(5) (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Corinella GMA (100%)	All depths	2,550	1,944	61	0	61	49
Giffard GMA (100%)	50-200	5,705	5,705	3,719	0	3,719	3,260
Leongatha GMA (100%)	All depths	6,500	1,471	625	0	625	441
Rosedale GMA (6%)	Zone 1 50-150 Zone 2 25-350 Zone 3 200-300	1,337	782	452	0	452	651
Stratford GMA (7%)	Zone 1 >150 Zone 2 >350	2,001	2,566	1,388	0	1,388	1,280
Tarwin GMA (100%)	≤25	1,300	41	0	12	12	12
Sale WSPA (6%)	25-200	1,171	1,171	737	0	737	577
Yarram WSPA (95%)	Zone 1 >200 Zone 2 All depths	25,008	25,008	15,149	0	15,149	10,475
Total		**45,573**	**38,689**	**22,132**	**12**	**22,144**	**16,746**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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

(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.

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

(5) Use in the Tarwin GMA has been estimated at 30% of licensed entitlement.

An estimate of domestic and stock groundwater use is provided in Table 22-7.

Table 22-7 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores(1)(2)	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Corinella GMA (100%)	157	314
Giffard GMA (100%)	171	342
Leongatha GMA (100%)	114	228
Rosedale GMA (6%)	25	50
Stratford GMA (7%)	30	60
Tarwin GMA (100%)(3)	806	1,612
Sale WSPA (6%)	51	102
Yarram WSPA (95%)	918	1,836
Total	**2,272**	**4,544**

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 volume in the previous table.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) In the State Water Reports, household supply was considered the dominant domestic and stock use in the Tarwin GMA and an estimate of 0.3 ML/bore was used. New data collected in 2006/07 suggests this is not the case and therefore 2 ML/bore has been adopted.

Due to the declining surface water supply, groundwater was used to a larger extent than previous years to supplement urban water supply for Leongatha in 2006/07. South Gippsland Water extracted 384 ML from four bores, supplementing the bore at Condoluci that has traditionally supplied Leongatha. The licensed entitlements and metered use for urban groundwater supplies is provided in Table 22-8.

Table 22-8 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2006/07 (ML)	Metered use 2005/06 (ML)
Leongatha	400	384	56
Yarram	60	0	0
Total	**460**	**384**	**56**

22.8 Drought contingency measures

A range of drought contingency measures were undertaken in the South Gippsland basin in 2006/07. These include:

- restricting urban and rural water use (discussed below)
- provision of emergency water supply points
- water carting to Seaspray, Poowong, Loch, Nyora and Fish Creek
- transferring 613 ML from South Gippsland Water's Lance Creek Reservoir to Westernport Water's Candowie Reservoir
- drilling new groundwater bores to augment the supply systems for Leongatha, Wonthaggi, Korumburra, Toora and Phillip Island
- diverting water from the Tarwin River West Branch to supply Leongatha and Korumburra and
- construction of new pipelines and pumps in various locations.

In addition to these measures, rights were qualified on a number of occasions within the South Gippsland basin in 2006/07 to ensure that essential urban needs could be met. These are summarised in Table 22-9

Table 22-9 Qualifications of rights

Qualification Type	Qualification description
Passing flow	Changed Temporary Licence 9026456 from Coalition Creek. This qualification extended the period of the temporary licence, and increased the amount, rate and the maximum daily volume of water allowed to be taken to maintain emergency supplies to townships Dates: 31 October 2006 ongoing to 30 June 2007
Modify diversion rule	Changed the Bulk Entitlement (Meeniyan) Conversion Order 1997 to allow a temporary increase in entitlement volume and rate of extraction from Tarwin River. This qualification provided an emergency water supply to Leongatha and Korumburra Dates: 5 March 2007 ongoing to 30 June 2007
Passing flow	Changed the Bulk Entitlement (Toora – Port Franklin – Welshpool and Port Welshpool) Conversion Order 1997 to reduce passing flows on Agnes River to maintain emergency supplies to the townships Dates: 30 March 2007 to 21 June 2007
Passing flow	Changed Temporary Licence 9031555 from Powlett River. This qualification extended the period of the temporary licence, and altered passing flows to maintain emergency supply to Wonthaggi Dates: 21 June 2007 ongoing to 30 June 2007
Passing flow	Changed Licence 9026826 from Bass River. This qualification extended the period of the licence, and reduced passing flows to enable diversions to Candowie Reservoir to maintain emergency supply to Westernport townships Dates: 31 October 2006 ongoing to 30 June 2007

22.9 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 a number of towns reaching Stage 4 restrictions.

Groundwater use was unrestricted in the South Gippsland basin during 2006/07.

Table 22-10 Seasonal allocations and restrictions on water use in South Gippsland basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Seaspray	Stage 1 introduced October 2006, increasing to Stage 2 in November 2006 and Stage 4 in December 2006 before reducing to Stage 3 in June 2007.
	Koonwarra, Leongatha	Stage 4 from July 2006 to June 2007
	Yarram, Port Albert, Langsborough, Devon North, Alberton	Stage 2 introduced October 2006, increasing to Stage 4 from December 2006 to May 2007, replaced with permanent water savings measures in June 2007 after heavy rainfall
	Poowong, Loch, Nyora	Stage 2 introduced December 2006, increasing to Stage 3 in January 2007 and Stage 4 from February to June 2007
	Cape Paterson, Inverloch, Wonthaggi	Stage 1 introduced November 2006, increasing to Stage 2 in December 2006, Stage 3 in February 2007 and Stage 4 from March through to June 2007
	Port Welshpool, Welshpool, Port Franklin, Toora	Stage 2 introduced January 2007, increasing to Stage 4 from February to May 2007, replaced with permanent water savings measures in June 2007 after heavy rainfall
	Meeniyan, Dumbalk	Stage 4 introduced March 2007, remaining until June 2007
	Fish Creek	Stage 2 introduced December 2006, increasing to Stage 4 from January to June 2007
	Korumburra	Stage 3 July 2006 increasing to Stage 4 from November 2006 to June 2007
	All Westernport Water customers	Stage 1 introduced September 2006, increasing to Stage 3 October 2006 and Stage 4 from November 2006 to June 2007
Licensed diversions from unregulated streams	Bruthen Creek	Irrigation ban September 2006 to June 2007
	Tarra River, Greigs Creek	Stage 1 (roster) September 2006 increasing to an irrigation ban from October 2006 to June 2007
	Jack River	Irrigation ban November 2006 to June 2007

22.10 Recycled water

South Gippsland Water is responsible for nine wastewater treatment plants within the basin, with the Yarram (Tarraville) treatment plant the only site where all wastewater is recycled. Recycling opportunities are limited due to a small industrial base and crop types that are not suited to recycled water.

Westernport Water reuses water from its treatment plants at Coronet Bay and Cowes for sporting fields and gardens of significance.

Across the basin 10% of wastewater was reused, up from 7% in 2005/06 (Table 22-11).

Table 22-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Coronet Bay	116	115	99%	0	115	0	0	0	1
Cowes	786	111	13%	87	16	0	8	674	0
Foster	88	0	0%	0	0	0	0	88	0
Korumburra	396	1	0%	1	0	0	0	395	0
Leongatha domestic	374	1	0%	1	0	0	0	374	0
Leongatha trade waste	964	0	0%	0	0	0	0	0	964
Toora(4)	18	<0.5	1%	<0.5	0	0	0	17	0
Welshpool	22	0	0	0	0	0	0	22	0
Wonthaggi/Cape Paterson/Inverloch	818	27	3%	0	27	0	0	0	791
Yarram	111	111	100%	0	111	0	0	0	0
Total 2006/07	**3,692**	**365**	**10%**	**88**	**269**	**0**	**8**	**1,570**	**1,757**
Total 2005/06	**5,011**	**341**	**7%**	**41**	**285**	**0**	**15**	**1,235**	**3,434**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percent recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006.

(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) Toora recycled 0.2 ML of wastewater, which would otherwise show as zero in Table 22-11.

22.11 Water for the environment

22.11.1 Environmental Water Reserve (EWR)

In 2006/07 the South Gippsland basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Gippsland Water and South Gippsland Water
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

22.11.2 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin.

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. The location of these compliance points is presented in Figure 22-2.

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 (shown as 1 in Figure 22-2)
	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(shown as 2 in Figure 22-2)
	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 2006/07. Westernport Water's bulk entitlement does not contain any passing flow requirements.

22.11.3 Streamflow management plans (SFMPs)

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

22.11.4 Water leaving the basin

The amount of water flowing from the South Gippsland basin into Westernport and Bass Strait was 147,200 ML in 2006/07. This represents 77% of the total inflows into the basin, compared with 93% in 2005/06, a fall of more than 440,000 ML. 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 to ecologically function.

23 Bunyip basin

This chapter sets out the accounts for the Bunyip basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

23.1 Bunyip basin summary

Inflows to the Bunyip basin declined substantially in 2006/07 compared with prior years, reaching 49% of the long term average. Water consumption was higher than the previous year due to licensed diverters extracting more water from unregulated streams. Diversions in the Bunyip basin accounted for 10% of inflows, with most of the balance flowing into Port Phillip Bay and Westernport. Diversions from the basin will increase substantially when the Tarago Reservoir is connected to Melbourne Water's supply system in 2009.

The biggest impact of water shortages was felt by licensed diverters on small streams. There was a marked increase in the use of groundwater, with licensed groundwater extractions approximately doubling compared with recent years. A large number of emergency water supply points were also available to domestic and stock customers in the north-central region of the basin.

Because of low flows in the Tarago River, towns supplied from the Tarago system such as Warragul and Drouin were on Stage 3 restrictions for much of the year. Gippsland Water was able to obtain additional water from Melbourne's share of Tarago Reservoir to maintain a restricted supply to its towns.

Urban communities on the Mornington Peninsula were on Stage 3a restrictions as their water is supplied from the Melbourne system.

23.2 Responsibilities for management of water resources

Table 23-1 shows the responsibilities of various authorities within the Bunyip basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 23-1 Responsibilities for water resources management within the Bunyip basin, 2006/07

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 Bulk water supply to South East Water	Tarago Reservoir Responsibility for meeting passing flows 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)	Responsibility for meeting passing flows

Note:

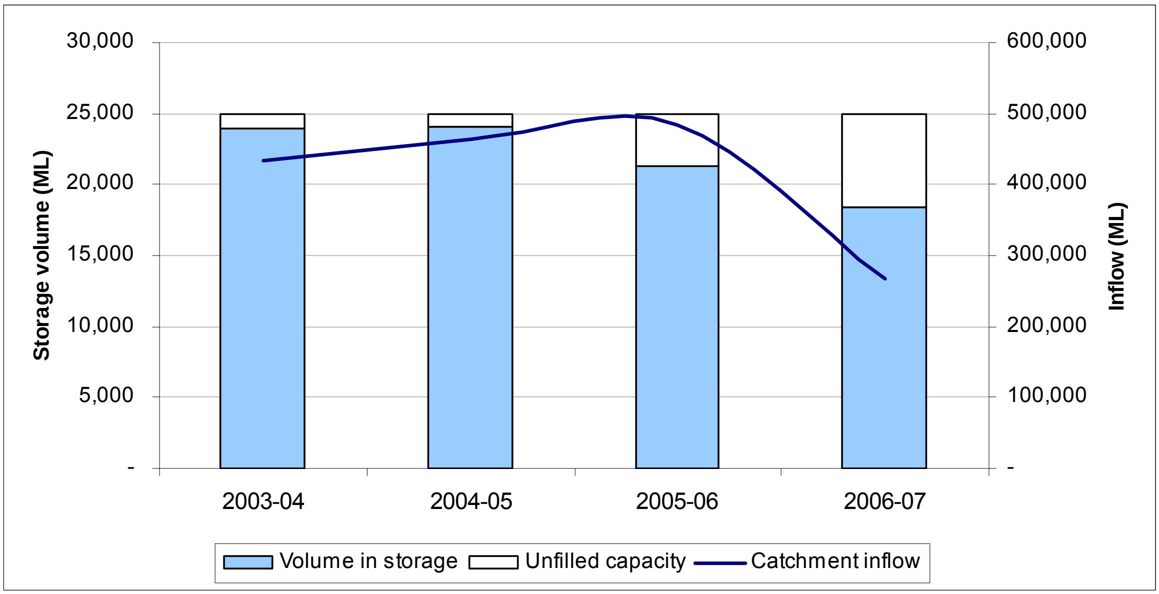
(1) This water is imported into the Bunyip basin from the Yarra/Thomson supply system.

23.3 Rainfall, inflows and storages in 2006/07

In 2006/07, rainfall in the Bunyip basin ranged between 60% and 80% of the long term average. Dry catchment conditions meant that inflows were 265,900 ML, or 49% of the long term average. This was a substantial reduction from the 2005/06 inflow of 484,800 ML.

Low inflows resulted in storage levels falling from 21,300 ML at the start of the year to 18,400 ML at the end of the year. Low inflows also likely contributed to a blue-green algal bloom in Berwick Springs in April, impacting recreational users.

Figure 23-1 All major storages and catchment inflows in the Bunyip basin



23.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Bunyip basin are shown in Table 23-2. These figures exclude water delivered directly to customers from Melbourne Water's supply system in the Yarra basin.

In the Bunyip basin, surface water extraction is a small proportion of the total inflow. However, 83% of the groundwater resource was utilised.

Table 23-2 Summary of total water resources and water use in the Bunyip basin, 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	274,400	32,200
Groundwater(2)	23,800	20,900
Recycled water	137,820	26,700

Note:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 23-6.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the State Water Report 2005/2006.

23.5 Location of water resources

Figure 23-2 Map of the Bunyip basin

23.6 Surface water resources

23.6.1 Water balance

A surface water balance for the Bunyip basin is shown in Table 23-3. The basin includes Tarago Reservoir, which is owned by Melbourne Water and is not currently used for Melbourne's metropolitan water supply. Following construction of a water treatment plant, it is scheduled to be reconnected by the end of 2009. 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 74% of total capacity, a reduction from 85% at the start of the year.

Table 23-3 Balance of surface water in the Bunyip basin

Water account component	2006/07 (ML)	2005/06 (ML)
Major on-stream storage		
Volume in storage at start of year	21,300	24,100
Volume in storage at end of year	18,400	21,300
Change in storage	**-2,900**	**-2,800**
Inflows		
Catchment inflow(1)	265,900	484,800
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river(2)	8,480	1,070
Sub-total	**274,400**	**485,900**
Usage		
Urban diversions	3,350	2,930
Licensed diversions from regulated streams	3,000	2,800
Licensed diversions from unregulated streams	10,400	6,400
Small catchment dams(3)	15,400	15,500
Sub-total	**32,200**	**27,600**
Losses		
Net evaporation losses from major storages(4)	400	0
Evaporation from small catchment dams(3)	1,600	600
In-stream infiltration to groundwater, flows to floodplain and evaporation(5)	1,400	1,500
Sub-total	**3,400**	**2,100**
Water passed at outlet of basin		
River outflows to the ocean and Port Phillip Bay and Westernport	241,700	459,000

Notes:

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

(2) The volume of treated wastewater discharged back to rivers within the Bunyip basin contained an error in the State Water Report 2005/2006. This figure has been corrected in Table 23-3 and also affects the catchment inflow, as this is a back-calculation.

(3) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(4) Evaporation for the Tarago Reservoir was inadvertently reported as gross evaporation in the State Water Report 2005/2006. The 2005/06 evaporation presented in Table 23-3 has been re-stated as net evaporation.

(5) Losses estimated using loss functions in the Tarago River REALM.

23.6.2 Small catchment dams

Small catchment dams are the source of the largest volume of diversions in the basin. Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values provided in Table 23-4 are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 23-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	8,000	4,000	n/a
Registered commercial and irrigation	13,700	11,400	n/a
Total	**21,700**	**15,400**	**17,000**

Note:
(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.
n/a: Information not available.

23.6.3 Water entitlement transfers

No information was available in relation to permanent transfer of water entitlements or diversion licences in 2006/07.

23.6.4 Volume diverted

The volume of water diverted in 2006/07 is shown in Table 23-5.

Licensed diversions from unregulated streams are a large component of water use in the basin, totalling 10,400 ML in 2006/07. These diversions are estimated based on irrigation demand modelling and climate information.

Table 23-5 Volume of water diverted under surface water entitlements in the Bunyip basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance?
Gippsland Water					
Tarago/ Bunyip	n/a	n/a	0	3,348	n/a
Melbourne Water					
Tarago/ Bunyip	n/a	n/a	0	0	n/a
Southern Rural Water					
Tarago/ Bunyip	n/a	n/a	0	3,000	n/a
Total annual volume of bulk entitlements 2006/07		**n/a**		**6,348**	
Total annual volume of bulk entitlements 2005/06		**n/a**	**0**	**5,726**	
Licensed diversions from unregulated streams 2006/07		*17,984*		*10,400*	
Licensed diversions from unregulated streams 2005/06		*10,162*		*6,400*	

Note:
n/a: bulk entitlement conversion order was not finalised at the beginning of 2006/07.

23.7 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 Table 23-6.

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. Groundwater use increased significantly in all GMUs except the Frankston GMA which recorded a small increase. Despite this, no GMUs are exhibiting any adverse long term trends in their water levels.

Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts.

Table 23-6 Licensed groundwater volumes, Bunyip basin 2006/07

WSPA/GMA[1]	GMA/ WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Frankston GMA (100%)	All depths	3,200	1,045	319	0	319	310
Moorabbin GMA (61%)	All depths	1,660	1,552	1,222	0	1,222	406
Nepean GMA (100%)	All depths	6,013	6,013	3,645	0	3,645	1,815
Koo-Wee-Rup WSPA (100%)	All depths	12,915	12,915	6,452	0	6,452	3,460
Total		**23,788**	**21,524**	**11,638**	**0**	**11,638**	**5,991**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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

(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.

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

An estimate of domestic and stock groundwater use is provided in Table 23-7.

Table 23-7 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Frankston GMA (100%)	199	398
Moorabbin GMA (61%)	146	292
Nepean GMA[3] (100%)	1,766	3,532
Koo-Wee-Rup WSPA (100%)	2,500	5,000
Total	**4,611**	**9,222**

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 volume in the previous table.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by the surface area percentage in the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

(3) In previous State Water Reports, household supply was considered the dominant domestic and stock use in the Nepean GMA and an estimate of 0.3 ML/bore was used. New data collected in 2006/07 suggests this is not the case and therefore 2 ML/bore has been adopted

23.8 Drought contingency measures

A range of drought contingency measures were undertaken in the Bunyip basin in 2006/07. These include:

- restricting urban and rural water use (discussed below)
- providing access to emergency water supply points (as indicated in Figure 23-2)
- reducing the draw down limit on the Cardinia Reservoir gaining access to an additional 30,000 ML of storage.

No rights were qualified in the Bunyip basin in 2006/07.

23.9 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 23-8. Groundwater use was unrestricted in the Bunyip basin during 2006/07.

Table 23-8 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, Neerim South, Rokeby, Robin Hood and Warragul)	Stage 1 restrictions in October 2006, increasing to Stage 2 in November 2006 and Stage 3 from January to June 2007
	South East Water customers	Stage 1 restrictions introduced September 2006, increasing to Stage 2 in November 2006, Stage 3 in January 2007 and Stage 3a from April to June 2007
Licensed diversions from unregulated streams	Monbulk Creek	Irrigation ban January to April 2007, reducing to Stage 1 (rostered times) from May to June 2007

23.10 Recycled water

Gippsland Water, South East Water and Melbourne Water operate wastewater treatment plants within the Bunyip basin. Overall, 9% of wastewater was recycled for off-site purposes.

The largest treatment plant is the Eastern Treatment Plant operated by Melbourne Water, which recycled 8% of its total wastewater volume of 127,060 ML. The plant's recycled wastewater was predominantly used on-site and this volume has not been included in the percentage of water recycled. However, an increasing amount is being used by the Eastern Irrigation Scheme for horticultural, recreational and residential customers.

Table 23-9 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)					Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				To retailers	Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Blind Bight	161	199	100%	0	0	161	0	38	0	0
Boneo	2,752	92	3%	0	76	0	0	16	2,676	0
Drouin	398	255	64%	0	0	255	0	0	143	0
Eastern Treatment Plant	127,060	23,478	8%	10,424	0	0	0	13,054	0	103,582
Koo-Wee-Rup	49	49	100%	0	0	49	0	0	0	0
Lang Lang	52	52	100%	0	0	52	0	0	0	0
Longwarry	77	77	100%	0	0	77	0	0	0	0
Mt Martha	4,370	929	2%	0	30	45	0	854	4,295	0
Neerim South	46	0	0%	0	0	0	0	0	46	0
Pakenham	1,622	1,194	73%	0	40	1,149	0	5	449	0
Somers	1,234	374	30%	0	5	360	0	9	870	0
Total 2006/07	**137,821**	**26,699**	**9%**	**10,424**	**151**	**2,148**	**0**	**13,976**	**8,478**	**103,582**
Total 2005/06	**159,550**	**23,223**	**5%**	**6,632**	**55**	**1,824**	**0**	**14,712**	**10,531**	**126,442**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006.

(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.

23.11 Water for the environment

23.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Bunyip basin EWR comprised all water in the basin not allocated for consumptive use, i.e. water above cap.

23.11.2 Passing flow requirements

There were no entitlements for the environment in the Bunyip basin in 2006/07 and therefore no statutory passing flow requirements. However, Melbourne Water operates Tarago Reservoir to provide a passing flow below the reservoir.

23.11.3 Water leaving the basin

The amount of water flowing from the Bunyip basin into Port Phillip Bay, Westernport and Bass Strait was 241,700 ML in 2006/07. This represents 91% of the inflows into the basin, and 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 to ecologically function.

24 Yarra basin

This chapter sets out the accounts for the Yarra basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

24.1 Yarra basin summary

Low rainfall contributed to a decline in inflows in the Yarra basin for the second consecutive year, which were 37% of the long term average. A restricted supply to Melbourne was maintained by drawing down storages and transferring 219,000 ML from the Thomson Reservoir. Melbourne Water has increased transfers from the Thomson basin in recent years, making use of its role as a drought reserve (increased transfers in 2006/07 also reflected a decision to avert water quality problems by moving water out of the fire-threatened Thomson basin).

A range of contingency measures were introduced during 2006/07, including progressively higher water restrictions for Melbourne. Stage 1 restrictions were introduced in Melbourne in September and restrictions quickly moved to Stage 2 (November), Stage 3 (January) and Stage 3a (April). This was the first time for many years that Melbourne had moved beyond Stage 2 restrictions.

Irrigation bans operated on many streams for most of the year and all streams over summer as the lack of winter and spring rainfall translated into lower streamflows.

24.2 Responsibilities for management of water resources

Table 24-1 shows the responsibilities of various authorities within the Yarra basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 24-1 Responsibilities for water resources management within the Yarra basin, 2006/07

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 Storage operator for the Melbourne supply system with obligation to meet passing flow requirements
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 Rainfall, inflows and storages in 2006/07

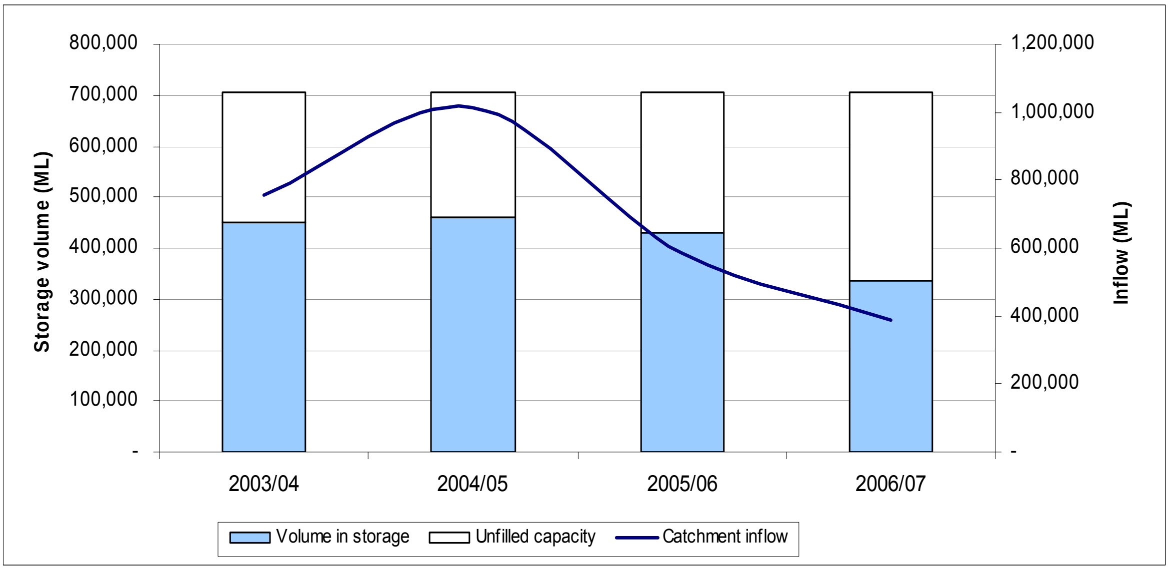
In 2006/07 rainfall in the Yarra basin ranged between 60% and 80% of the long term average. Dry catchment conditions contributed to total inflows reaching 37% of the long term average of 1,054,000 ML.

Melbourne Water operates seven major storages within the Yarra basin. Upper Yarra Reservoir, O'Shannassy Reservoir and Maroondah Reservoir 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 an off-stream storage located within the Bunyip basin, although it stores water harvested from the Yarra basin.

Storage levels fell by 95,000 ML during 2006/07 to 336,000 ML, which represents 48% of the total storage capacity of 705,000 ML within the Yarra basin. The major on-stream storages in the basin, which comprise 36% of the basin's total storage capacity, experienced a 2% increase in storage levels.

Low inflows also likely contributed to a blue-green algal bloom at Yan Yean Reservoir between March and April, forcing the storage to be taken off-line for urban supply. There was also an outbreak in a lake at Henley golf course in April 2007.

Figure 24-1 All major storages and catchment inflows in 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 24-2.

Table 24-2 Summary of total water resources and water use in the Yarra basin, 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	615,000	471,000
Groundwater(2)	4,300	2,300
Recycled water	8,070	1,610

Note:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 24-6.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the figures presented in the State Water Report 2005/2006.

24.4.1 Infrastructure projects to improve water availability

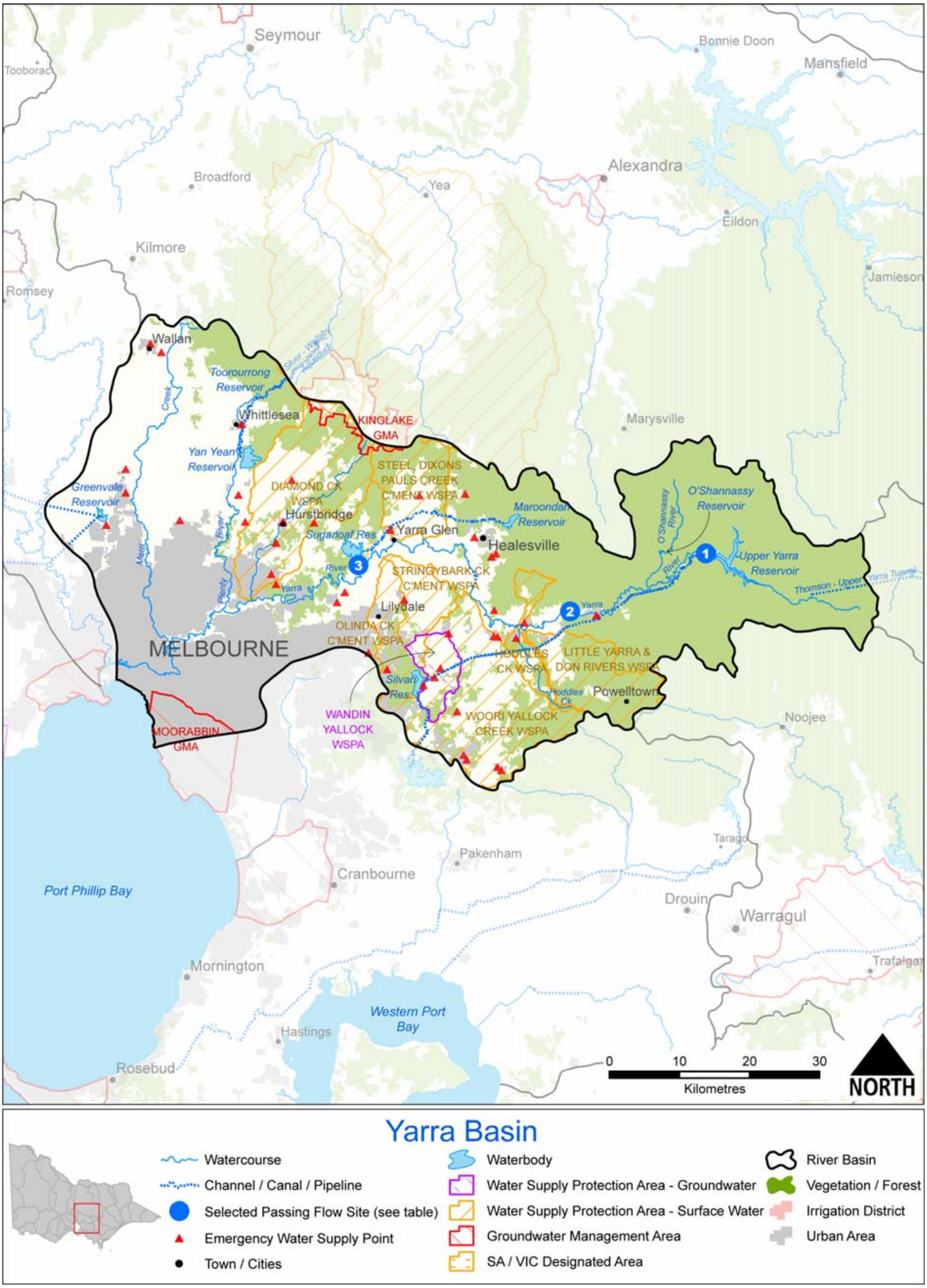
Melbourne Water installed several smaller pumps at the Yering Gorge Pump Station on the Yarra River to enable harvesting of water closer to the trigger levels for the minimum environmental passing flows. The new pumps provide the potential to harvest an additional 10,000 ML to 15,000 ML per annum.

Melbourne Water has also completed refurbishment of the old high level outlet at Upper Yarra Reservoir, enabling water to be drawn off at four different levels instead of only one level. The refurbishment and operation of the old outlet is now improving water quality during draw-off at low reservoir levels.

In June 2007, the government announced that it would link Melbourne with the northern Victorian irrigation systems by building a pipeline from the Goulburn River to Melbourne's Sugarloaf Reservoir. The project is due for completion by the end of 2010. It also announced a desalination plant to be built near Wonthaggi by the end of 2011.

24.5 Location of water resources

Figure 24-2 Map of the Yarra basin



24.6 Surface water resources

24.6.1 Water balance

A surface water balance for the Yarra basin is presented in Table 24-3.

During the year there was a net transfer of water into the Yarra basin from other basins. Melbourne Water imported 219,100 ML from the Thomson basin and 1,200 ML from Silver and Wallaby Creek to supply Melbourne's customers.

The increased transfer of water from the Thomson basin to the Yarra basin (an increase from 129,000 ML in 2005/06) was in response to low inflows and storage levels in the Yarra basin, and the need to avert a water quality threat in the event that the 2006 bushfires had spread to the Thomson catchment.

Table 24-3 Balance of surface water in the Yarra basin

Water account component	2006/07 (ML)	2005/06 (ML)
Major on-stream storage		
Volume in storage at start of year	110,200	131,100
Volume in storage at end of year	115,300	110,200
Change in storage	**5,100**	**-20,900**
Inflows		
Catchment inflow(1)	388,200	582,600
Transfers from other basins	220,400	134,400
Return flow from irrigation	0	0
Treated wastewater discharged back to river	6,440	8,360
Sub-total	**615,000**	**725,400**
Usage		
Urban diversions(2)	422,680	444,370
Licensed diversions from unregulated streams	33,200	30,200
Small catchment dams(3)	15,100	15,900
Transfers to the Werribee system	0	0
Sub-total	**471,000**	**490,500**
Losses		
Net evaporation losses from major storages(4)	1,400	1,200
Evaporation from small catchment dams(3)	1,400	1,200
In-stream infiltration to groundwater, flows to floodplain and evaporation(5)	0	0
Sub-total	**2,800**	**2,400**
Water passed at outlet of basin		
River outflows to Port Phillip Bay	136,100	253,400

Notes:

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

(2) Diversions from the Melbourne supply system represent the total amount diverted for consumptive purposes and do not equate to the sum of the three individual Melbourne bulk entitlements, due to a different calculation method.

(3) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(4) Evaporation for Melbourne Water's Yarra basin storages was inadvertently reported as gross evaporation in the State Water Report 2005/2006. The 2005/06 evaporation presented in Table 24-3 has been re-stated as net evaporation.

(5) Losses estimated to be zero since no loss function is available for the Yarra basin.

24.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 24-4 have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 24-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	10,500	5,000	n/a
Registered commercial and irrigation	12,600	10,100	n/a
Total	**23,100**	**15,100**	**16,500**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

24.6.3 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 2006/07.

24.6.4 Volume diverted

In October 2006, the Melbourne metropolitan retailers, City West Water, South East Water and Yarra Valley Water, were granted a pooled bulk entitlement on the Yarra River. Western Water was also granted a bulk entitlement in the Yarra basin. The volume of water diverted by Western Water and the Melbourne retailers is shown in Table 24-5.

Approximately half of licensed diversions on unregulated streams are metered. Total licensed diversions of 33,200 ML from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 24-5 Volume of water diverted under surface water entitlements in the Yarra basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)(1)	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance? (2)(3)
Melbourne metropolitan retailers					
Yarra River	15	400,000	0	79,514	Yes
Western Water					
Yarra River	1	11,250	0	10,934	Yes
Total annual volume taken in 2006/07(4)		**411,250**	**0**	**90,448**	
Total annual volume taken in 2005/06		**n/a**	**0**	**444,365**	
Licensed diversions from unregulated streams 2006/07		*45,284*		*33,200*	
Licensed diversions from unregulated streams 2005/06		*45,382*		*30,200*	

Notes:

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

(2) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.

(3) Compliance for the entire Melbourne supply system is assessed against a long term (15 year) average volume limit of 555,000 ML. The corresponding long term average annual diversions for 2006/07 was 469,687 ML.

(4) The 90,448 ML volume diverted in 2006/07 was low because of the drought. To supply its total demand of 411,747 ML (this figure can also be compared with the 444,365 ML reported in the State Water Report 2005/2006), Melbourne also relied upon transfers from the Thomson and storage drawdown.

24.7 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 24-6.

The Yarra basin contains the whole Wandin Yallock WSPA as well as part of the Kinglake GMA and Moorabbin GMA. Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts. All GMUs experienced increases in use, in part related to the irrigation bans introduced on unregulated streams.

Table 24-6 Licensed groundwater volumes, Yarra basin 2006/07

WSPA/GMA(1)	GMA/WSPA depth limits(2) (m)	Entitlement (ML/year)	Licensed entitlement(4) (ML/year)	Metered use (ML)	Estimated use in unmetered bores(5) (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Kinglake GMA (19%)	All depths	379	379	0	228	228	182
Moorabbin GMA (39%)	All depths	1,040	973	766	0	766	255
Wandin Yallock WSPA (100%)	All depths	2,924	2,924	792	0	792	590
Total		**4,344**	**4,276**	**1,557**	**228**	**1,785**	**1,027**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures represented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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

(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.

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

(5) Goulburn-Murray Water has estimated use in the Kinglake GMA at 60% of licensed entitlement.

An estimate of domestic and stock groundwater use is provided in Table 24-7. Groundwater is not used to augment urban supplies in the Yarra basin.

Table 24-7 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores(1)(2)	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Kinglake GMA (19%)	11	22
Moorabbin GMA (39%)	92	184
Wandin Yallock WSPA (100%)	163	326
Total	**266**	**532**

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 volume in Table 24-6.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by the surface area percentage within the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

24.8 Drought contingency measures

There was a range of drought contingency measures undertaken in the Yarra basin in 2006/07. These include:

- restricting urban and rural water use (discussed below)
- providing access to emergency water supply points (as indicated in Figure 24-2)
- changing the draw-down limit on the Yan Yean and Sugarloaf Reservoirs, gaining access to an additional 18,000 ML of storage
- installing a smaller pump at Yering to improve flexibility of extractions from the Yarra River
- installing backup pump at Maroondah Reservoir to secure Healesville's water supply
- rescheduling logging away from a catchment with high water yield to one with lower water yield
- increased harvesting of Yarra tributaries by taking the first storm flushes
- reduced leakage from aqueducts.

One formal qualification of rights was declared in the Yarra basin in April 2007 and is presented in Table 24-8.

Table 24-8 Qualifications of rights

Qualification type	Qualification description
Passing flow	Delayed the introduction of the new environmental flow regime for the Yarra River to retain water in storages for supply to Melbourne Date: From 16 April 2007 to 30 June 2007

24.9 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. Urban customers faced a number of stages of water restrictions throughout the year and many unregulated streams had irrigation bans in place, particularly over summer.

Groundwater use was unrestricted in the Yarra basin during 2006/07.

Table 24-9 Seasonal allocations and restrictions on water use in Yarra basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Yarra Valley Water customers	Stage 1 restrictions in September 2006, increasing to Stage 2 in November 2006, Stage 3 in January 2007 and Stage 3a from April to June 2007
Licensed diversions from unregulated streams	Darebin Creek	Irrigation ban October 2006, December 2006 to March 2007
	Diamond Creek	Irrigation ban July 2006 to May 2007
	Hoddles Creek	Irrigation ban July 2006 to May 2007
	Yarra River	Irrigation ban October to November 2006, February to March 2007, restrictions April to May 2007
	Little Yarra River	Irrigation ban December 2006 to May 2007
	Don River	Irrigation ban December 2006 to May 2007
	Pauls Creek	Irrigation ban July 2006 to May 2007
	Plenty River	Irrigation ban September to November 2006, January to May 2007
	Steels/Dixons Creek	Irrigation ban July 2006 to June 2007
	Wandin Yallock Creek	Irrigation ban July to September 2006, January to February 2007, April to May 2007
	Woori Yallock Creek	Irrigation ban July to September 2006, November 2006, January to May 2007
	Mullum Mullum Creek	Irrigation ban November to December 2006
	Kororoit Creek	Irrigation ban November 2006 to January 2007
	Olinda Creek	Irrigation ban November 2006 to May 2007
	Arundel	Irrigation ban December 2006 to January 2007
	Moonee Ponds Creek	Irrigation ban December 2006 to January 2007
	Stringybark Creek	Irrigation ban December 2006 to January 2007

24.10 Recycled water

Yarra Valley Water operates eight wastewater treatment plants within the Yarra basin. A summary of the volume of recycled water is provided below in Table 24-10.

Wastewater was reused at six of the plants in 2006/07 and the volume of recycled water increased even though the volume of wastewater entering the treatment plants reduced (mainly due to water restrictions). Overall, 9% of wastewater was reused in the basin, which is a significant increase from the percentage recycled in 2005/06 (4%).

Table 24-10 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[(3)]
				Urban & industrial	Agriculture	Beneficial allocation[(1)]	Within process[(2)]		
Brushy Creek	3,690	480	2%	0	60	0	420	3,210	0
Craigieburn	1,059	132	12%	0	132	0	0	928	0
Healesville	322	0	0%	0	0	0	0	322	0
Lilydale	1,798	361	0%	0	1	0	360	1,437	0
Monbulk	12	0	0%	0	0	0	0	12	0
Upper Yarra	607	78	0%	0	0	0	78	529	0
Wallan	393	387	99%	0	387	0	0	0	6
Whittlesea	192	175	84%	0	162	0	13	0	17
Total 2006/07	**8,073**	**1,612**	**9%**	**0**	**741**	**0**	**871**	**6,438**	**23**
Total 2005/06	**9,013**	**404**	**4%**	**0**	**404**	**0**	**0**	**8,359**	**251**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percent recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006.

(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.

24.11 Water for the environment

24.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Yarra basin EWR comprised all water in the basin not allocated for consumptive use.

The Yarra River Environmental Entitlement (2006) was granted in October 2006 and the environmental water reserve was to start accruing the entitlement's 17,000 ML on 1 July 2007. On 26 April 2007, the Minister for Water qualified the entitlement to defer the implementation of the additional environmental flows proposed under the environmental entitlement and this decision is to apply until Stage 2 water restrictions are lifted in Melbourne.

The environmental flow rules in place prior to the granting of the Yarra River Environmental Entitlement order in 2006 have remained. These include the environmental flow rules set out in schedule F7 (Waters of the Yarra Catchment) of the Victorian State Environment Protection Policy.

24.11.2 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin. These passing flows are established in Melbourne Water's operating rules and in the case of the Yarra River at Warrandyte, established by the State Environment Protection Policy – Waters of Victoria (SEPP WoV), Schedule F7 (Waters of the Yarra Catchment).

Table 24-11 shows a number of passing flow requirements in the Yarra basin for selected compliance points. While there are other compliance points, the points below have been chosen as they were judged to be of community interest. The location of these compliance points is presented in Figure 24-2.

Table 24-11 Selected passing flow requirements in the Yarra basin at selected sites

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 (shown as 1 in Figure 24-2)
	Passing flow rules	• 10 ML/day
	Compliance point	Millgrove (shown as 2 in Figure 24-2)
	Passing flow rules	• 98 ML/day
	Compliance point	Yering Gorge Pump Station (shown as 3 in Figure 24-2)
	Passing flow rules	• 245 ML/day

Melbourne Water reported that compliance with the requirements of its State Environment Protection Policy environmental flow obligations were met for 2006/07. No flushing flows were released by Melbourne Water due to the qualification of rights.

24.11.3 Streamflow management plans

Streamflow management plans (SFMPs) currently exist for Diamond Creek and Hoddles Creek within the Yarra basin. Melbourne Water will submit an annual compliance report on the SFMPs some time in 2007/08.

SFMPs were submitted to the Minister for Water for approval for Plenty River, Stringybark Creek, Olinda Creek and Pauls, Steels and Dixons Creeks. Whilst the Plenty River SFMP received Ministerial approval in October 2007, the other draft SFMPs are on hold pending the outcome of Stream Flow Tenders. This is a pilot program to assist in the implementation of SFMPs and the outcomes of the Stream Flow Tenders will be used to finalise the draft SFMPs.

During 2006/07 WSPAs were declared for Little Yarra River, Don River and Woori Yallock Creek, enabling the future development of SFMPs for these streams.

24.11.4 Water leaving the basin

The amount of water flowing from the Yarra basin into Port Phillip Bay was 136,100 ML in 2006/07. This represents 35% of the catchment inflows to the basin, compared with 43% in 2005/06. This water comprises consumptive water that was not used under entitlements and the EWR (water above cap).

25 Maribyrnong basin

This chapter sets out the accounts for the Maribyrnong basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

25.1 Maribyrnong basin summary

By year end, the Rosslynne Reservoir held 1,100 ML out of a total capacity of more than 25,300 ML, or 4% full. The draw-down in storage levels was a result of low inflows that were 17% of the long term average.

Towns in the Maribyrnong basin such as Gisborne and Sunbury now rely on water from the Yarra basin for their supplies as local sources are not sufficient to meet demand. Southern Rural Water released no water to irrigators on the Maribyrnong River. Maribyrnong River irrigators were able to access potable water from the Melbourne system to replace diversions from the river.

In October 2006, Southern Rural Water's Maribyrnong bulk entitlement was amended to reduce passing flow requirements at the Sunbury compliance point, which were proving difficult to meet because of the extremely dry conditions and continued low inflows.

25.2 Responsibilities for management of water resources

Table 25-1 shows the responsibilities of various authorities within the Maribyrnong basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 25-1 Responsibilities for water resources management within the Maribyrnong basin, 2006/07

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
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

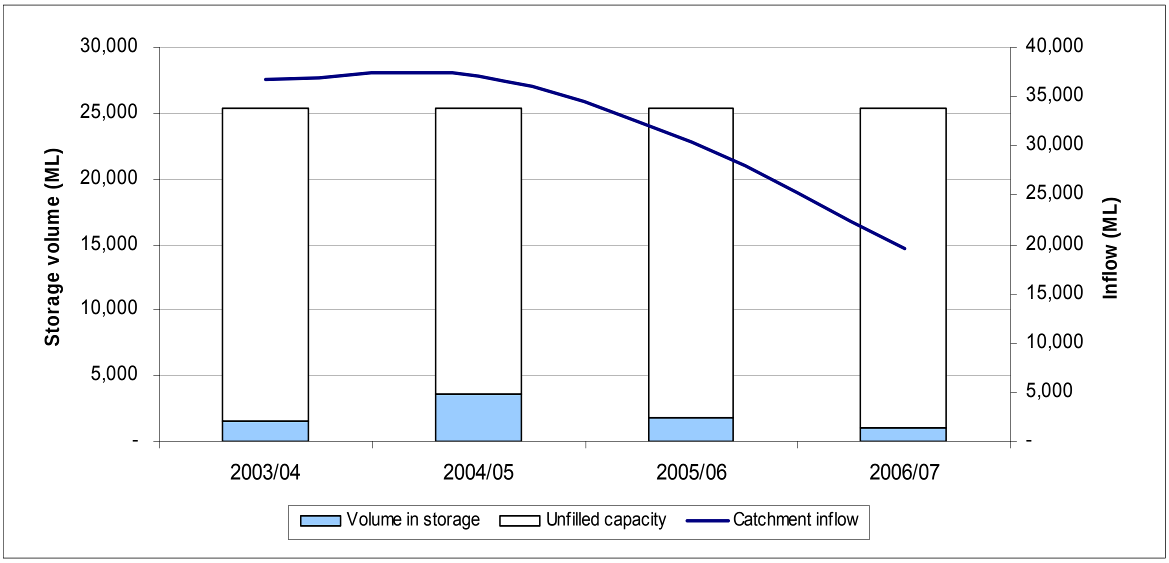
25.3 Rainfall, inflows and storages in 2006/07

In 2006/07 the majority of the Maribyrnong basin experienced rainfall between 60% and 80% of the long term average. The southern-most tip of the basin (including Melbourne) received between 40% and 60% of the long term average. Depleted soil moisture again affected inflows in 2006/07 and the pattern of low inflows in the basin continued.

Inflows into the Maribyrnong basin were only 17% of the long term average, substantially less than the inflows recorded in the previous three years. Usage was relatively stable, so the reduced inflows had the greatest impact on the amount of water flowing into Port Phillip Bay.

Rosslynne Reservoir is the only large storage located within the basin. The storage volume was low at the start of the year at 7% of total capacity. It decreased during 2006/07, and was 4% full at the end of June 2007.

Figure 25-1 All major storages and catchment inflows in the Maribyrnong basin



25.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Maribyrnong basin are shown in Table 25-2.

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

Table 25-2 Summary of total water resources and water use in the Maribyrnong basin, 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	20,700	7,600
Groundwater(2)	2,300	500
Recycled water	2,390	1,290

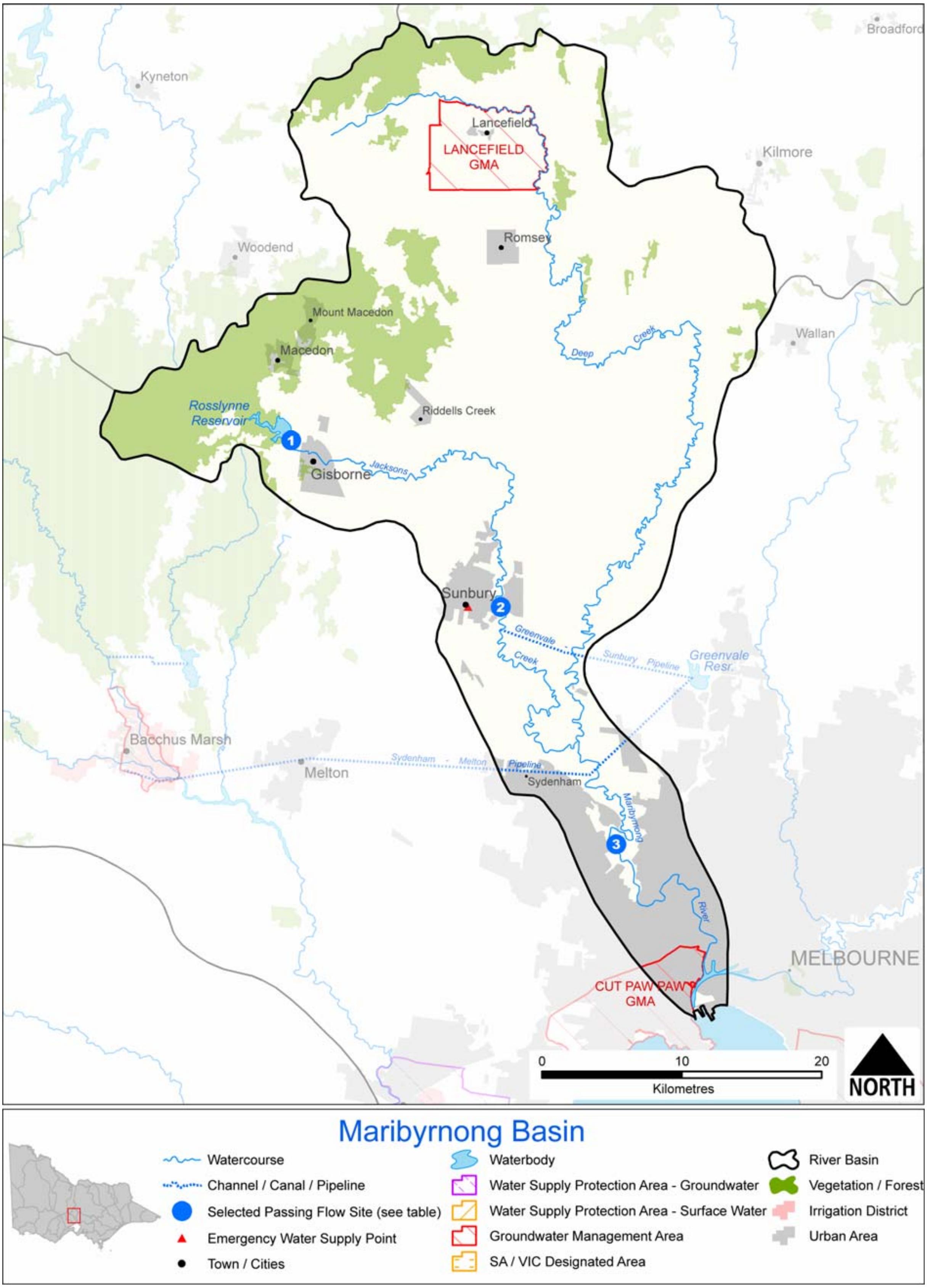
Note:

(1) For groundwater the total water resource is the total entitlement limit as presented in Table 25-7Table 25-6.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in methodology from the State Water Report 2005/2006.

25.5 Location of water resources

Figure 25-2 Map of the Maribyrnong basin



25.6 Surface water resources

25.6.1 Water balance

A surface water balance for the Maribyrnong basin is shown in Table 25-3.

Supply to urban areas within the Maribyrnong basin does not rely heavily on the water resources of the basin. The area of the basin within the Melbourne metropolitan area receives its water supply from the Yarra and Thomson basins. Because the basin's local sources of water (e.g. Rosslynne Reservoir) have been severely affected by drought in recent years, Western Water almost totally relies on its pipelines from the Melbourne system to supply its towns and is fully utilising its Yarra bulk entitlement to do so. By far the largest diversion of water in the Maribyrnong basin in 2006/07 was by small catchment dams, comprising approximately 74% of the total diversions.

Table 25-3 Balance of surface water in the Maribyrnong basin

Water account component	2006/07 (ML)	2005/06 (ML)
Major on-stream storage		
Volume in storage at start of year	1,800	3,600
Volume in storage at end of year	1,100	1,800
Change in storage	**-700**	**-1,800**
Inflows		
Catchment inflow(1)	19,600	30,400
Transfers from other basins(2)	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	1,100	1,540
Sub-total	**20,700**	**31,900**
Usage		
Urban diversions	600	880
Licensed diversions from regulated streams	100	500
Licensed diversions from unregulated streams	1,300	1,400
Small catchment dams(3)	5,600	7,800
Sub-total	**7,600**	**10,600**
Losses		
Net evaporation losses from major storages	400	300
Evaporation from small catchment dams(3)	6,500	4,800
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	2,300	2,000
Sub-total	**9,200**	**7,100**
Water passed at outlet of basin		
River outflows to Port Phillip Bay	4,600	16,000

Notes:

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

(2) 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.

(3) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(4) Losses estimated using loss functions from the Maribyrnong REALM.

25.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 25-4 are based on the estimates from the Department of Sustainability and Environment per Chapter 5.

Table 25-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	5,800	2,100	n/a
Registered commercial and irrigation	5,800	3,500	n/a
Total	**11,600**	**5,600**	**12,100**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

25.6.3 Water entitlement transfers

A summary of Victorian entitlements transferred into and out of the Maribyrnong basin is presented in Table 25-5. The small volume of transfers was between licensed private diverters. There were no entitlement transfers of a permanent nature.

Table 25-5 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
Total 2006/07	0	0	0	0	**76**	**76**	**2**	0
Total 2005/06	**10**	**10**	**1**	**0**	**86**	**86**	**3**	**0**

Note:

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

n/a: Information not available.

25.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 25-6. 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 2006/07. For multi-year entitlements, compliance is assessed based on the total volume of water diverted over the term of the entitlement. Therefore it is possible that the volume diverted in any given year may exceed the average bulk entitlement volume.

There was almost no water taken for irrigation from the regulated part of the Maribyrnong River. Western Water sourced the majority of its water from its Yarra bulk entitlement. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 25-6 Volume of water diverted under surface water entitlements in the Maribyrnong basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)[1]	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance? [2] [3]
Western Water					
Gisborne – Barringo Creek	1	320	0	13	Yes
Lancefield	1	315	0	72	Yes
Macedon and Mt Macedon[3]	1	645	0	317	Yes
Riddells Creek	1	300	0	26	Yes
Romsey	1	460	0	168	Yes
Maribyrnong (Rosslynne Reservoir)	5	6,100	0	0	Yes
Melbourne Water					
Maribyrnong	5	1,160	0	132	Yes
Southern Rural Water					
Maribyrnong	5	382	0	0	Yes
Total annual volume of bulk entitlements 2006/07		**9,682**	**0**	**727**	
Total annual volume of bulk entitlements 2005/06		**9,676**	**0**	**1,410**	
Licensed diversions from unregulated streams 2006/07		*1,787*		*1,300*	
Licensed diversions from unregulated streams 2005/06		*2,059*		*1,400*	

Notes:

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

(2) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited

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

(4) Average bulk entitlement is 645 ML/yr, but up to 873 ML can be diverted in any one year.

25.7 Groundwater resources

The Maribyrnong basin contains the whole Lancefield GMA and part of the Cut Paw Paw GMA. Licensed groundwater entitlements and use for these GMAs in the Maribyrnong basin, excluding domestic and stock use, are presented in Table 25-7.

Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts.

Table 25-7 Licensed groundwater volumes, Maribyrnong basin 2006/07

WSPA/GMA(1)	GMA/WSPA depth limits(2) (m)	Evaluation limit(3) (ML/year)	Licensed entitlement(4) (ML/year)	Metered use (ML)	Estimated use in unmetered bores(5) (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Cut Paw Paw GMA (23%)	>50	848	125	0	37	37	37
Lancefield GMA (100%)	All depths	1,485	1,373	273	0	273	400
Total		**2,333**	**1,498**	**273**	**37**	**311**	**437**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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

(3) The evaluation limit represents the sum of licensed entitlements for the respective GMA/WSPA.

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

(5) Unmetered use has been estimated at 30% of licensed entitlement.

An estimate of domestic and stock groundwater use is provided in Table 25-8.

Table 25-8 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores(1)(2)	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Cut Paw Paw GMA (23%)	0	0
Lancefield GMA (100%)	76	152
Total	**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 volume in the Table 25-7.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by the surface water percentage in the basin.

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 25-9.

Table 25-9 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2006/07 (ML)	Metered use 2005/06 (ML)
Lancefield	585	143	254

25.8 Drought contingency measures

A range of drought contingency measures were undertaken in the Maribyrnong basin in 2006/07. These include:

- restricting urban and rural water use (discussed below)
- establishing an emergency water supply point at Sunbury
- amending Southern Rural Water's Maribyrnong bulk entitlement to reduce environmental flow releases from Rosslynne Reservoir from October 2006 to the end of the year
- utilising disinfected and unfiltered surface water to supplement groundwater supplies in Lancefield
- connecting Romsey to the Sunbury supply system, which has been taking its water from the Yarra basin.

There were no qualifications of rights in the Maribyrnong basin in 2006/07.

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

Restrictions applying to urban customers and licensed diversions are shown in Table 25-10. Urban restrictions became more severe as the year progressed and many unregulated streams continued irrigation bans from 2005/06 or introduced new bans in 2006/07.

Groundwater use was unrestricted in the Maribyrnong basin during 2006/07.

Table 25-10 Seasonal allocations and restrictions on water use in Maribyrnong basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	City West Water customers and Western Water customers (except in Lancefield)	Stage 1 introduced September 2006, increasing to Stage 2 in November 2006, Stage 3 in January 2007 and Stage 3a from April to June 2007
	Lancefield	Stage 1 introduced September 2006, increasing to Stage 2 in November 2006, Stage 3 from January to June 2007
Licensed diversions from unregulated streams	Turitable Creek, Willimingongon Creek	Domestic and stock diversions permitted from July to September 2006 when flow was 0.5 ML per day, converting to an irrigation ban in October 2006 and from December 2006 to February 2007 (water shortages declared in November 2006 and from March to June 2007)
	Barringo Creek, Bolinda Creek, Deep Creek	Irrigation ban July 2006 to June 2007
	Riddells Creek	Irrigation ban August 2006 to June 2007
	Witch Creek	Irrigation ban September 2006 to June 2007
	Maribyrnong River	Irrigation ban was enforced from September 2006 to May 2007
Irrigation and regulated diversions (Southern Rural Water)	Jacksons Creek	0% of licensed volume in July 2006, increasing to 5% of licensed volume in August 2006
Irrigation and regulated diversions (Melbourne Water)	Maribyrnong River	No releases from Rosslynne reservoir were made for entitlement holders on the Maribyrnong River in 2006/07

25.10 Recycled water

All wastewater treatment plants within the basin are operated by Western Water. Overall, 46% of the wastewater was reused in 2006/07, primarily for agricultural purposes such as wineries and vegetable producers.

Table 25-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Gisborne	356	196	39%	85	53	0	58	160	0
Riddells Creek	121	121	100%	0	121	0	0	0	0
Romsey	209	209	100%	0	209	0	0	0	0
Sunbury	1,701	763	38%	289	352	0	122	938	0
Total 2006/07	**2,387**	**1,289**	**46%**	**374**	**735**	**0**	**180**	**1,098**	**0**
Total 2005/06	**2,900**	**1,420**	**46%**	**299**	**1,034**	**0**	**87**	**1,543**	**0**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percent recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006.

(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.

25.11 Water for the environment

25.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Maribyrnong basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Western Water and Southern Rural Water
- water set aside for the environment through the operation of licensed diversions with passing flow conditions (regulated and unregulated waterways)
- all other water in the basin not allocated for consumptive use, i.e. water above cap.

25.11.2 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin.

Table 25-12 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 25-12 Selected passing flow requirements in the Maribyrnong basin

River	Passing flow	
Maribyrnong River, Jacksons Creek	Instrument where passing flows are specified	Bulk Entitlement (Maribyrnong – Southern Rural Water) Conversion Order 2000, amended 2004
	Responsible authority	Southern Rural Water
	Compliance point	Gisborne gauging station (shown as 1 in Figure 25-2)
	Passing flow rules	• The lesser of 3 ML/day or natural flow
	Compliance point	Sunbury gauging station (shown as 2 in Figure 25-2)
	Passing flow rules	• The lesser of 10 ML/day or natural flow
	Compliance point	Keilor gauging station (shown as 3 in Figure 25-2)
	Passing flow rules	• The lesser of 5 ML/day or natural flow

Western Water reported that it complied with the requirements of its bulk entitlements.

Southern Rural Water reported that it experienced difficulties in meeting its passing flow obligations and an application to amend the bulk entitlement was made in June 2006 and adopted in October 2006.

25.11.3 Streamflow management plans (SFMPs)

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

25.11.4 Water leaving the basin

The volume of water flowing from the Maribyrnong basin into Port Phillip Bay was 4,600 ML in 2006/07. This represents 23% of the total inflows into the basin, compared with 53% in 2005/06 and the decline was solely due to lower inflows into the basin. This water comprises consumptive water that was not used under entitlements, traded water and the EWR (passing flows and any water above cap).

26 Werribee basin

This chapter sets out the accounts for the Werribee basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

26.1 Werribee basin summary

The Werribee River's average annual flow over the past decade has been 37% of the long term average and 2006/07 inflows were lower again, recording 15% of average. Ten years of very low inflows have taken a toll on storage levels within the basin, which fell from 16% at the beginning of the year to 9% full at year end.

The low inflows and declining storage levels impacted irrigators in the basin, with Werribee and Bacchus Marsh irrigators receiving a 10% allocation. Many Werribee irrigators have signed up to the Werribee Irrigation District recycled water scheme to supplement their allocation. The volume of water purchased under the scheme increased seven-fold in 2006/07 compared with 2005/06. The scheme supplied 10,950 ML of recycled water in 2006/07 and is used by the majority of the district's market gardeners.

Bacchus Marsh irrigators cannot access recycled water from the Western Treatment Plant and have relied on other sources of water. Southern Rural Water pumped dead storage from Pykes Creek Reservoir to supply irrigators and passed 148 ML of its share of Lake Merrimu to irrigators through Western Water's reticulation system.

The Deutgam WSPA was the only aquifer in the state that had a qualification of rights declared during 2006/07. Extractions on some licences were limited to 25% of licensed entitlement from the beginning of the year before being further qualified to 0% in June, resulting in extractions falling by approximately 60%.

26.2 Responsibilities for management of water resources

Table 26-1 shows the responsibilities of various authorities within the Werribee basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 26-1 Responsibilities for water resources management within the Werribee basin, 2006/07

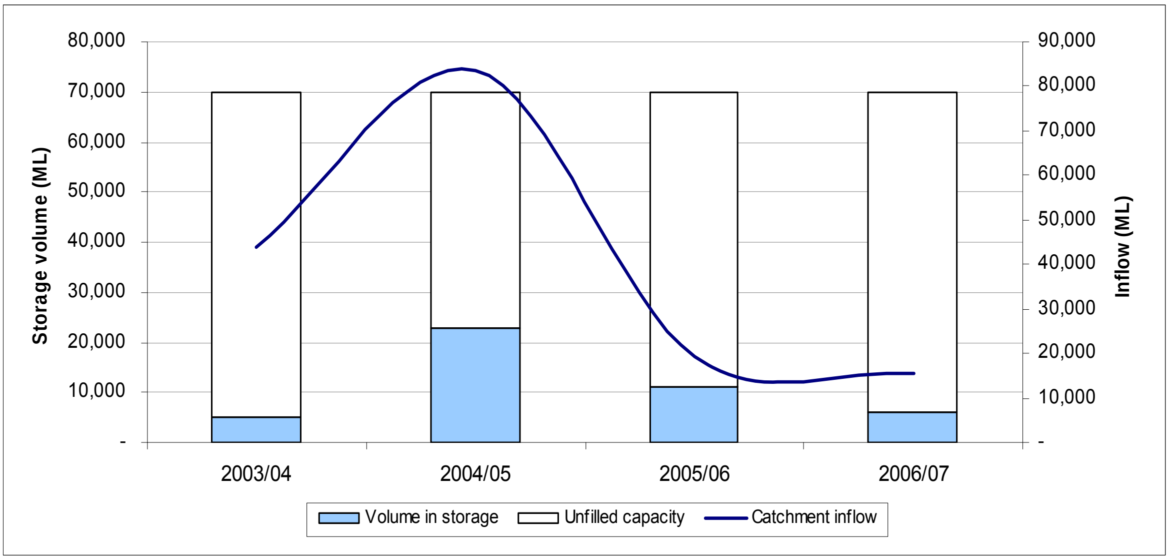
Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water	Werribee and Bacchus Marsh irrigation districts	Groundwater and surface water licensed diversions		Pykes Creek Reservoir, Melton Reservoir and 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 supplier and wastewater manager to parts of metropolitan Melbourne that are in the basin	
Central Highlands Water			Urban water supply to Blackwood and Ballan	Obligation to meet passing flow requirements

26.3 Rainfall, inflows and storages in 2006/07

In 2006/07, rainfall in the Werribee basin ranged between 60% and 80% of the long term average. Inflows dropped by more than 50% compared with 2005/06 and were15% of the long term average.

Storage volumes fell from 16% of capacity at the start of the year to 9% of capacity at the end. Low inflows and storages likely contributed to a number of outbreaks of blue-green algal blooms during the year. The outbreaks occurred at Merrimu Reservoir, the Werribee River at Werribee South, Pykes Creek and the Western Treatment Plant, impacting a range of users. The Western Treatment Plant outbreak suspended recycled water supplies, the Merrimu Reservoir bloom affecting drinking water, and Pykes Creek and the Werribee River reduced irrigation supplies.

Figure 26-1 All major storages and catchment inflows in the Werribee basin



26.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Werribee basin are shown in Table 26-2.

Table 26-2 Summary of total water resources and water use, Werribee basin, 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	15,600	8,900
Groundwater(2)	8,400	1,800
Recycled water	150,080	55,280

Note:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 26-7.

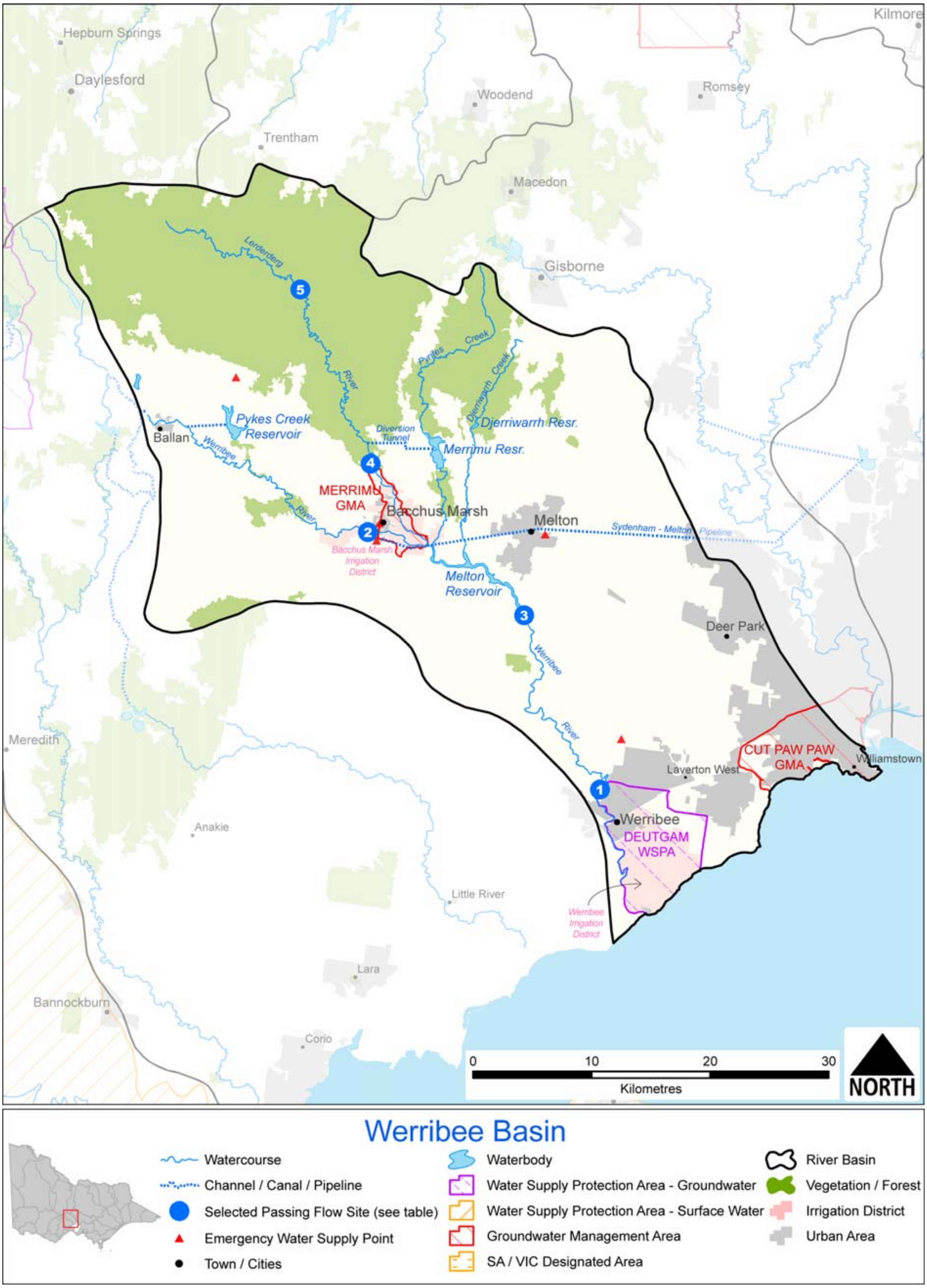
(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the State Water Report 2005/2006.

26.4.1 Infrastructure projects to improve water availability

Southern Rural Water began pumping dead storage from Pykes Creek Reservoir to supply water to Bacchus Marsh irrigators who received a 10% seasonal allocation.

26.5 Location of water resources

Figure 26-2 Map of the Werribee basin



26.6 Surface water resources

26.6.1 Water balance

A surface water balance for the Werribee basin is shown in Table 26-3. Note that only those on-stream storages greater than 1,000 ML capacity have been included in the water balance. In the Werribee basin, this includes Melton Reservoir, Merrimu Reservoir and Pykes Creek Reservoir.

Table 26-3 Balance of surface water in the Werribee basin

Water account component	2006/07 (ML)	2005/06 (ML)
Major on-stream storage		
Volume in storage at start of year	10,900	22,900
Volume in storage at end of year	6,000	10,900
Change in storage	**-4,900**	**-12,000**
Inflows		
Catchment inflow(1)	15,400	19,200
Transfers from other basins	0	0
Return flow from irrigation	200	600
Treated wastewater discharged back to river	0	0
Sub-total	**15,600**	**19,800**
Usage		
Urban diversions	100	130
Irrigation district diversions(2)	3,400	7,700
Licensed diversions from unregulated streams	500	400
Small catchment dams(3)	4,900	9,300
Sub-total	**8,900**	**17,500**
Losses		
Net evaporation losses from major storages	2,600	2,100
Evaporation from small catchment dams(3)	2,500	5,400
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	5,600	5,900
Sub-total	**10,700**	**13,400**
Water passed at outlet of basin		
River outflows to Port Phillip Bay	900	900

Notes:

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

(2) Urban diversions in the State Water Report 2005/2006 were overstated by 2,400 ML. The 2005/06 urban diversions in Table 26-3 are the corrected volume.

(3) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(4) Losses estimated using loss functions from the Werribee REALM.

26.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 26-4 below have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 26-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	5,900	1,500	n/a
Registered commercial and irrigation	7,600	3,400	n/a
Total	**13,500**	**4,900**	**7,400**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

26.6.3 Water entitlement transfers

A summary of Victorian entitlements transferred into and out of the Werribee basin is presented in Table 26-5.

Over 60 temporary trades occurred in Southern Rural Water's Werribee and Bacchus Marsh irrigation districts with 963 ML traded. No permanent trades were made.

Table 26-5 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	963	963	61	0
Total 2006/07	**0**	**0**	**0**	**0**	**963**	**963**	**61**	**0**
Total 2005/06	**0**	**0**	**0**	**0**	**1,657**	**1,657**	**104**	**0**

Note:

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

26.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 26-6. 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 2006/07. For multi-year entitlements, compliance is assessed based on the total volume of water diverted over the term of the entitlement. Therefore it is possible that the volume diverted in any given year may exceed the average bulk entitlement volume.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 26-6 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)[1]	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance?[2] [3]
Central Highlands Water					
Ballan[4]	1	451	0	0	Yes
Blackwood and Barry's Reef	1	140	0	33	Yes
Western Water					
Myrniong	1	58	0	32	Yes
Werribee system – urban	5	8,500	0	32	Yes
Southern Rural Water					
Werribee system	5	27,040	0	3,445	Yes
Total annual volume of bulk entitlements 2006/07		**36,189**	**0**	**3,542**	
Total annual volume of bulk entitlements 2005/06		**36,189**	**0**	**7,863**	
Licensed diversions from unregulated streams 2006/07		*1,185*		*500*	
Licensed diversions from unregulated streams 2005/06		*919*		*400*	

Notes:

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

(2) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.

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

(4) Although no water was diverted under this bulk entitlement, a small amount of unmetered water was taken form the Colebrook Reservoir for emergency supply to Blackwood.

26.7 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 26-7.

The Werribee basin contains the whole Deutgam WSPA and Merrimu GMA as well as part of the Cut Paw Paw GMA. The volume extracted from the Deutgam WSPA fell by approximately 60% compared with 2005/06 after extractions on some licences were qualified. From the beginning of the year to 8 June they received 25% of licensed entitlement and then extractions were banned for the remainder of the year. During 2006/07 the depth boundary for the Merrimu GMA was also revised to allow for additional access to groundwater.

Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts.

Table 26-7 Licensed groundwater volumes, Werribee basin 2006/07

WSPA/GMA(1)	GMA/WSPA depth limits(2) (m)	Entitlement limit(3) (ML/year)	Licensed entitlement(4) (ML/year)	Metered use (ML)	Estimated use in unmetered bores(5) (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Cut Paw Paw GMA (77%)	>50	2,802	412	0	124	124	123
Merrimu GMA (100%)	<30	450	450	79	0	79	120
Deutgam WSPA (100%)	≤30	5,100	5,100	1,093	0	1,093	2,660
Total		**8,352**	**5,962**	**1,172**	**124**	**1,295**	**2,903**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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

(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.

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

(5) In non-metered areas, use has been estimated at 30% of licensed entitlement.

An estimate of domestic and stock groundwater use is provided in Table 26-8. Groundwater is not used to supplement urban supplies in the Werribee basin.

Table 26-8 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores(1)(2)	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Cut Paw Paw GMA (77%)	2	4
Merrimu GMA (100%)	13	26
Deutgam WSPA (100%)	257	514
Total	**272**	**544**

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 volume in the Table 26-7.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by the surface area percentage in the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

26.8 Drought contingency measures

A range of drought contingency measures were undertaken in the Werribee basin in 2006/07. These include:

- restricting urban and rural water use (discussed below)
- providing access to emergency water supply points.
- water carting from Colebrook Reservoir to Blackwood and Bacchus Marsh to Myrniong
- use of unallocated water in Lake Merrimu for Bacchus Marsh irrigators
- pumping dead storage from Pykes Creek Reservoir
- supplying Melton and Bacchus Marsh from the Melbourne system
- carry-over of irrigation allocation from the previous year
- use of recycled water for irrigation at Werribee.

There were two qualifications of rights declared in the Werribee basin in 2006/07. These are presented in Table 26-9.

Table 26-9 Qualifications of rights

Qualification type	Qualification description
Access to unallocated water	Changed the Bulk Entitlement (Werribee System – Irrigation) Conversion Order 1997 to allow Southern Rural Water to take 1,200 ML of unallocated water in Lake Merrimu to maintain the viability of critical businesses relying on water from the Bacchus Marsh irrigation system Date: From 31 October 2006 to 30 June 2007
Differential access by priority entitlement holders	Qualified the Deutgam WSPA to limit extractions on some licences to 25% of licensed entitlement from the beginning of the year until 8 June, when the qualification was amended to 0% of licensed entitlement Date: From 1 July 2006 to 30 June 2007

26.9 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 diverters in the Werribee system received an allocation of 10% of their entitlement.

Groundwater use was unrestricted in the Werribee basin during 2006/07.

Table 26-10 Seasonal allocations and restrictions on water use in Werribee basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Ballan	Stage 2 from July 2006, increasing to Stage 3 from September 2006, increasing to Stage 4 from November 2006 to June 2007
	Barry's Reef and Blackwood	Stage 1 from July 2006, increasing to Stage 2 from December 2006, increasing to Stage 3 from March 2007 to June 2007
	Toolern, Diggers Rest, Myrniong, Bacchus Marsh and Melton	In line with restrictions for Melbourne, Stage 1 from September 2006, increasing to Stage 2 from November 2006, increasing to Stage 3 from January 2007, increasing to Stage 3a from April 2007 to June 2007
Licensed diversions from unregulated streams	Lerderderg River	Irrigation ban from July 2006 to June 2007
	Kororoit Creek	Irrigation ban from July 2006 to June 2007
	Werribee River unregulated	Irrigation ban from July 2006, unrestricted from August 2006, irrigation ban from September 2006, unrestricted from October 2006 to June 2007
Irrigation and regulated diversions	Werribee system (Werribee Irrigation District, Bacchus Marsh Irrigation District, Werribee River)	Werribee Irrigation District and diverters below Melton, 10% of water right in July 2006, with no change to June 2007. Bacchus Marsh Irrigation District and diverters above Melton, 0% of water right in July 2006 increasing to 10% in October 2006, with no change to June 2007
Groundwater	Deutgam WSPA	Groundwater extractions qualified to 25% of licence volume from the beginning of the year to when they were further qualified to 0% in June 2007

26.10 Recycled water

Five wastewater treatment plants operate within the Werribee basin. Overall, 37% of wastewater was reused in 2006/07, some 12,817 ML more than the 42,464 ML recycled in 2005/06.

The majority of water recycling in the basin occurs at Melbourne Water's Western Treatment Plant, which reused 36% of wastewater, including 26,317 ML for on-site irrigation and environmental management and 13,856 ML for habitat management at Ramsar-listed wetlands. The main reason for the increase in recycled water usage was greater sales from Melbourne Water to City West Water for on-sell to urban customers, and to Southern Rural Water for use in the Werribee Irrigation District.

Table 26-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)					Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				To retailers	Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Altona	4,744	0	0%	0	0	0	0	0	0	4,744
Ballan	73	75	103%	0	0	75	0	0	0	-2
Melton	2,885	2,885	100%	0	435	2,450	0	0	0	0
Parwan (Bacchus Marsh)	881	881	100%	0	0	881	0	0	0	0
Western Treatment Plant	141,497	51,440	36%	11,047	220	26,317	13,856	0	0	90,057
Total 2006/07	**150,080**	**55,281**	**37%**	**11,047**	**655**	**29,723**	**13,856**	**0**	**0**	**94,799**
Total 2005/06	**162,413**	**42,464**	**26%**	**1,279**	**332**	**25,788**	**15,065**	**0**	**0**	**119,949**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006.

(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.

26.11 Water for the environment

26.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Werribee basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Central Highlands Water, Western Water and Southern Rural Water
- water set aside for the environment through the operation of licensed diversions with passing flow conditions (regulated and unregulated waterways)
- all other water in the basin not allocated for consumptive use.

26.11.2 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin.

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 (shown as 1 in Figure 26-2)
	Passing flow rules	• The lesser of 5 ML/day or the natural inflow
	Compliance point	Bacchus Marsh Diversion Weir (gauging station) (shown as 2 in Figure 26-2)
	Passing flow rules	• 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 (shown as 3 in Figure 26-2)
	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 (shown as 4 in Figure 26-2)

	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 (shown as 5 in Figure 26-2)
	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

Western Water reported that it met all passing flow requirements under its bulk entitlements at all sites in the Werribee basin.

Southern Rural Water did not report any incidences of non-compliance of its passing flow obligations.

26.11.3 Water leaving the basin

The amount of water flowing from the Werribee basin into Port Phillip Bay was 900 ML in 2006/07. This represents 6% of the total inflows into the basin, relatively unchanged from the 5% in 2005/06, but much less than the 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).

27 Moorabool basin

This chapter sets out the accounts for the Moorabool basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

27.1 Moorabool basin summary

Inflows in the Moorabool basin totalled 25,100 ML in 2006/07, which was exceeded by the volume diverted for consumptive purposes (26,700 ML). This was the case in spite of Ballarat (which is partly supplied from the Moorabool basin) being on Stage 4 water restrictions for most of the year. The very dry conditions experienced in the Moorabool basin over the last two years has had a severe impact on Ballarat's water supply, with the Lal Lal Reservoir (which supplies Ballarat, and other towns) 5% full by the end of the year.

In order to secure Ballarat's water supply for the future, the Goldfields Superpipe from the Waranga Western Channel in the Goulburn basin is being connected to Ballarat's water supply. The 86 kilometre pipeline from Bendigo's Sandhurst Reservoir will link to Ballarat's White Swan Reservoir (in the Barwon basin) and provide up to 18,000 ML each year.

In 2006/07, however, water authorities had to implement a number of drought contingency measures to secure water supplies in the basin. Two qualifications of rights were declared – one reducing passing flows to retain water in storage for Ballarat, the other ensuring Meredith's water supply was secure. Other measures included imposing Stage 4 restrictions on urban use for much of the year, banning rural diversions from the Moorabool River and linking Lethbridge to the Stoney Creek system.

27.2 Responsibilities for management of water resources

Table 27-1 shows the responsibilities of various authorities within the Moorabool basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 27-1 Responsibilities for water resources management within the Moorabool basin, 2006/07

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.

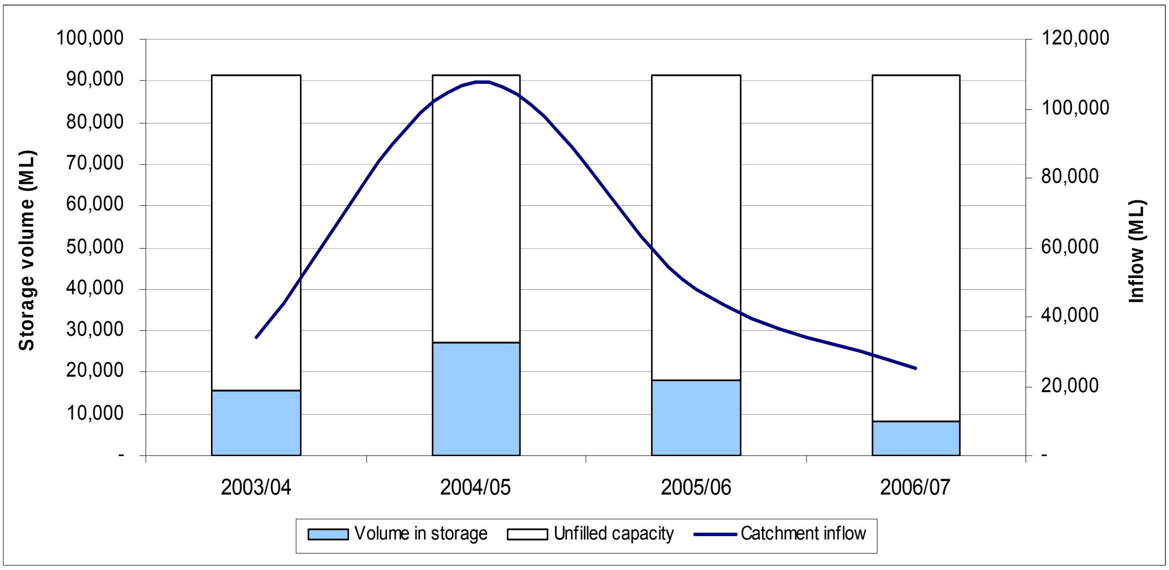
(2) The vast majority of Ballarat is outside the Moorabool basin's boundary.

27.3 Rainfall, inflows and storages in 2006/07

In 2006/07, rainfall in the Moorabool basin ranged between 40% and 80% of the long term average, a reduction from the previous three years which experienced rainfall nearer the long term average. Total inflows in 2006/07 were 26% of the long term average of 97,000 ML.

The basin includes six storages: Bostock, Upper Stony Creek, Korweinguboora, Lal Lal, Wilsons and Moorabool Reservoirs. Lal Lal Reservoir accounts for around two-thirds of the basin's storage capacity and its stored volume fell from 16,600 ML to 3,300 ML during the year. As a result, total storage volumes were at 9% of capacity by the end of the year.

Figure 27-1 All major storages and catchment inflows in the Moorabool basin



27.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Moorabool basin are shown in Table 27-2.

Table 27-2 Summary of total water resources and water use in the Moorabool basin, 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	25,100	26,700
Groundwater(2)	3,500	2,700
Recycled water	0	0

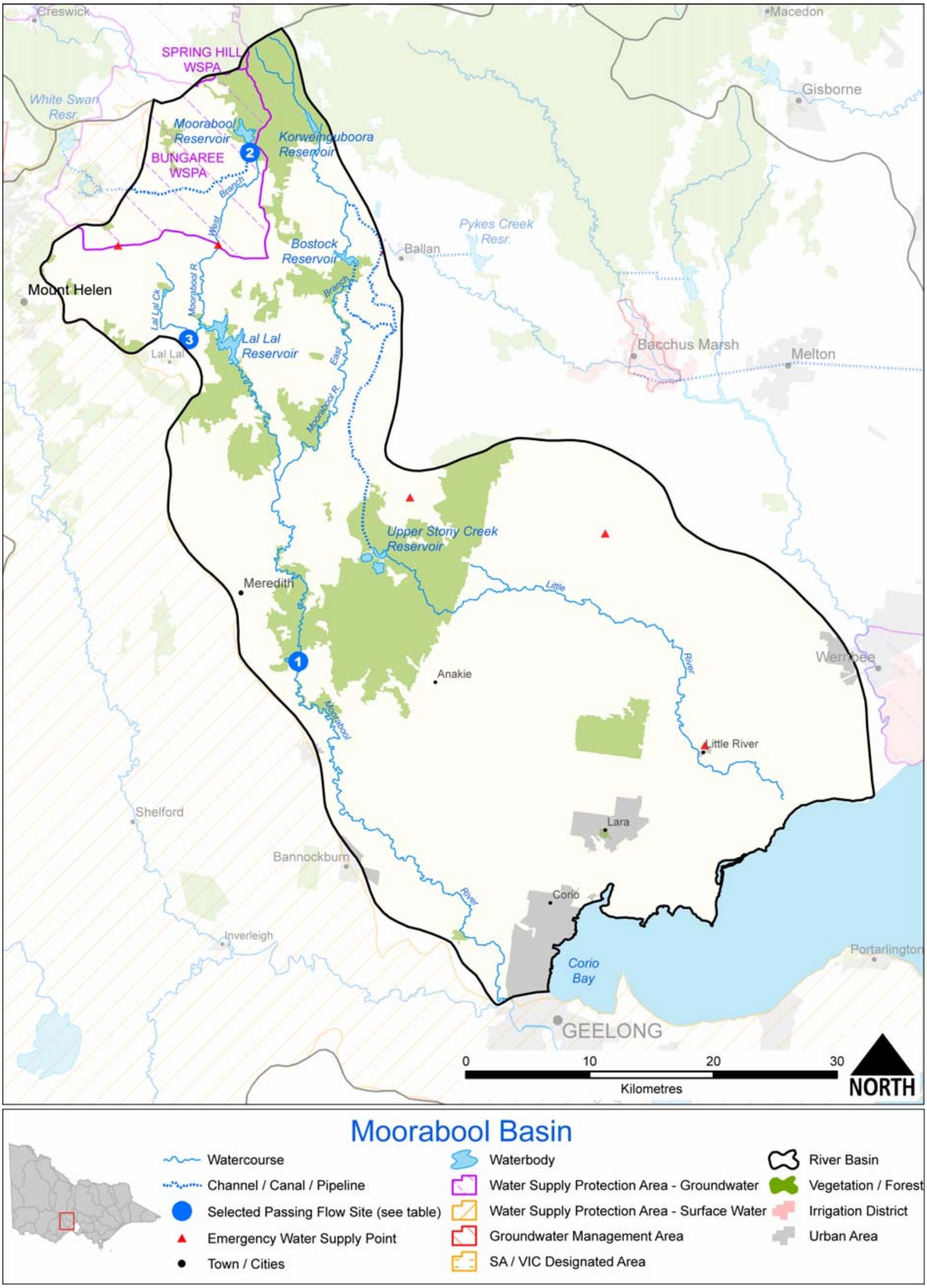
Notes:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 27-6.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the State Water Report 2005/2006.

27.5 Location of water resources

Figure 27-2 Map of the Moorabool basin



27.6 Surface water resources

27.6.1 Water balance

A surface water balance for the Moorabool basin is shown in Table 27-3.

The majority of water used for consumptive purposes in the basin is sourced from small catchment dams.

Table 27-3 Balance of surface water in the Moorabool basin

Water account component	2006/07 (ML)	2005/06 (ML)
Major on-stream storage		
Volume in storage at start of year	17,100	22,400
Volume in storage at end of year	3,800	17,100
Change in storage	**-13,300**	**-5,300**
Inflows		
Catchment inflow(1)	25,100	47,900
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**25,100**	**47,900**
Usage		
Urban diversions(2)	9,780	12,580
Transfers to Barwon basin (White Swan Reservoir) (2)	210	2,300
Licensed diversions from unregulated streams	1,400	1,600
Small catchment dams(3)	15,300	22,200
Sub-total	**26,700**	**38,700**
Losses		
Net evaporation losses from major storages	1,700	1,800
Evaporation from small catchment dams(3)	5,700	7,300
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	900	2,100
Sub-total	**8,300**	**11,200**
Water passed at outlet of basin		
River outflows to Port Phillip Bay (Little River)	2,900	1,500
River outflows to the Barwon River (Moorabool River)	500	1,800

Notes:

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

(2) The urban diversions figure of 9,780 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 210 ML was 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.

(3) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(4) 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.

27.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 27-4 below are based on the methodology outlined in Chapter 5.

Table 27-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	6,100	2,100	n/a
Registered commercial and irrigation	22,800	13,200	n/a
Total	**28,900**	**15,300**	**21,000**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

27.6.3 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 2006/07.

27.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 27-5.

Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2006/07.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 27-5 Volume of water diverted under surface water entitlements in the Moorabool basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)(1)	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance?(2) (3)
Barwon Water					
Lal Lal	3	7,000	0	819	Yes
Meredith	1	600	0	389	Yes
Upper East Moorabool System	1	9,000	0	1,581	Yes
She Oaks	3	2,000	0	0	Yes
Central Highlands Water					
Lal Lal	3	14,000	0	6,986	Yes
Upper West Moorabool System	1	10,500	0	206	Yes
Total annual volume of bulk entitlements 2006/07		**43,100**	**0**	**9,981**	
Total annual volume of bulk entitlements 2005/06		**43,100**	**0**	**14,915**	
Licensed diversions from unregulated streams 2006/07		*2,022*		*1,400*	
Licensed diversions from unregulated streams 2005/06		*3,605*		*1,600*	

Notes:

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

(2) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.

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

27.7 Groundwater resources

A summary of the licensed entitlements and use for the Bungaree WSPA in the Moorabool basin, excluding domestic and stock use, is presented in Table 27-6. The Bungaree WSPA was used as an emergency supply for Ballarat in 2006/07 and usage in the WSPA increased by more than one-third compared with 2005/06.

Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts.

Table 27-6 Licensed groundwater volumes, Moorabool basin 2006/07

WSPA/GMA[1]	GMA/ WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Bungaree WSPA (67%)	All depths	3,512	3,512	2,412	0	2,412	1,798
Total		**3,512**	**3,512**	**2,412**	**0**	**2,412**	**1,798**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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

(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.

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

An estimate of domestic and stock groundwater use is provided in Table 27-7.

Table 27-7 Number of domestic and stock bores and estimated use, 2005/06

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Bungaree WSPA (67%)	168	336
Total	**168**	**336**

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 volume in the Table 27-6.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965 multiplied by the surface area percentage in the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

27.8 Drought contingency measures

A range of drought contingency measures were undertaken in the Moorabool basin in 2006/07. These include:

- restricting urban and rural water use (discussed below)
- providing access to emergency water supply points
- voluntary demand reduction measures implemented in March that reduced water consumption by 15% compared with Stage 4 demand
- accessing groundwater for Ballarat via licence transfers in the Bungaree WSPA
- Barwon Water commencing construction of pipeline from Sheoaks treatment plant to supply Lethbridge in order to augment the supply to the Meredith system in the event of continued dry conditions.

Rights to water were qualified on two occasions in the Moorabool basin in 2006/07. These are summarised in Table 27-8.

Table 27-8 Qualifications of rights

Qualification type	Qualification description
Reduce passing flows	Changed the Barwon Water and Central Highlands Water bulk entitlements for Lal Lal Reservoir and Barwon Water's Upper West Moorabool System bulk entitlement to waive passing flow requirements downstream of Upper West Moorabool, Lal Lal and White Swan Reservoirs in order to reserve water for emergency supply to Ballarat Dates: 31 October 2006 to 30 June 2007
Additional diversion point	Changed Barwon Water's Lal Lal bulk entitlement to enable Barwon Water's share of the reservoir to be extracted at a different location in order to secure an emergency supply to Meredith Dates: From 30 October 2006 to 30 June 2007

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

Restrictions applying to urban customers and licensed diversions are shown in Table 27-9.

Groundwater use was unrestricted in the Moorabool basin during 2006/07.

Table 27-9 Seasonal allocations and restrictions on water use in Moorabool basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Geelong and other towns served by Barwon Water in the Moorabool basin including Meredith, Lethbridge, Anakie, Bannockburn, Little River.	Stage 1 from July 2006, increasing to Stage 2 from September 2006, Stage 3 in November 2006 and Stage 4 from December 2006 to June 2007
	Gordon, Wallace	Stage 2 from July 2006 increasing to Stage 3 in September 2006 and Stage 4 from November 2006 to June 2007
Licensed diversions from unregulated streams	Moorabool River	Winter fill ban from August 2006, reducing to winter fill restrictions in September 2006, increasing to irrigation ban in October 2006 before the establishment of a roster for winter fill in June 2007

27.10 Recycled water

There are no wastewater treatment plants within the Moorabool basin.

27.11 Water for the environment

27.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Moorabool basin EWR comprised the following components:

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

27.11.2 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 (shown as 1 in Figure 27-2)
	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 (shown as 2 in Figure 27-2)
	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 (shown as 3 in Figure 27-2)
	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 non-compliance at some sites in 2006/07.

Central Highlands Water met all its passing flow requirements during the year, noting that passing flows were not required to be met following the qualification of rights in October.

27.11.3 Water leaving the basin

The amount of water flowing from the Moorabool basin into Port Phillip Bay and the Barwon River was 3,400 ML in 2006/07, or 14% of the total inflows into the basin. This is approximately double the proportion that left the basin in 2005/06, but this was only possible because of a large draw-down in the volume of water in storage. This water comprises consumptive water that was not used under entitlements and the EWR (passing flows and any water above cap).

28 Barwon basin

This chapter sets out the accounts for the Barwon basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

28.1 Barwon basin summary

Low rainfall in the Barwon basin has contributed to a decline in inflows in recent years – in 2006/07 inflows were 23% of the long term average. Although surface water diversions in the basin reduced significantly during this time (2006/07 usage was approximately half of what was used in 2004/05), water authorities have had to draw down storage levels to supply consumptive use.

With the continued decline of surface water supplies, the basin is increasingly relying on groundwater to meet consumptive needs. Barwon Water, which used no groundwater for Geelong in 2004/05, extracted 11,800 ML or approximately 35% of Geelong's total water consumption in 2006/07. The government also announced that Geelong will be connected to Melbourne's water supply by 2011 to boost its supply. However, before that occurs, the Anglesea borefield will be upgraded to supply an additional 7,000 ML per year.

Barwon Water customers in the basin moved to Stage 4 restrictions in December 2006 and bans and restrictions applied to irrigators on the Barwon River for much of the year.

Ballarat was on Stage 4 restrictions from November 2006 and Central Highlands Water implemented a campaign to reduce demand even further.

28.2 Responsibilities for management of water resources

Table 28-1 shows the responsibilities of various authorities within the Barwon basin.

Table 28-1 Responsibilities for water resources management within the Barwon basin, 2006/07

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

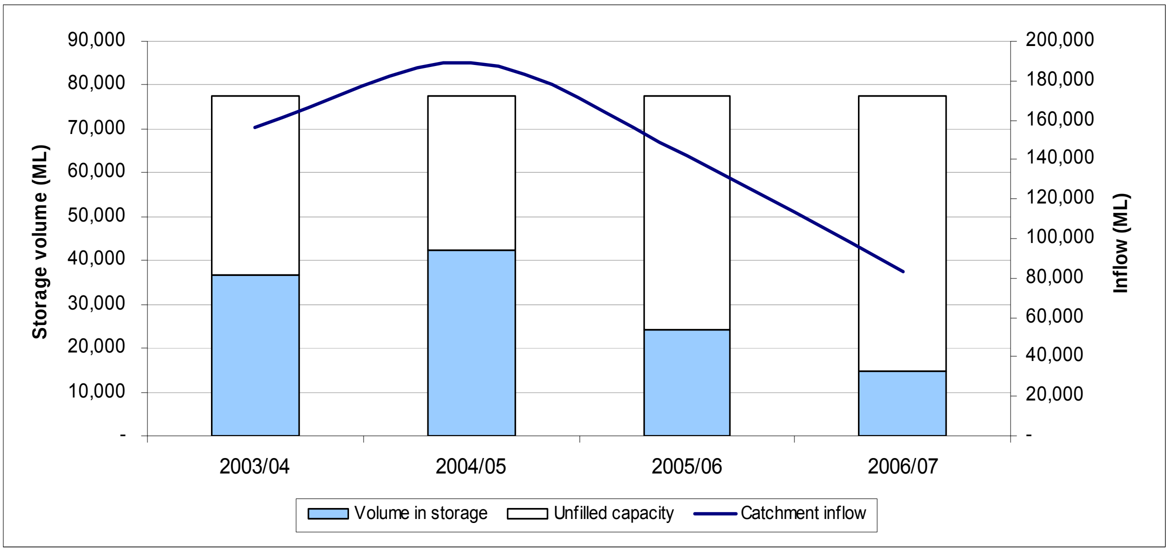
28.3 Rainfall, inflows and storages in 2006/07

In 2006/07, rainfall in the Barwon basin ranged between 40% and 80% of the long term average, a decrease from the 60-100% experienced in 2005/06.Inflows in 2006/07 were 23% of the long term average (360,000 ML) compared with 39% in 2005/06.

Storages began 2006/07 with 31% of the total capacity in storage; however this volume dropped to 19% by the end of the year. Wurdee Boluc Reservoir, Geelong's largest storage in the basin, fell from 15,789 ML to 9,607 ML during the year.

The low inflows and storage levels likely contributed to a number of blue-green algal blooms, e.g. Blue Waters Lake (in March – affecting recreational users and the stormwater reserve), Barwon River (at 'The Falls' in May, affecting irrigation and recreation) and Painkalac Reservoir (May, closing the reservoir that supplies drinking water).

Figure 28-1 All major storages and catchment inflows in the Barwon basin



28.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Barwon basin are shown in Table 28-2.

Barwon Water sources water from the Barwon and Moorabool basins to supply Geelong, which is located in both basins.

Table 28-2 Summary of total water resources and water use in the Barwon basin, 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	91,300	38,300
Groundwater(2)	22,000	13,000
Recycled water	25,020	3,430

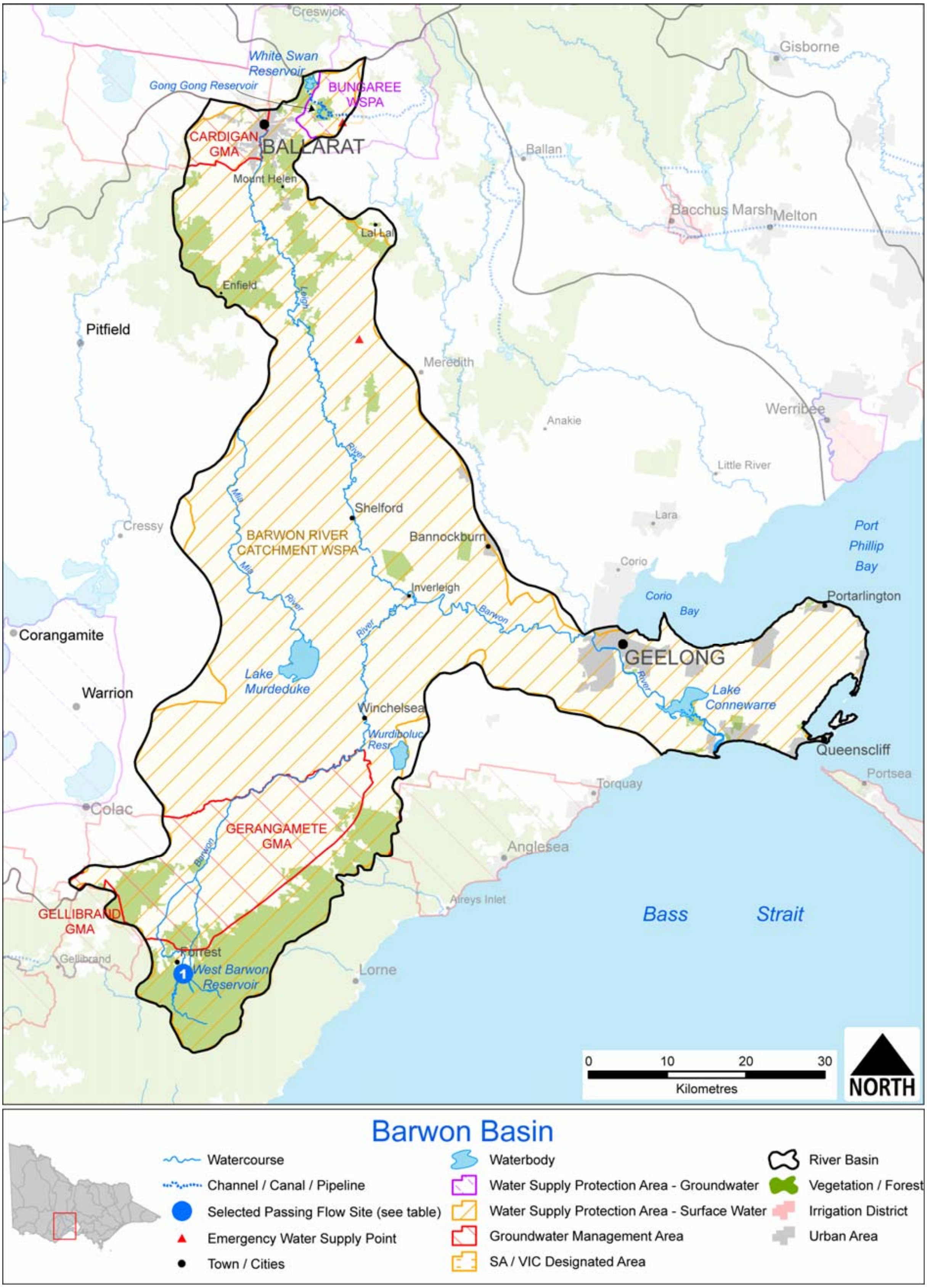
Note:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 28-6.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the State Water Report 2005/2006. The Gerangamete GMA is one exception in the Barwon basin and this is discussed in note 7 beneath Table 28-6.

28.5 Location of water resources

Figure 28-2 Map of the Barwon basin



28.6 Surface water resources

28.6.1 Water balance

A surface water balance for the Barwon basin is shown in Table 28-3. Central Highlands Water operates two major on-stream storages within the basin, namely White Swan Reservoir and Gong Gong Reservoir, whilst Barwon Water operates the West Barwon Dam. Small catchment dams in the Barwon basin have a capacity that is approximately equivalent to the on-stream storages in the basin.

Transfers from the Moorabool basin to White Swan Reservoir in the Barwon basin (for supply to Ballarat) fell in 2006/07 because of low water availability in the Moorabool basin.

Table 28-3 Balance of surface water in the Barwon basin

Water account component	2006/07 (ML)	2005/06 (ML)
Major on-stream storage		
Volume in storage at start of year	8,500	18,700
Volume in storage at end of year	5,200	8,500
Change in storage	**-3,300**	**-10,200**
Inflows		
Catchment inflow(1)	83,400	142,000
Inflows from the Moorabool River	500	1,800
Transfers from Moorabool basin to White Swan Reservoir	210	2,300
Return flow from irrigation	0	0
Treated wastewater discharged back to river	7,150	8,130
Sub-total	**91,300**	**154,200**
Usage		
Urban diversions	17,460	28,530
Licensed diversions from unregulated streams	1,700	3,800
Small catchment dams(2)	19,100	30,900
Sub-total	**38,300**	**63,200**
Losses		
Net evaporation losses from major storages	1,300	1,500
Evaporation from small catchment dams(2)	21,200	12,500
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	2,100	6,200
Sub-total	**24,600**	**20,200**
Water passed at outlet of basin		
River outflows to the ocean	31,700	81,000

Notes:

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

(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

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

28.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 28-4 are provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 28-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	10,400	3,200	n/a
Registered commercial and irrigation	30,600	15,900	n/a
Total	**41,000**	**19,100**	**40,300**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

28.6.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements or diversion licences within the basin or across basin boundaries in 2006/07.

28.6.4 Volume diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 28-5. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2006/07. For multi-year entitlements, compliance is assessed based on the total volume of water diverted over the term of the entitlement. Therefore it is possible that the volume diverted in any given year may exceed the average bulk entitlement volume.

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 28-5 Volume of water diverted under surface water entitlements in the Barwon basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)(1)	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance? (2)(3)
Barwon Water					
Upper Barwon system	3	43,467	0	13,790	Yes
Central Highlands Water					
Yarrowee – White Swan system(4)	3	12,267	0	3,672	Yes
Total annual volume of bulk entitlements 2006/07		**55,733**	**0**	**17,462**	
Total annual volume of bulk entitlements 2005/06		**55,733**	**0**	**28,534**	
Licensed diversions from unregulated streams 2006/07		*4,740*		*1,700*	
Licensed diversions from unregulated streams 2005/06		*4,199*		*3,800*	

Notes:

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

(2) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.

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

(4) This bulk entitlement overlaps with Central Highlands Water's Upper West Moorabool system bulk entitlement in the Moorabool basin.

28.7 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 28-6.

The Barwon basin contains part of the Cardigan GMA, Gellibrand GMA, Gerangamete GMA and Bungaree WSPA. The Gellibrand GMA's permissive consumptive volume (PCV) will be set subsequent to an investigation of the extent to which it interacts with surface water. Extractions in Gerangamete GMA, which also has the highest PCV, increased almost six-fold compared with 2005/06 as Barwon Water relied on groundwater as an emergency supply for Geelong. The Gerangamete GMA is now experiencing a declining long term trend in water levels.

Groundwater allocation and use for unincorporated areas have not been included in the 2006/07 water accounts.

Table 28-6 Licensed groundwater volumes, Barwon basin 2006/07

WSPA/GMA(1)	GMA/ WSPA depth limits(2) (m)	Entitlement limit(3) (ML/year)	Licensed entitlement(4) (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Cardigan GMA (20%)	All depths	785	152	0	45	45	50
Gellibrand GMA (10%)(5)	All depths	0	0	0	0	0	0
Gerangamete GMA (86%)(6)(7)	>60	20,000	20,000	11,807	0	11,807	2,000
Bungaree WSPA (24%)	All depths	1,246	1,246	856	0	856	638
Total		**22,032**	**21,398**	**12,663**	**45**	**12,708**	**2,688**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage (with the exception of Gerangamete GMA – see note 6). This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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

(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.

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

(5) The PCV and licensed entitlement for the Gellibrand GMA are set at zero because studies indicate that any groundwater extractions will directly impact on streamflow in the Gellibrand River.

(6) The PCV for the Gerangamete GMA has the following limits: 20,000 ML in one year, 80,000 ML over 10 years and 400,000 ML over 100 years. The entitlement limit in Table 28-6 represents the single year limit; however compliance would also need to be assessed at the 10 year and 100 year level.

(7) Barwon Water is the sole licence holder in the Gerangamete GMA and uses groundwater to supplement Geelong's water supply (see Table 28-8). As all of this groundwater would be used in the Barwon basin, all volumes have been 100% allocated to the Barwon basin despite the Gerangamete GMA having 14% of its surface area in the Corangamite basin.

An estimate of domestic and stock groundwater use is provided in Table 28-7.

Table 28-7 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores(1)(2)	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Cardigan GMA (20%)	95	190
Gellibrand GMA (10%)	0	0
Gerangamete GMA (86%)	4	8
Bungaree WSPA (24%)	60	120
Total	**159**	**318**

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 volume in Table 28-6.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

Groundwater was increasingly used as part of the urban water supply for Geelong in 2006/07. The capacity of the Barwon Downs borefield was upgraded in April 2007 and groundwater supplied 35% of greater Geelong's water supply during the year. This compares with 2004/05 when no groundwater was used. The licensed entitlements and metered use for this supply is provided in Table 28-8.

Table 28-8 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2006/07 (ML)	Metered use 2005/06 (ML)
Greater Geelong area	20,000	11,807	1,998

28.8 Drought contingency measures

A range of drought contingency measures were undertaken in the Barwon basin in 2006/07. These include:

- imposing restrictions on urban and rural water use (discussed below)

- implementation of a number of emergency water supply points
- carting water from Colac to rural customers on Boundary Creek
- increased groundwater use for Geelong and Ballarat
- connecting Newlyn Reservoir to the Ballarat System
- additional use of groundwater by upgrading the capacity of the Barwon Downs borefield from 35 ML/day to 55 ML/day.

Construction of the Goldfields Superpipe, which will draw water from the Waranga Western Channel in the Goulburn basin, to Lake Eppalock the Campaspe basin and then to Ballarat's supply system, commenced in February 2007. This pipeline will supply the Ballarat region with 18,000 ML each year from June 2008.

No rights were qualified in the Barwon basin in 2006/07.

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

Restrictions applying to urban customers and licensed diversions are shown in Table 28-9.

Groundwater use was unrestricted in the Barwon basin during 2006/07.

Table 28-9 Seasonal allocations and restrictions on water use in Barwon basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Barwon Water customers (Geelong, other towns on Bellarine Peninsula, Ocean Grove etc)	Stage 1 from July 2006, increasing to Stage 2 from September, Stage 3 in November and Stage 4 from December 2006 to June 2007
	Ballarat, Bungaree, Buninyong	Stage 2 from July 2006, increasing to Stage 3 from September, and Stage 4 from November 2006 to June 2007
	Connewarra	Stage 1 from July 2006, increasing to Staged 2 from October, and Stage 3 in November 2006 to June 2007
Licensed diversions from unregulated streams	Barwon River – Zone A	Irrigation ban February to June 2007
	Barwon/Leigh River	Stage 3 (50% reduction) from September 2006 increasing to irrigation ban in Zone A and B and reducing to a roster in Zone C and Leigh River from January to June 2007

28.10 Recycled water

Both Barwon Water and Central Highlands Water operate wastewater treatment plants within the Barwon basin.

In 2005/06, some 10% or 3,429 ML of wastewater in the Barwon basin was recycled, mostly for agricultural purposes. This is an increase from 9% (2,630 ML) on the previous year and notably, the volume of recycled water increased even though the volume of wastewater treated declined. The increase was primarily due to the completion of new infrastructure at the Black Rock treatment plant in 2006 which increased the recycled water supply capacity.

Table 28-10 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Ballarat North	1,767	0	0%	0	0	0	0	1,767	0
Ballarat South	5,429	43	0%	3	0	0	40	5,386	0
Bannockburn	26	26	100%	0	26	0	0	0	0
Black Rock	17,531	3,094	13%	0	2,298	0	796	0	14,438
Portarlington	247	247	100%	0	247	0	0	0	0
Winchelsea	20	20	100%	0	20	0	0	0	0
Total 2006/07	**25,019**	**3,429**	**10%**	**3**	**2,590**	**0**	**836**	**7,153**	**14,438**
Total 2005/06	**28,955**	**2,630**	**6%**	**0**	**1,796**	**0**	**834**	**8,131**	**18,989**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006.

(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.

28.11 Water for the environment

28.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Barwon basin EWR comprised the following components:

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

28.11.2 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin.

Table 28-11 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. The location of this point is presented in Figure 28-2.

Table 28-11 Selected passing flow requirements in the Barwon basin

River	Passing flow	
West Barwon River, East Barwon River, Callahan Creek, Dewing Creek, Matthews Creek and Pennyroyal Creek	Instrument where passing flows are specified	Bulk Entitlement (Upper Barwon System) Conversion Order 2002
	Responsible authority	Barwon Water
	Compliance point	West Barwon diversion weir (West Barwon Dam) (shown as 1 in Figure 28-2)
	Passing flow 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 in the upper Barwon streams diversion area.

Central Highlands Water reported that it met all passing flow requirements under its bulk entitlements at all sites in the Barwon basin.

28.11.3 Streamflow management plans (SFMPs)

In 2006/07 technical studies and administrative processes continued 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.

28.11.4 Water leaving the basin

The amount of water flowing from the Barwon basin into Corio Bay and Bass Strait was 31,700 ML in 2006/07. This represents 38% of the inflows into the basin, compared with 57% in 2005/06 and 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).

The Bellarine Peninsula contains internationally significant wetlands listed under the Ramsar convention which rely on the freshwater inputs from the Barwon basin to ecologically function.

29 Corangamite basin

This chapter sets out the accounts for the Corangamite basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

29.1 Corangamite basin summary

Inflows to the Corangamite basin were substantially lower than previous years and recorded 4% of the long term average in 2006/07. For urban users, these dry conditions had little relevance as towns within the Corangamite basin are supplied from other basins. However, many rural water users in the north of the basin suffered from water shortages as a result of the extremely low stream flows.

The basin's Western District Lakes, however, received significantly less water than previous years. The lakes, which are Ramsar listed wetlands, received 2,300 ML in 2006/07, compared with 53,300 ML in 2005/06 and 245,300 ML in 2004/05. At the end of 2006/07 the largest lakes were at their lowest level for 60 years. Irrigators with licences to take water from Lake Tooliorook were banned from diverting water for the entire year.

29.2 Responsibilities for management of water resources

Table 29-1 shows the responsibilities of various authorities within the Corangamite basin.

Table 29-1 Responsibilities for water resources management within the Corangamite basin, 2006/07

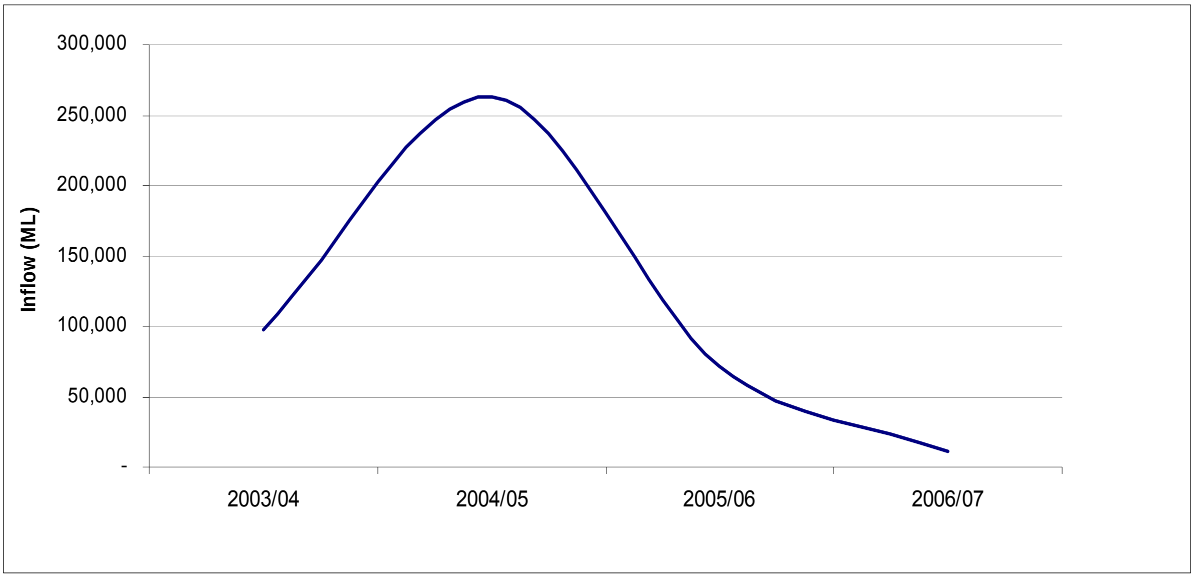
Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water		Groundwater and surface water licensed diversions		
Barwon Water			Urban water supply to Colac (supplied from the Otway Coast basin)	
Central 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 Rainfall, inflows and storages in 2006/07

In 2006/07, rainfall in the Corangamite basin ranged between 40% and 80% of the long term average. However, inflows were 7,300 ML or 4% of the long term average across the basin. Inflows reduced substantially compared with those received in 2005/06, which were 22% of the long term average.

There are no major water supply storages, either on or off-stream, in the Corangamite basin.

Figure 29-1 Catchment inflows in the Corangamite basin



29.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Corangamite basin are shown in Table 29-2.

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.

Table 29-2 Summary of total water resources and water use in the Corangamite basin, 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	13,200	6,900
Groundwater(2)	23,100	5,400
Recycled water	1,840	230

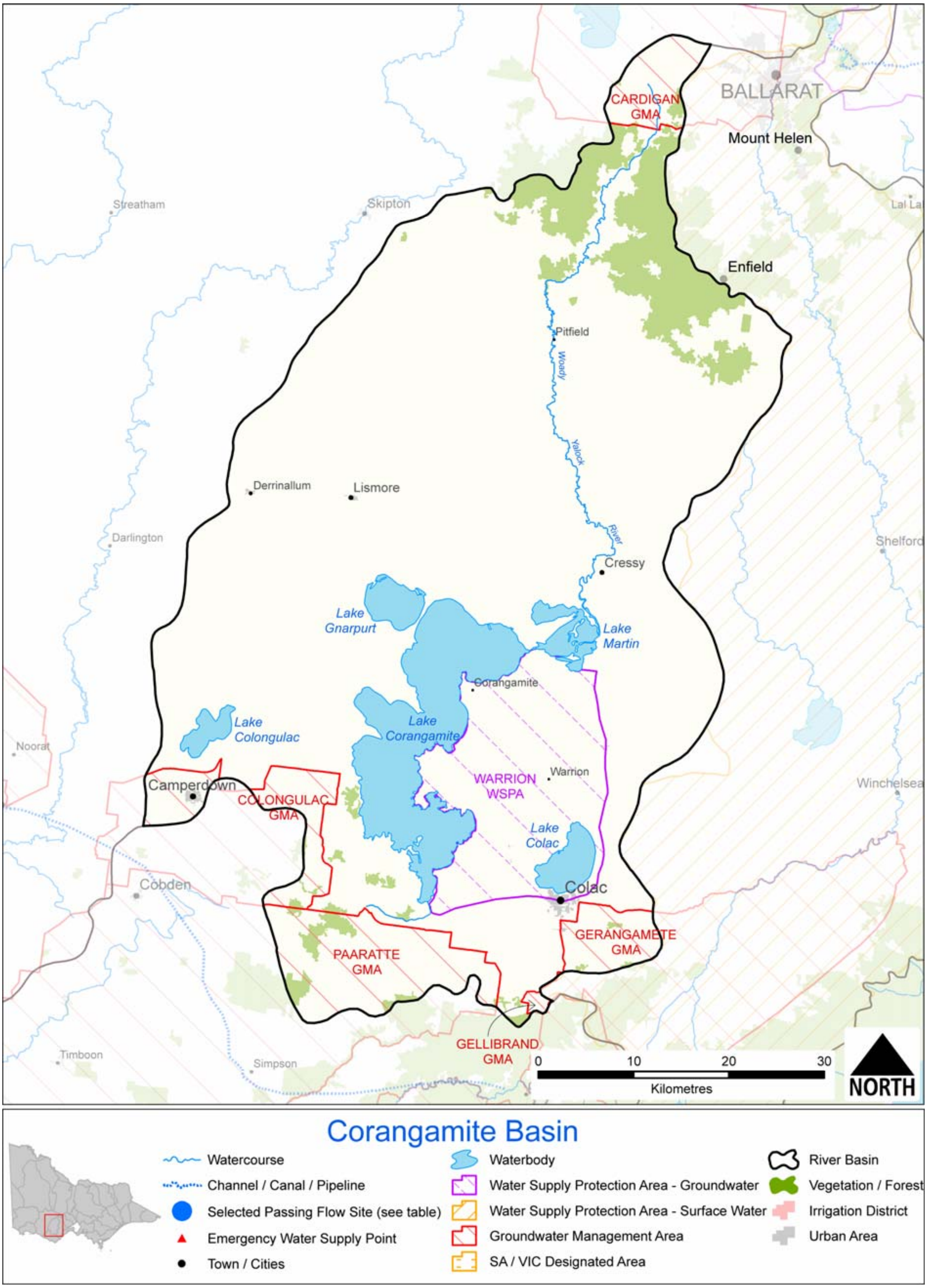
Notes:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 29-5.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the State Water Report 2005/2006. The Gerangamete GMA is one exception in the Corangamite basin and this is discussed in note 6 beneath Table 29-5.

29.5 Location of water resources

Figure 29-2 Map of the Corangamite basin



29.6 Surface water resources

29.6.1 Water balance

A surface water balance for the Corangamite basin is shown in Table 29-3.

Urban water is supplied from sources located outside of the basin due to the better quality of water available in the Otway Coast basin.

Table 29-3 Balance of surface water in the Corangamite basin

Water account component	2006/07 (ML)	2005/06 (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)	11,700	71,000
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	1,510	1,700
Sub-total	**13,200**	**72,700**
Usage		
Urban diversions	0	0
Licensed diversions from unregulated streams	100	500
Small catchment dams(2)	6,800	12,300
Sub-total	**6,900**	**12,800**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(2)	4,000	6,600
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	0	0
Sub-total	**4,000**	**6,600**
Water passed at outlet of basin		
River outflows to the Corangamite Lakes	2,300	53,300

Notes:

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

(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(3) Losses estimated to be zero because data is not readily available.

29.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 29-4 have been provided by the Department of Sustainability and Environment outlined in Chapter 5.

Table 29-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed) (1)	8,100	2,200	n/a
Registered commercial and irrigation	9,900	4,600	n/a
Total	**18,000**	**6,800**	**10,800**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

29.6.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements or diversion licences within the basin or across basin boundaries in 2006/07.

29.6.4 Volume diverted

The only surface water licences utilised in the Corangamite basin are licences on unregulated streams. In 2006/07, licensed volume totalled 984 ML and use was estimated to be 100 ML.

29.7 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 29-5.

The Corangamite basin contains the whole Warrion WSPA as well as part of the Colongulac GMA, Cardigan GMA, Gerangamete GMA and Paaratte GMA. Groundwater use exhibited no uniform trend across each GMU, with extractions in some increasing, whilst others remained the same or decreased. In the Warrion WSPA, which has the largest volume of entitlements within the basin, use fell by 18%.

Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts.

Table 29-5 Licensed groundwater volumes, Corangamite basin 2006/07

WSPA/GMA(1)	GMA/ WSPA depth limits(2) (m)	Entitlement limit(3) (ML/year)	Licensed entitlement(4) (year)	Metered use (ML)	Estimated use in unmetered bores(5) (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Cardigan GMA (19%)	All depths	773	149	0	45	45	51
Colongulac GMA (36%)	≤60	5,175	5,175	420	0	420	389
Gerangamete GMA (14%)(5)	>60	0	0	0	0	0	0
Paaratte GMA (15%)	>120	674	674	0	202	202	140
Warrion WSPA (100%)	All depths	16,500	16,500	2,994	0	2,994	3,650
Total		**23,123**	**22,499**	**3,414**	**247**	**3,661**	**4,231**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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

(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.

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

(5) In non-metered areas, use has been estimated at 30% of licensed entitlement.

(6) Barwon Water is the sole licence holder in the Gerangamete GMA and uses groundwater to supplement Geelong's water supply. As all of this groundwater would be used in the Barwon basin, all volumes have been 100% allocated to the Barwon basin despite the Gerangamete GMA having 14% of its surface area in the Corangamite basin. See Table 28-6 in the Barwon basin chapter for Gerangamete GMA volumes.

An estimate of domestic and stock groundwater use is provided in Table 29-6. Groundwater is not used to supply towns within the Corangamite basin.

Table 29-6 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores(1)(2)	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Cardigan GMA (19%)	94	188
Colongulac GMA (36%)	75	150
Gerangamete GMA (14%)	1	2
Paaratte GMA (15%)	1	2
Warrion WSPA (100%)	700	1,400
Total	**871**	**1,742**

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 volume in the Table 29-5.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

29.8 Drought contingency measures

The main drought contingency measure in place in the Corangamite basin was restrictions on urban and rural water use (discussed below). Barwon Water constructed a new service basin in Colac to provide increased storage over summer. No rights were qualified in the Corangamite basin in 2006/07.

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

Restrictions applying to urban customers and licensed diversions are shown in Table 29-7. The Corangamite basin does not supply any towns with water, so urban water restrictions reflected the conditions of the respective supply systems outside the basin. Barwon

Groundwater use was unrestricted in the Corangamite basin during 2006/07.

Table 29-7 Seasonal allocations and restrictions on water use in Corangamite basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Linton, Rokewood, Smythesdale	Stage 2 from July 2006, increasing to Stage 3 from September 2006, and Stage 4 November 2006 to June 2007
	Beeac, Colac, Cressy, Alvie, Congulac, Cororooke, Elliminyt, Irrewarra, Ondit, Warrion	Stage 2 from November 2006 to June 2007
Licensed diversions from unregulated streams	Lake Tooliorook	Irrigation ban July 2006 to June 2007

29.10 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 29-8 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Camperdown Industrial[4]	39	<0.5	1%	0	<0.5	0	0	0	39
Camperdown Municipal	289	198	69%	0	198	0	0	0	90
Colac	1,508	29	0%	0	0	0	29	1,479	0
Total 2006/07	**1,836**	**228**	**11%**	**0**	**199**		**29**	**1,479**	**129**
Total 2005/06	**2,141**	**310**	**13%**	**0**	**282**	**0**	**27**	**1,702**	**130**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006.

(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) Camperdown Industrial recycled 0.3 ML of wastewater, which would otherwise show as zero in Table 29-8.

29.11 Water for the environment

29.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Corangamite basin EWR comprised the component of water in the basin not allocated for consumptive use, i.e. water above cap.

29.11.2 Compliance with passing flow requirements

There are currently no bulk entitlements in operation in the Corangamite basin.

29.11.3 Water leaving the basin

The amount of water flowing from the Corangamite basin into the Western District Lakes was 2,300 ML in 2006/07. This compares with flows of 53,300 ML in 2005/06 and 245,300 ML in 2004/05. This water comprises consumptive water that was not used under entitlements and the EWR (water above cap).

The Western District Lakes are internationally significant wetlands listed under the Ramsar convention and rely on the freshwater inputs from the Corangamite basin to ecologically function.

Low inflows resulted in the two largest lakes in the basin – Lake Corangamite and Lake Colac – falling to their lowest levels in over 60 years. Water quality in the lakes suffered as a result.

30 Otway Coast basin

This chapter sets out the accounts for the Otway Coast basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

30.1 Otway Coast basin summary

Inflows into the basin were only 34% of the long term average in 2006/07, much the same as the 36% received in the previous year. However, most water supplies in the basin were not seriously threatened by the low flows because consumptive use is only a small proportion of the total resource.

Several drought contingency measures were nevertheless undertaken within the basin. Bans on unregulated streams reduced diversions by approximately half; towns in the south of the basin were on Stage 2 restrictions and towns in the east on Stage 4. Apollo Bay's supply was also secured via a qualification to one of Barwon Water's licences.

30.2 Responsibilities for management of water resources

Table 30-1 shows the responsibilities of various authorities within the Otway Coast basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 30-1 Responsibilities for water resources management within the Otway Coast basin, 2006/07

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:

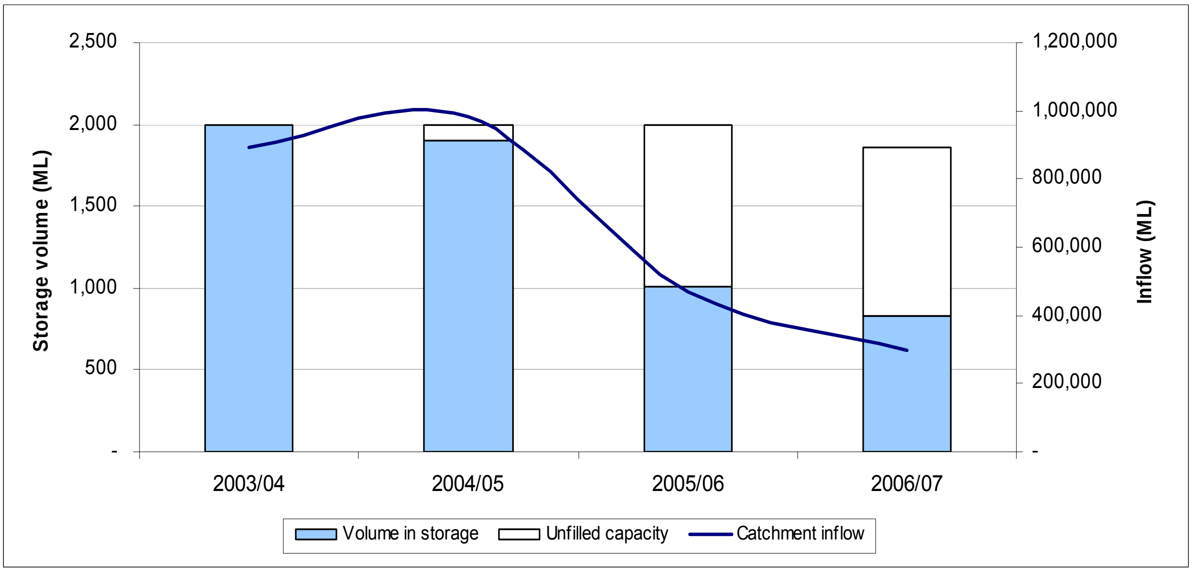
(1) The Otway water supply system extends westward to Warrnambool and Koroit and north to Lismore and Derrinallum, supplying Cobden, Camperdown, Terang and Allansford on the way. Port Campbell, Timboon and Peterborough are supplied via a separate linked system drawing on the Dilwyn aquifer at Port Campbell.

30.3 Rainfall, inflows and storages in 2006/07

The Otway basin is normally one of the wettest basins in Victoria. Rainfall in the Otway Coast basin in 2005/06 was, however, below average (60-80%). With lower rainfall than in the previous three years, 2006/07 inflows were around 40% lower than in 2005/06. Inflows in 2006/07 were 34% of the long term average.

The only major storage in the basin is the West Gellibrand Reservoir which started the year at 54% of capacity, and finished the year at 45% or 827 ML.

Figure 30-1 All major storages and catchment inflows in the Otway Coast basin



30.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Otway Coast basin are shown in Table 30-2.

Table 30-2 Summary of total water resources and water use in the Otway Coast basin, 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	297,700	26,400
Groundwater(2)	20,600	6,000
Recycled water	1,260	440

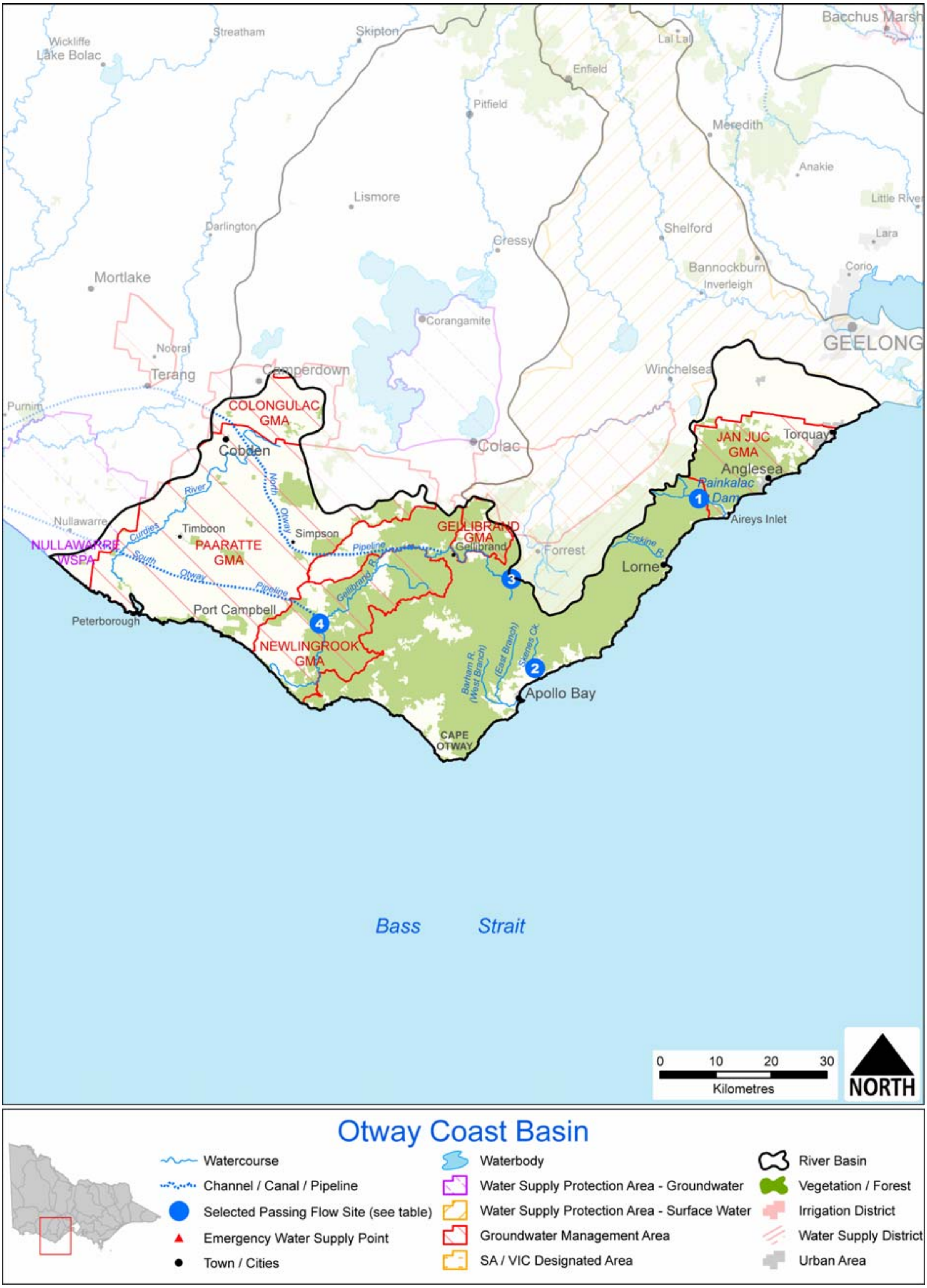
Note:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 30-6.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the State Water Report 2005/2006.

30.5 Location of water resources

Figure 30-2 Map of the Otway Coast basin



30.6 Surface water resources

30.6.1 Water balance

A surface water balance for the Otway Coast basin is shown in Table 30-3.

Table 30-3 Balance of surface water in the Otway Coast basin

Water account component	2006/07 (ML)	2005/06 (ML)
Major on-stream storage		
Volume in storage at start of year	1,000	1,900
Volume in storage at end of year	800	1,000
Change in storage	**-200**	**-900**
Inflows		
Catchment inflow(1)	297,000	467,300
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	740	20
Sub-total	**297,700**	**467,300**
Usage		
Urban diversions	14,470	16,100
Licensed diversions from unregulated streams	1,700	3,300
Small catchment dams(2)	10,200	12,800
Sub-total	**26,400**	**32,200**
Losses		
Net evaporation losses from major storages	200	200
Evaporation from small catchment dams(2)	6,600	3,400
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	0	0
Sub-total	**6,800**	**3,600**
Water passed at outlet of basin		
River outflows to the ocean	264,700	432,400

Notes:

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

(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(3) Assumed to be zero because data is not readily available.

30.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 30-4 below are based on the methodology outlined in Chapter 5.

Table 30-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	10,700	4,300	n/a
Registered commercial and irrigation	8,800	5,900	n/a
Total	**19,500**	**10,200**	**16,800**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

30.6.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements or diversion licences within the basin or across basin boundaries in 2006/07.

30.6.4 Volume diverted

The volume of water diverted under each bulk entitlement is shown in Table 30-5. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2006/07. Diversions fell in 2006/07, primarily due to a 1,300 ML reduction in diversions from 2005/06 under the Colac bulk entitlement.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 30-5 Volume of water diverted under surface water entitlements in the Otway Coast basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance?(1)
Barwon Water					
Aireys Inlet	1	317	0	205	Yes
Apollo Bay and Skenes Creek	1	365	0	303	Yes
Colac	1	5,400	0	3,413	Yes
Gellibrand	1	60	0	20	Yes
Lorne	1	510	0	401	Yes
Wannon Water					
Otway system	1	12,580	0	10,129	Yes
Total annual volume of bulk entitlements 2006/07		**19,232**	**0**	**14,472**	
Total annual volume of bulk entitlements 2005/06		**19,232**	**0**	**16,101**	
Licensed diversions from unregulated streams 2006/07		*7,716*		*1,700*	
Licensed diversions from unregulated streams 2005/06		*6,298*		*3,300*	

Notes:

(1) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.

30.7 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 30-6.

The Otway Coast basin contains all of the Jan Juc GMA and Newlingrook GMA as well as part of the Colongulac GMA, Gellibrand GMA, Paaratte GMA and Nullawarre WSPA. The Nullawarre WSPA recorded the largest increase in extraction compared with 2005/06, with use more than doubling to 2,344 ML. More groundwater was extracted from the Nullawarre WSPA than any other GMU, although it only has 11% of its surface area within the basin.

Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts.

Table 30-6 Licensed groundwater volumes, Otway Coast basin 2005/06

WSPA/GMA(1)	GMA/ WSPA depth limits(2) (m)	Entitlement limit(3) (ML/year)	Licensed entitlement(4) (ML/year)	Metered use (ML)	Estimated use in unmetered bores(5) (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Colongulac GMA (55%)	≤60	7,833	7,833	635	0	635	589
Gellibrand GMA (90%)(6)	All depths	0	0	0	0	0	0
Jan Juc GMA (100%)	All depths	4,250	4,250	0	1,275	1,275	1,200
Newlingrook GMA (100%)(7)	All depths	1,977	1,968	70	0	70	590
Paaratte GMA (85%)	>120	3,932	3,932	0	1,180	1,180	818
Nullawarre WSPA (11%)	≤250	2,651	2,651	2,344	0	2,344	1,109
Total		**20,643**	**20,634**	**3,049**	**2,455**	**5,504**	**4,306**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006 report. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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

(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.
(4) Licensed entitlement includes domestic and stock usage in those cases where it is part of an existing licence.
(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) The entitlement limit as reported in the State Water Report 2005/2006 of 74,970 ML was the permissible annual volume (PAV), which has been replaced with the PCV of 1,977 ML, because the PAV did not take into account interactions with the river,

An estimate of domestic and stock groundwater use is provided in Table 30-7.

Table 30-7 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores(1)(2)	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Colongulac GMA (55%)	114	228
Gellibrand GMA (90%)	0	0
Jan Juc GMA (100%)	6	12
Newlingrook GMA (100%)	10	20
Paaratte GMA (85%)	3	6
Nullawarre WSPA (11%)	126	252
Total	**259**	**518**

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 volume in Table 30-6.
(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by the surface area percentage in the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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 30-8.

Table 30-8 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2006/07 (ML)	Metered use 2005/06 (ML)
Otway system (Carlisle)	1,800	249	109
Otway system (Curdie Vale)	2,150	0	0
Port Campbell, Timboon and Peterborough	1,009	370	387
Total	**4,959**	**619**	**496**

30.8 Drought contingency measures

One drought contingency measure undertaken in the Otway Coast basin in 2006/07 involved restricting urban and rural water use (discussed below).

The other drought contingency measure was implemented when one of Barwon Water's licences was qualified. Details of this are in Table 30-9.

Table 30-9 Qualification of rights

Qualification type	Qualification description
Extended pumping/diversion times	Extended temporary licence 9016902 to allow pumping from Barham River through November and December to avoid a potential water shortage in Apollo Bay at the end of summer Dates: 31 October 2006 to 30 June 2007

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

Restrictions applying to urban customers and licensed diversions are shown in Table 30-10. Towns in the east of the basin faced higher restrictions than those in the south. Towns in the west of the basin are supplied by groundwater and had no restrictions because groundwater use was unrestricted in the Otway Coast basin during 2006/07.

Table 30-10 Seasonal allocations and restrictions on water use in Otway Coast basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Skenes Creek, Apollo Bay, Marengo	Stage 2 from November 2006 to June 2007
	Torquay, Mt Duneed, Jan Juc, Anglesea	Stage 1 from July 2006 increasing to Stage 2 in September, Stage 3 in November and Stage 4 from February to June 2007
	Lorne, Aireys Inlet, Fairhaven	Stage 1 from July 2006 increasing to Stage 2 in May 2007
	Gellibrand	Stage 1 from July 2006 increasing to Stage 2 in December 2006
Licensed diversions from unregulated streams	Curdies River	Irrigation ban October 2006 to May 2007
	Gellibrand River	Stage 2 restriction (25% reduction) in July 2006 only
	Lake Purrumbete	Irrigation ban from July 2006 to June 2007

30.10 Recycled water

Wastewater treatment plants within the Otway Coast basin are operated by Barwon Water and Wannon Water, with the largest plants located at Lorne and Apollo Bay. In 2006/07, 30% of the volume of treated wastewater was used within the Otway Coast basin (Table 30-11), which represents an increase in both the volume and percentage of recycled water from 2005/06.

Table 30-11 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Aireys Inlet	113	113	100%	0	113	0	0	0	0
Anglesea	217	139	53%	0	114	0	25	103	-25
Apollo Bay	344	15	0%	0	0	0	15	344	-15
Cobden	162	87	53%	0	87	0	0	0	76
Lorne	293	15	0%	0	0	0	15	293	-15
Port Campbell	56	25	45%	0	25	0	0	0	31
Simpson	14	0	0%	0	0	0	0	0	14
Timboon	56	41	73%	0	41	0	0	0	15
Total 2006/07	**1,256**	**435**	**30%**	**0**	**380**	**0**	**55**	**740**	**81**
Total 2005/06	**1,360**	**363**	**23%**	**0**	**309**	**0**	**54**	**18**	**1,033**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006.

(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.

30.11 Water for the environment

30.11.1 Environmental Water Reserve (EWR)

In 2005/06 the Otway Coast basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Barwon Water and Wannon Water
- all other water in the basin not allocated for consumptive use.

30.11.2 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 (shown as 1 in Figure 30-2)
	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	Skenes Creek diversion weir (shown as 2 in Figure 30-2)
	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 (shown as 3 in Figure 30-2)
	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 (shown as 4 in Figure 30-2)
	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

Wannon Water reported that all passing flow requirements under their bulk entitlements in the Otway Coast basin were met in 2006/07. Barwon Water met all of its passing flow requirements with the exception of one occasion at the West Gellibrand and Olangolah Reservoirs.

30.11.3 Streamflow management plans (SFMPs)

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

30.11.4 Water leaving the basin

The amount of water flowing from the Otway basin into Bass Strait was 264,700 ML in 2006/07. This represents 89% of the total inflows into the basin, compared with 93% in 2005/06. However, the total volume of water leaving the basin fell 39% compared with 2005/06 due to lower inflows. This water comprises consumptive water that was not used under entitlements and the EWR (passing flows and any water above cap).

31 Hopkins basin

This chapter sets out the accounts for the Hopkins basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

31.1 Hopkins basin summary

Inflows to the Hopkins basin have reduced significantly over the past two years. In 2004/05, inflows were 395,300 ML, compared with 82,100 ML recorded in 2006/07, which was 13% of the long term average. The total volume of consumptive entitlements relying on surface water in the Hopkins basin is low compared with the total surface water resource, with by far the largest diversions made by small catchment dams.

Most towns in the basin experienced severe restrictions on water use (Stage 3 and Stage 4). The largest town of Warrnambool, however, is supplied from outside the basin (from the Otway system) and faced no restrictions in 2006/07.

Groundwater is a significant resource in the Hopkins basin and licensed groundwater use doubled in 2006/07 compared with the previous year. Most of the use is for agriculture.

31.2 Responsibilities for management of water resources

Table 31-1 shows the responsibilities of various authorities within the Hopkins basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 31-1 Responsibilities for water resources management within the Hopkins basin, 2006/07

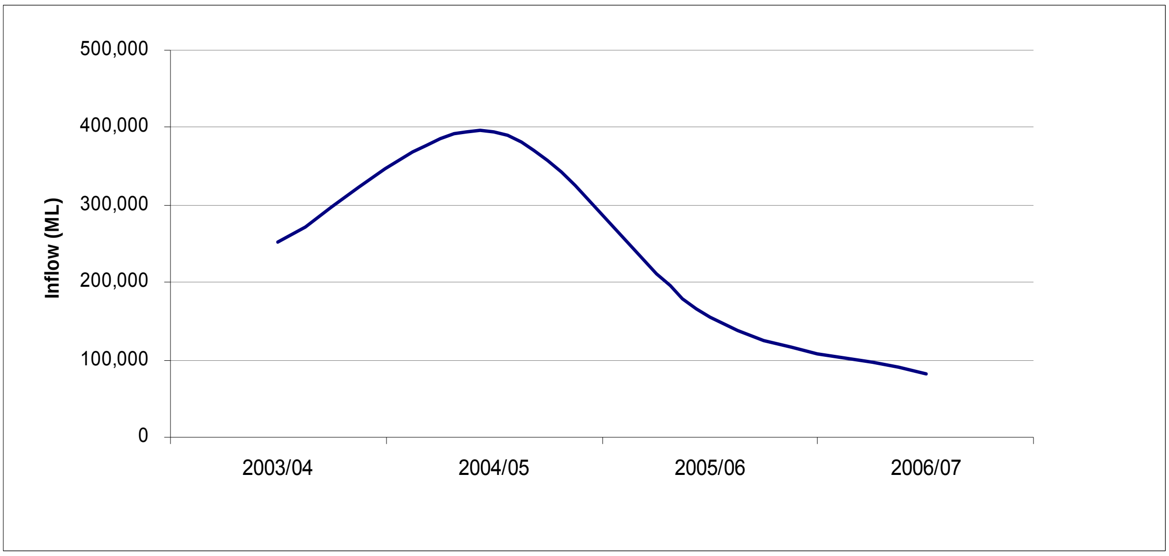
Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Southern Rural Water		Groundwater and surface water licensed diversions		
Wannon Water			Supply to towns in the south of the basin including Warrnambool	
GWMWater			Supply to towns in the north of the basin including Ararat	
Central Highlands Water			Supply to towns in the north east of the basin including Ballarat, 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 Rainfall, inflows and storages in 2006/07

In 2006/07, rainfall in the Hopkins basin ranged between 60% and 80% of the long term average. This was similar to the 2005/06 result but represented a decline from both 2004/05 and 2003/04, when rainfall was equal to or above average. Inflows fell to 13% of the long term average (635,000 ML). Since 2004/05, when the inflow was 62% of average, annual inflows have decreased by more than 300,000 ML.

There are no major water storages (greater than 1,000 ML in size) in the basin.

Figure 31-1 Catchment inflows in the Hopkins basin



31.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Hopkins basin are shown in Table 31-2. Wannon Water transferred water from the Otway Coast basin into the Hopkins basin to supply towns, Central Highlands Water transferred water from the Barwon basin into the Hopkins basin to supply Skipton, and GWMWater transferred water from the Wimmera basin to supply Ararat, Moyston, Willaura, Lake Bolac and Wickliffe.

Table 31-2 Summary of total water resources and water use in the Hopkins basin, 2006/07

Water source	Total water resource (ML)(1)	Total use (ML)
Surface water	82,100	35,800
Groundwater(2)	43,100	31,800
Recycled water	5,640	700

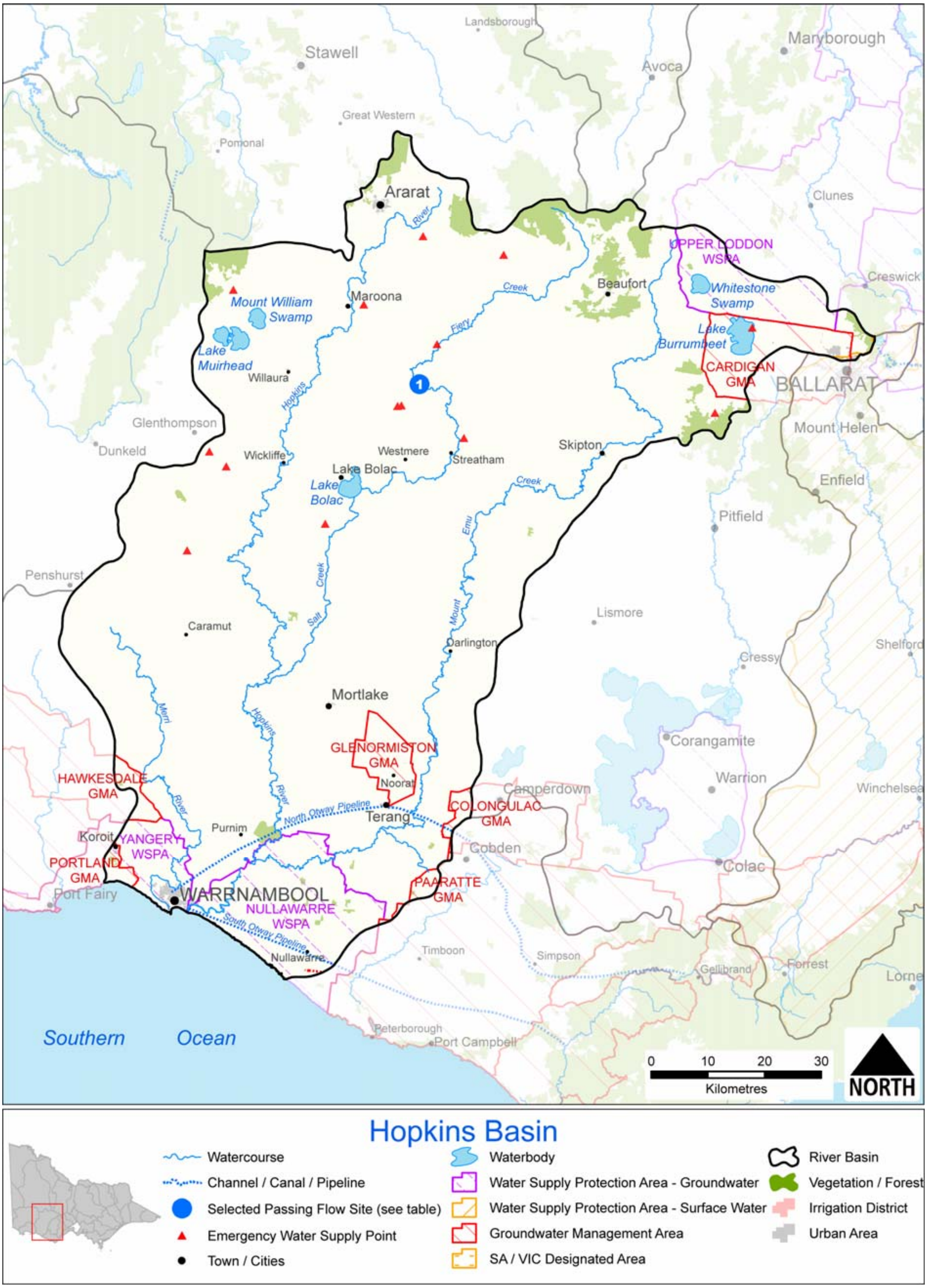
Note:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 31-6.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the State Water Report 2005/2006.

31.5 Location of water resources

Figure 31-2 Map of the Hopkins basin



31.6 Surface water resources

31.6.1 Water balance

A water balance for the Hopkins basin is shown in Table 31-3. 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.

Transfers into the basin for urban water supply did not affect streamflows and so are not accounted for in the water balance for the Hopkins basin.

Table 31-3 Balance of surface water in the Hopkins basin

Water account component	2006/07 (ML)	2005/06 (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)	82,100	154,900
Transfers from other basins(2)	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	10	30
Sub-total	**82,100**	**154,900**
Usage		
Urban diversions	370	470
Licensed diversions from unregulated streams	4,400	3,500
Small catchment dams(3)	31,000	64,600
Sub-total	**35,800**	**68,600**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(3)	15,300	30,100
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	0	0
Sub-total	**15,300**	**30,100**
Water passed at outlet of basin		
River outflows to the ocean	31,000	56,200

Notes:

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

(2) Water from other basins used to supply urban needs are not shown as they were provided directly into the relevant urban supply systems and did not affect streamflows in the Hopkins basin.

(3) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(4) Assumed to be zero because data is not readily available.

31.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 31-4 below have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 31-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	30,900	7,400	n/a
Registered commercial and irrigation	58,400	23,600	n/a
Total	**89,300**	**31,000**	**46,300**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

31.6.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements or diversion licences within the basin or across basin boundaries in 2006/07.

31.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 31-5. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2006/07. No water was extracted under the Skipton bulk entitlement as the town was supplied from the Ballarat system.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 31-5 Volume of water diverted under surface water entitlements in the Hopkins basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)(1)	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance?(2)
Central Highlands Water					
Beaufort	1	419	0	191	Yes
Skipton	1	210	0	0	Yes
GWMWater					
Willaura, Moyston, Lake Bolac and Wickliffe(3)	n/a	n/a	0	182	n/a
Total annual volume of bulk entitlements 2006/07		**629**	**0**	**373**	
Total annual volume of bulk entitlements 2005/06		**629**	**0**	**467**	
Licensed diversions from unregulated streams 2006/07		*9,007*		*4,400*	
Licensed diversions from unregulated streams 2005/06		*9,928*		*3,500*	

Note:

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

(2) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.

(3) These towns are supplied by the Mt William supply system and are yet to be converted to formalised bulk entitlements.

31.7 Groundwater resources

A summary of the licensed entitlements and use for groundwater management units overlapping the Hopkins basin, excluding domestic and stock use, is presented in Table 31-6.

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.

As surface water inflows declined, the use of groundwater increased substantially in the Hopkins basin. Total groundwater use more than doubled in 2006/07 compared with 2005/06 and in total, almost 27,000 ML of groundwater was extracted. Licensed groundwater accounted for 43% of all water use (both surface water and groundwater) in the basin in 2006/07, compared with 16% in 2005/06.

This groundwater use does not include use in unincorporated areas, which are not reported in the 2006/07 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 31-6 Licensed groundwater volumes, Hopkins basin 2006/07

WSPA/GMA[1]	GMA/ WSPA depth limits[2] (m)	Entitlement limit[3] (ML/year)	Licensed entitlement[4] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Cardigan GMA (61%)	All depths	2,408	465	0	139	139	160
Colongulac GMA (9%)	≤60	1,263	1,263	102	0	102	95
Glenormiston GMA (100%)	≤60	5,042	5,042	1,044	0	1,044	753
Nullawarre WSPA (89%)	≤250	22,449	22,449	19,845	0	19,845	9,391
Upper Loddon WSPA (24%)	All depths	3,224	3,224	1,489	0	1,489	572
Yangery WSPA (60%)	≤100	8,735	8,735	4,359	0	4,359	1,976
Total		43,121	41,178	26,839	139	26,979	12,947

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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

(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.

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

An estimate of domestic and stock groundwater use is provided in Table 31-7.

Table 31-7 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores[1][2]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Cardigan GMA (61%)	292	584
Colongulac GMA (9%)	18	36
Glenormiston GMA (100%)	125	250
Nullawarre WSPA (89%)	1,071	2,142
Upper Loddon WSPA (24%)	30	60
Yangery WSPA (60%)	865	1,730
Total	**2,401**	**4,802**

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 volume in the Table 31-6.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by the surface area percentage in the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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 31-8.

Table 31-8 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2006/07 (ML)	Metered use 2005/06 (ML)
Caramut	50	35	47
Darlington	10	2	2
Glenthompson[1]	140	46	63
Koroit	524	0	0
Mortlake	295	41	39
Warrnambool, Allansford and Koroit	750	411	397
Total	**1,769**	**535**	**548**

Notes:

(1) Although Glenthompson is located in the Glenelg basin, its groundwater is sourced from the Willaura bore system in the Hopkins basin.

31.8 Drought contingency measures

A range of drought contingency measures were undertaken in the Hopkins basin in 2006/07. These include:

- restricting urban and rural water use (discussed below)
- providing emergency water supply points

No rights were qualified in the Hopkins basin in 2006/07.

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

Restrictions applying to urban customers and licensed diversions are shown in Table 31-9.

Groundwater use was unrestricted in the Hopkins basin during 2006/07.

Table 31-9 Seasonal allocations and restrictions on water use in Hopkins basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Beaufort, Raglan	Stage 2 December 2006, reducing to Stage 1 January 2007, increasing to Stage 3 from February 2007 to June 2007
	Skipton	Stage 2 restrictions July 2006, increasing to Stage 3 September 2006 and Stage 4 from November 2006 to June 2007
	Ararat	Stage 3 restrictions July 2006, increasing to Stage 4 from October 2006 to June 2007
	Buangor	Stage 2 December 2006 to June 2007
	Lake Bolac, Wickliffe and Willaura	Stage 4 January 2007 to June 2007
	Streatham and Westmere	Stage 1 October 2006 to June 2007
Licensed diversions from unregulated streams	Merri River (downstream of Woodford)	Stage 3 (50% reduction) from October 2006, increasing to Stage 4 (75% reduction) in Zone B and an irrigation ban in Zone A from January 2007, decreasing to unrestricted from June 2007
	Merri River (upstream of Woodford)	Stage 1 in July 2006, decreasing to unrestricted from August 2006, before increasing to Stage 3 from October 2006, and Stage 4 in Zone B and an irrigation ban in Zone A from January 2007, decreasing to unrestricted from June 2007
	Mt Emu Creek	Stage 3 from October 2006, decreasing to unrestricted from June 2007
	Hopkins River	Stage 2 from January 2007, decreasing to unrestricted from June 2007
	Lake Cartcarrong	Irrigation ban from July 2006 to June 2007

31.10 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 dropped to 12% of the total wastewater volume produced, 342 ML lower than at 2005/06 levels of 18% (Table 31-10). The main explanation for this drop in recycled water is a lower amount of wastewater entering the Ararat treatment plant, commensurate with restricted use.

Table 31-10 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Ararat(4)	578	586	100%	205	373	0	8	0	-8
Beaufort	64	0	0%	0	0	0	0	0	64
Cardigan Village	0	0	0%	0	0	0	0	0	0
Mortlake	96	4	4%	0	4	0	0	0	92
Terang	184	111	60%	0	111	0	0	0	73
Warrnambool	4,708	0	0%	0	0	0	0	0	4,708
Willaura	10	0	0%	0	0	0	0	10	0
Total 2006/07	**5,640**	**701**	**12%**	**205**	**488**	**0**	**8**	**10**	**4,929**
Total 2005/06	**5,763**	**1,043**	**18%**	**62**	**954**	**0**	**27**	**29**	**4,691**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology from the figures presented in the State Water Report 2005/2006.

(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) Some water was carried over in storage from the previous year, resulting in a negative value in the Other column.

31.11 Water for the environment

31.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Hopkins basin EWR comprised the following components:

- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Central Highlands Water and GWMWater
- all other water in the basin not allocated for consumptive use.

31.11.2 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin.

Table 31-11 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. The location of these compliance points is presented in Figure 31-2.

Table 31-11 Selected passing flow requirements in the Hopkins basin at selected sites

River	Passing flow	
Cave Hill Creek, Glut Creek, Side Spring Creek	Instrument where passing flows are specified	Bulk Entitlement (Beaufort) Conversion Order 2005
	Responsible authority	Central Highlands Water
	Compliance point	Cave Hill Creek Weir (shown as 1 in Figure 31-2)
	Passing flow 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 did not report any non-compliance with their bulk entitlements within the Hopkins basin.

31.11.3 Streamflow management plans (SFMPs)

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

31.11.4 Water leaving the basin

The volume of water flowing from the Hopkins basin into Bass Strait was 31,000 ML in 2006/07. This represents 38% of the total inflows into the basin, compared with 36% in 2005/06. This water comprises consumptive water that was not used under entitlements and the EWR (passing flows and any water above cap).

32 Portland Coast basin

This chapter sets out the accounts for the Portland Coast basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

32.1 Portland Coast basin summary

Groundwater, and in particular the Dilwyn aquifer, supplies the major towns within the basin and for this reason there were no urban restrictions in the Portland Coast basin in 2006/07.

Although inflows declined and were only 16% of the long term average, urban consumptive use in the Portland Coast basin is relatively unaffected by drought as long as groundwater supplies remain plentiful.

Rural users, however, felt the effects of the last two years of very low inflows, with all major watercourses in the basin subject to restrictions or bans for most of the year.

32.2 Responsibilities for management of water resources

Table 32-1 shows the responsibilities of various authorities within the Portland Coast basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 32-1 Responsibilities for water resources management within the Portland Coast basin, 2006/07

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

Notes:

(1) Supplied from the Otway Coast basin.

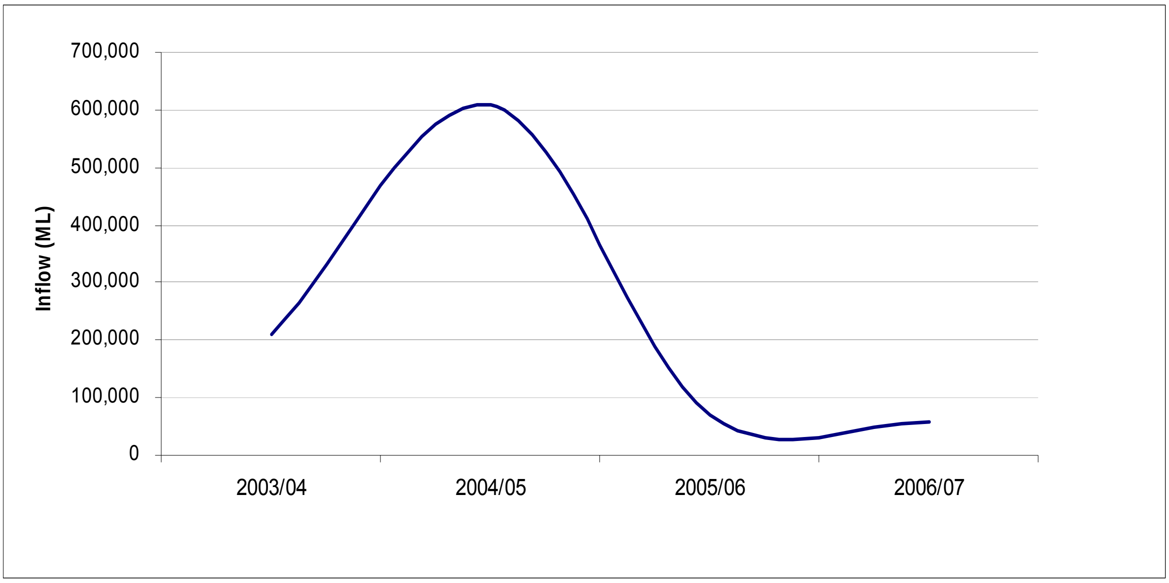
(2) Supplied from groundwater.

32.3 Rainfall, inflows and storages in 2006/07

In 2006/07, rainfall in the Portland Coast basin ranged between 80% and 100% of the long term average, which was lower than the preceding three years. Consequently, inflows in the catchment were significantly less in 2006/07, especially compared with 2004/05. Overall, inflows were 16% of the long term average (361,000 ML) in 2006/07, down from 19% in 2005/06 and 168% in 2004/05.

There are no major storages (greater than 1,000 ML) in the basin.

Figure 32-1 Catchment inflows in the Portland Coast basin



32.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Portland Coast basin are shown in Table 32-2.

Table 32-2 Summary of total water resources and water use in the Portland Coast basin, 2006/07

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	57,100	7,800
Groundwater[2]	59,200	20,400
Recycled water	2,000	130

Note:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 32-5.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5 and footnote (1) beneath Table 32-5. This represents a change in methodology from the State Water Report 2005/2006.

32.5 Location of water resources

Figure 32-2 Map of the Portland Coast basin

32.6 Surface water resources

32.6.1 Water balance

A water balance for the Portland Coast basin is shown in Table 32-3.

Only 14% of the total inflows were diverted for consumptive use, mainly from small catchment dams. All towns serviced by Wannon Water in this basin are supplied by groundwater or from other river basins and hence there are no urban surface water diversions.

Table 32-3 Balance of surface water in the Portland Coast basin

Water account component	2006/07 (ML)	2005/06 (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)	57,100	69,600
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	0
Sub-total	**57,100**	**69,600**
Usage		
Urban diversions	0	0
Licensed diversions from unregulated streams	800	400
Small catchment dams(2)	7,000	16,200
Sub-total	**7,800**	**16,600**
Losses		
Net evaporation losses from major storages	0	0
Evaporation from small catchment dams(2)	10,200	4,400
In-stream infiltration to groundwater, flows to floodplain and evaporation(3)	0	0
Sub-total	**10,200**	**4,400**
Water passed at outlet of basin		
River outflows to the ocean	39,100	48,600

Notes:

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

(2) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(3) Assumed to be zero because data is not readily available.

32.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 32-4 below have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 32-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	4,500	1,000	n/a
Registered commercial and irrigation	16,500	6,000	n/a
Total	**21,000**	**7,000**	**17,200**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

32.6.3 Water entitlement transfers

There were no temporary or permanent transfers of water entitlements, diversion licences or sales of water within the basin or across basin boundaries in 2006/07.

32.6.4 Volume diverted

The only licences used in the Portland Coast basin are licences on unregulated streams. In 2006/07, licensed volume totalled 2,177 ML and use was estimated to be 800 ML.

32.7 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 32-5.

The Portland Coast basin contains all of the Heywood GMA and Hawkesdale GMA as well as part of the Condah WSPA (52%), Yangery WSPA (40%) and Portland GMA (73%). Both the Condah WSPA and Yangery WSPA recorded large increases in groundwater use (44% and 120% respectively).

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.

The water level in the Condah WSPA is exhibiting a declining long term trend and a management planned is being developed by the Department of Sustainability and Environment.

Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts.

Table 32-5 Licensed groundwater volumes, Portland Coast basin 2006/07

WSPA/GMA(1)	GMA/ WSPA depth limits(2) (m)	Entitlement limit(3) (ML/year)	Licensed entitlement(4) (ML/year)	Metered use (ML)	Estimated use in unmetered bores(5) (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Hawkesdale GMA (100%)(6)	Zone 1 All depths Zone 2 <200	12,174	12,174	1,423	0	1,423	Not available
Heywood GMA (100%)	≤70	21,763	21,763	1,629	0	1,629	1,942
Portland GMA (73%)	>200	15,022	8,293	3,244	214	3,458	510
Condah WSPA (52%)	70-200	4,564	4,564	2,053	0	2,053	1,422
Yangery WSPA (40%)	≤100	5,723	5,723	2,856	0	2,856	1,294
Total		**59,247**	**52,518**	**11,205**	**214**	**11,418**	**5,168**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included. The exception in this table is Portland GMA, which is known to have 7,581 ML of urban licensed volume and therefore 100% of the Portland GMA urban licensed entitlement and metered use is allocated to the Portland Coast basin and not shared on a proportional basis with the Glenelg basin, in which the Portland GMA has 27% of its surface area. Only non-urban licensed volume and the unmetered use from these licences are allocated according to the surface area percentages.

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

(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.

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

(5) In unmetered areas, use has been estimated at 30% of non-urban licensed entitlement.

(6) The Hawkesdale aquifer was not converted to a GMA until 2006/07 and therefore was not included in the State Water Report 2005/2006.

An estimate of domestic and stock groundwater use is provided in Table 31-6.

Table 32-6 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores[(1)(2)]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Hawkesdale GMA (100%)	2,100	4,200
Heywood GMA (100%)	1,735	3,470
Portland GMA (73%)	46	92
Condah WSPA (52%)	30	60
Yangery WSPA (40%)	567	1,134
Total	**4,478**	**8,956**

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 volume in the Table 32-5.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by the surface area percentage in the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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 32-7.

Table 32-7 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2006/07 (ML)	Metered use 2005/06 (ML)
Heywood	333	195	247
Port Fairy	1,026	840	727
Portland	6,222	2,209	2,258
Total	**7,581**	**3,244**	**3,232**

32.8 Drought contingency measures

The main drought contingency measures undertaken in the Portland Coast basin in 2006/07 were:

- restrictions on diversions on unregulated streams (discussed below)
- the provision of emergency water supply points.

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

Restrictions applying to urban customers and licensed diversions are shown in Table 32-8. Urban residents did not experience water restrictions outside of the permanent water savings measures adopted around the state. Most towns within the basin are supplied by groundwater, which was unrestricted in the Portland Coast basin during 2006/07.

Table 32-8 Seasonal allocations and restrictions on water use in Portland Coast basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Heywood, Koroit, Macarthur, Port Fairy, Portland	Permanent water savings measures in place for the entire year
Licensed diversions from unregulated streams	Darlots Creek	Stage 3 (50% reduction) from October 2006, increasing to irrigation ban from January to April 2007, decreasing to Stage 3 in May 2007, and unrestricted in June 2007
	Condah Drain	Stage 3 (50% reduction) from October 2006, increasing to irrigation ban from January to April 2007, decreasing to Stage 4 (75% reduction) in May 2007, and unrestricted in June 2007
	Eumarella River, Surrey River and Moyne River	Irrigation ban October 2006 to May 2007, and unrestricted in June 2007
	Fitzroy River	Irrigation ban November 2006 to May 2007, and unrestricted in June 2007

32.10 Recycled water

Wannon Water operates all treatment plants within the Portland Coast basin. In 2006/07, 6% of the total wastewater produced in the basin was reused, including 56% from the Heywood treatment plant for wood lot irrigation (down from 100% in 2005/06). All wastewater from the Portland and Port Fairy treatment plants is discharged to the ocean (Table 32-9).

Table 32-9 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[3]
				Urban & industrial	Agriculture	Beneficial allocation[1]	Within process[2]		
Heywood	227	128	56%	0	128	0	0	0	99
Port Fairy	790	0	0	0	0	0	0	0	790
Portland	978	0	0	0	0	0	0	0	978
Total 2006/07	**1,996**	**128**	**6%**	**0**	**128**	**0**	**0**	**0**	**1,868**
Total 2005/06	**2,132**	**256**	**12%**	**0**	**256**	**0**	**0**	**0**	**1,876**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology from the figures presented in the State Water Report 2005/2006.

(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.

32.11 Water for the environment

32.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Portland Coast basin EWR comprised water in the basin not otherwise allocated for consumptive use, i.e. water above cap.

32.11.2 Passing flow requirements

There are currently no bulk entitlements in operation and therefore no passing flow obligations on water corporations in the Portland Coast basin.

32.11.3 Water leaving the basin

The amount of water flowing from the Portland Coast basin into Bass Strait was 39,100 ML in 2006/07. This represents 68% of the total inflows into the basin, similar to the 70% in 2005/06. This water comprises consumptive water that was not used under entitlements and the EWR (water above cap).

33 Glenelg basin

This chapter sets out the accounts for the Glenelg basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

33.1 Glenelg basin summary

The Glenelg basin has experienced inflows well below average for a number of years, with the last three years' inflows all below 20% of the long term average. Storage levels have been unable to recover, with the Rocklands Reservoir ending the year 2% full. Diversions to the Wimmera Mallee system, which have historically averaged 60,000 ML each year, were 2,500 ML in 2006/07.

Hamilton's water supply experienced severe water shortages due to low stream flows and the town relied on emergency groundwater bores to maintain supply. In June, the government announced that Hamilton's supply system would be linked to the Grampians Headworks system by 2010, supplying an additional 2,000 ML each year for Hamilton.

The uncertain outlook for future water supply in the region caused a reduction in the volume of water recycled. Wannon Water decided to hold over treated wastewater in storage for potential use in 2007/08 as either potable substitution or for fire fighting if required. Groundwater use almost doubled as all major streams in the basin had irrigation bans in place for most of the year.

33.2 Responsibilities for management of water resources

Table 33-1 shows the responsibilities of various authorities within the Glenelg basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 33-1 Responsibilities for water resources management within the Glenelg basin, 2006/07

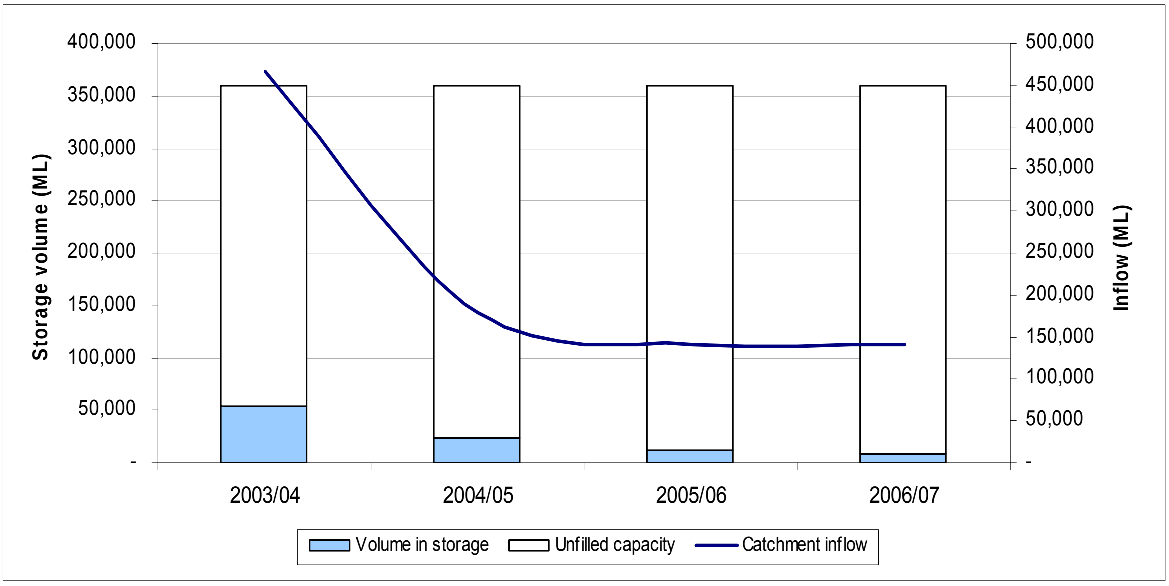
Authority	Irrigation and rural water supply	Licensing	Urban water supply	Storage management; waterway management; environmental obligations
Coliban Water			Towns located in the Loddon Basin but supplied from the Wimmera-Mallee system.	
Southern Rural Water		Groundwater and surface water licensed diversions 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 Rainfall, inflows and storages in 2006/07

During 2006/07, rainfall in the Glenelg basin was 60-100% of the long term average. Streamflows across the basin were almost identical to 2005/06 inflows and again much lower than average with the run-off recorded at 15% of the long term average (964,000 ML).

Four major storages are within the basin, dominated by the Rocklands Reservoir which accounts for 97% of the total capacity of Glenelg basin storages. At the end of 2006/07 Rocklands Reservoir was at less than 2% of capacity.

Figure 33-1 All major storages and catchment inflows in the Glenelg basin



33.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Glenelg basin are shown in Table 33-2.

Table 33-2 Summary of total water resources and water use in the Glenelg basin, 2006/07

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	140,200	33,000
Groundwater[2]	33,000	12,600
Recycled water	1,100	300

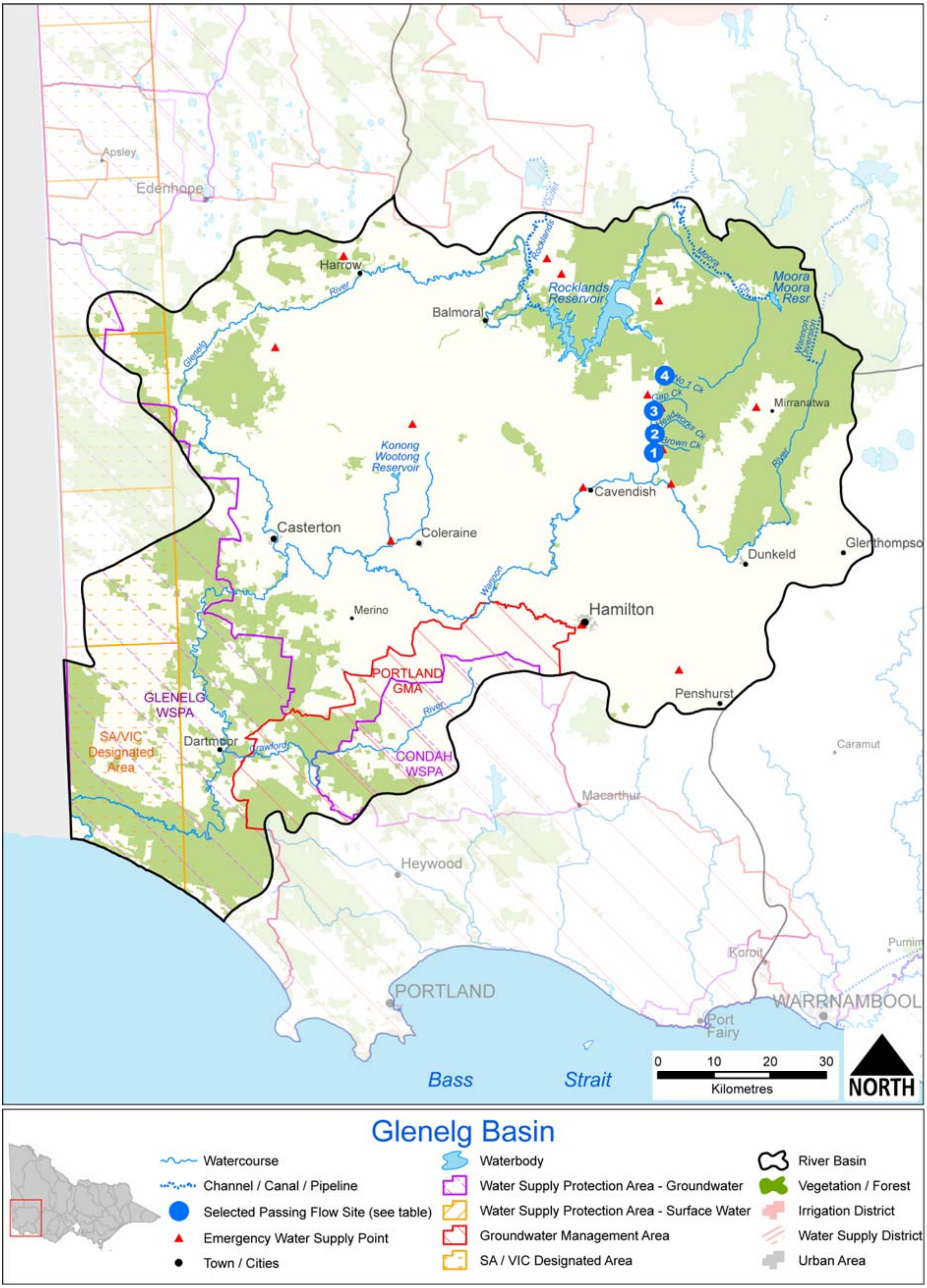
Notes:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 33-6.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5 and footnote (1) beneath Table 33-6. This represents a change in approach from the State Water Report 2005/2006.

33.5 Location of water resources

Figure 33-2 Map of the Glenelg basin



33.6 Surface water resources

33.6.1 Water balance

A water balance for the Glenelg basin is shown in Table 33-3. By far the largest use of water in 2006/07 was for small catchment dams, although the dry conditions experienced during the year caused estimated diversions from small catchment dams to reduce by half. Diversions to the Wimmera Mallee System fell from 32,500 ML in 2004/05 to 2,500 ML in 2006/07.

Table 33-3 Balance of surface water in the Glenelg basin

Water account component	2006/07 (ML)	2005/06 (ML)
Major on-stream storage		
Volume in storage at start of year	11,300	23,900
Volume in storage at end of year	8,500	11,300
Change in storage	**-2,800**	**-12,600**
Inflows		
Catchment inflow(1)	140,200	140,400
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated wastewater discharged back to river	0	10
Sub-total	**140,200**	**140,400**
Usage		
Urban diversions	1,150	1,490
Diversions to the Wimmera Mallee Water System	2,500	5,800
Licensed diversions from unregulated streams(2)	1,000	900
Small catchment dams(3)	28,300	55,500
Sub-total	**33,000**	**63,700**
Losses		
Net evaporation losses from major storages	6,800	9,200
Evaporation from small catchment dams(3)	52,600	24,600
In-stream infiltration to groundwater, flows to floodplain and evaporation(4)	8,400	4,100
Sub-total	**67,800**	**37,900**
Water passed at outlet of basin		
River outflows to the ocean	42,200	51,400

Notes:

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

(2) Licensed diversions from unregulated streams were overstated by 300 ML in the State Water Report 2005/2006. The 2005/06 volume in Table 33-3 is the correct figure.

(3) Data for water usage from small catchment dams is provided by the Department of Sustainability and Environment. Evaporation losses are calculated by subtracting usage from total estimated capacity.

(4) Estimated from loss functions in the Glenelg River REALM model.

33.6.2 Small catchment dams

Specific information on small catchment dam usage and losses for 2006/07 is not readily available. The values in Table 33-4 below have been provided by the Department of Sustainability and Environment as outlined in Chapter 5.

Table 33-4 Estimated small catchment dam information, 2006/07

Type of small catchment dam	Capacity (ML)	Usage (ML)	Total water harvested (ML)
Domestic and stock (not licensed)(1)	27,100	6,900	n/a
Registered commercial and irrigation	49,900	21,400	n/a
Total	**77,000**	**28,300**	**80,900**

Note:

(1) Estimate of domestic and stock usage for 2006/07 is provided by the Department of Sustainability and Environment and based on an estimate of 1982 small catchment dam usage.

n/a: Information not available.

33.6.3 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 2006/07.

33.6.4 Volume diverted

The volume of water diverted under each bulk water entitlement is shown in Table 33-5. Compliance with individual bulk entitlement volumes is deemed to occur if water use is not more than the maximum volume allowed to be diverted in 2006/07.

As in 2005/06, no water was diverted under the Glenthompson bulk entitlement due to lack of run-off. Wannon Water purchased 46 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 metered volume of water supplied to customers. Although Casterton and Sandford are included in this bulk entitlement, these towns are supplied from the Tullich bore system.

Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 33-5 Volume of water diverted under surface water entitlements in the Glenelg basin

Bulk entitlement	Bulk entitlement period (years)	Average annual bulk entitlement volume (ML)(1)	Net temporary transfer 2006/07 (ML)	Volume diverted 2006/07 (ML)	Bulk entitlement volume compliance? (2) (3)
Coliban Water					
Wimmera and Glenelg Rivers(4)(5)	1	450	0	285	Yes
Wannon Water					
Coleraine, Casterton, Sandford	1	855	0	148	Yes
Dunkeld	1	170	0	23	Yes
Glenthompson	1	94	0	0	Yes
Hamilton	1	3,435	0	924	Yes
Wimmera and Glenelg Rivers	1	465	0	55	Yes
GWMWater					
Wimmera and Glenelg Rivers – Grampians Water(4)(5)	5	16,109		10,045	Yes
Wimmera and Glenelg Rivers – Wimmera Mallee Water(4)	5	149,211	0	14,666	Yes
Minister for the Environment					
Wimmera and Glenelg Rivers(4)	5	40,563	0	0	Yes
Total annual volume of bulk entitlements 2006/07		**211,352**	**0**	**26,146**	
Total annual volume of bulk entitlements 2005/06(5)		**211,287**	**0**	**73,972**	
Licensed diversions from unregulated streams 2006/07		*1,175*		*1,000*	
Licensed diversions from unregulated streams 2005/06		*1,222*		*900*	

Notes:

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

(2) Bulk entitlement compliance for the purpose of the Victorian Water Accounts is assessed based on the information provided by the water businesses and has not been independently audited.

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

(4) Diversions under these bulk entitlements are not shown in the water balance for the Glenelg basin as diversions are taken from both the Glenelg and Wimmera river systems and cannot be disaggregated. They are shown in the water balance for the Wimmera basin.

(5) GWMWater's Wimmera and Glenelg – Grampians Water bulk entitlement and Coliban Water's Wimmera and Glenelg Rivers bulk entitlement were inadvertently omitted from the State Water Report 2005/2006. Their respective entitlement volumes and volumes diverted in 2005/06 are reflected in the 2005/06 volumes in Table 33-5.

33.7 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 33-6.

The Glenelg basin contains part of the Condah WSPA, Glenelg WSPA and Portland GMA. Groundwater use almost doubled in 2006/07 compared with 2005/06, with extractions in the Glenelg WSPA increasing by more than 5,000 ML.

Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts.

Table 33-6 Licensed groundwater volumes, Glenelg basin 2006/07

WSPA/GMA(1)	GMA/WSPA depth limits(2) (m)	Entitlement limit(3) (ML/year)	Licensed entitlement(4) (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Portland GMA (27%)	>200	5,661	269	0	80	80	192
Condah WSPA (48%)	70-200	4,136	4,136	1,860	0	1,860	1,288
Glenelg WSPA (70%)	All depths	23,163	23,163	10,409	0	10,409	5,335
Total		**32,960**	**27,567**	**12,268**	**80**	**12,349**	**6,815**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included. The exception in this table is Portland GMA, which is known to have 7,581 ML of urban licensed volume and therefore 100% of the Portland GMA urban licensed entitlement and metered use is allocated to the Portland Coast basin and not shared on a proportional basis with the Glenelg basin, in which Portland GMA has 27% of its surface area. Only non-urban licensed volume and the unmetered use from these licences are allocated according to the surface area percentages.

(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 the respective GMA/WSPA.

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

(5) In unmetered areas, use has been estimated at 30% of non-urban licensed entitlement.

An estimate of domestic and stock groundwater use is provided in Table 33-7.

Table 33-7 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores(1)(2)	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Portland GMA (27%)	17	34
Condah WSPA (48%)	28	56
Glenelg WSPA (70%)	73	146
Total	**118**	**236**

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 volume in the Table 33-6.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by the surface area percentage in the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

Groundwater is used as an urban water supply for a number of townships in the basin. The increase in usage was mostly due to two additional emergency bores drilled to augment the Hamilton supply during the year. The licensed entitlements and metered use for these groundwater supplies is provided in Table 33-8.

Table 33-8 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2006/07 (ML)	Metered use 2005/06 (ML)
Casterton	1,000	486	371
Dartmoor	170	28	16
Hamilton (emergency bores)	668	624	136

Harrow(1)	29	45	45
Macarthur	80	38	28
Merino	100	0	0
Penshurst	250	148	141
Total	**2,297**	**1,369**	**737**

Note:
(1) Harrow's groundwater licence was insufficient to supply the town's needs in 2006/07. GWMWater is considering an application for an increase in the licence volume.

33.8 Drought contingency measures

A range of drought contingency measures were undertaken in the Glenelg basin in 2006/07. These include:

- restricting urban and rural water use (discussed below)
- provision of emergency water supply points
- reducing demand by industry
- developing new groundwater bores for Hamilton and the Iluka sand mine
- purchasing additional water for Glenthompson (12.5 ML) and Balmoral (15 ML) from GWMWater
- use of evaporation retardant on Wannon Water's storages.

No rights were qualified in the Glenelg basin in 2006/07.

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

Restrictions applying to urban customers and licensed diversions are shown in Table 33-9.

Groundwater use was unrestricted in the Glenelg basin during 2006/07.

Table 33-9 Seasonal allocations and restrictions on water use in Glenelg basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Harrow	Stage 2 restrictions from July 2006, decreasing to Stage 1 from October 2006 to June 2007
	Balmoral and Glenthompson	Stage 2 restrictions from July 2006, increasing to Stage 4 from October 2006 to June 2007
	Cavendish, Dunkeld, Hamilton and Tarrington	Stage 2 restrictions from July 2006, increasing to Stage 3 November 2006 and Stage 4 from December 2006 to June 2007
	Coleraine	Stage 1 restrictions from December 2006 until June 2007, when replaced by permanent water savings measures
Licensed diversions from unregulated streams	Glenelg River, Wannon River, Crawford River, Grange Burn Creek, Glenelg River Upper, Jimmy Creek, McLeod Creek and Rocklands Reservoir.	Irrigation ban from October 2006 to June 2007

33.10 Recycled water

Wannon Water operates four wastewater treatment plants in the Glenelg basin. Some 27% of wastewater was recycled in 2006/07 compared with 99% in 2005/06. Wannon Water indicated that this was primarily because recycled water was held in storage for potable water substitution and emergency and fire purposes at Hamilton and Casterton. In addition, a number of recycled water users in Hamilton ceased its use because they were unable to comply with EPA guidelines for use of recycled water.

Table 33-10 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)[(3)]
				Urban & industrial	Agriculture	Beneficial allocation[(1)]	Within process[(2)]		
Casterton	215	0	0%	0	0	0	0	0	215
Coleraine	49	2	4%	2	0	0	0	0	47
Dunkeld	32	0	0%	0	0	0	0	0	32
Hamilton	806	294	36%	47	247	0	0	0	512
Total 2006/07	**1,102**	**296**	**27%**	**49**	**247**	**0**	**0**	**0**	**806**
Total 2005/06	**1,282**	**1,274**	**99%**	**0**	**1,235**	**39**	**0**	**6**	**2**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006.

(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, such as Wannon Water holding wastewater in storage for the next year.

33.11 Water for the environment

33.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Glenelg basin EWR comprised the following components:

- the Wimmera and Glenelg Rivers – Flora and Fauna entitlement
- water set aside for the environment through the operation of passing flows released as a condition of consumptive bulk entitlements held by Wannon Water and GWMWater
- all other water in the basin not allocated for consumptive use.

33.11.2 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 2006/07.

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.

No water was released under this entitlement in 2006/07 following a direction from the Minister for Water to withhold releases until the available water resource situation improves.

33.11.3 Passing flow requirements

Bulk entitlements require passing flows to be met at a number of points in the basin.

Table 33-11 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 33-11 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 (shown as 1 in Figure 33-2)
	Passing flow rules	• The lesser of 0.4 ML/day or natural flow
	Compliance point	Headworks Creek (shown as 2 in Figure 33-2)
	Passing flow rules	• The lesser of 0.4 ML/day or natural flow
	Compliance point	Gap Creek (shown as 3 in Figure 33-2)
	Passing flow rules	• The lesser of 0.4 ML/day or natural flow
	Compliance point	No 1 Creek (shown as 4 in Figure 33-2)
	Passing flow rules	• The lesser of 0.4 ML/day or natural flow

Wannon Water reported that it was not able to comply with its passing flow obligations.

33.11.4 Water leaving the basin

The volume of water flowing from the Glenelg basin into Bass Strait was 42,200 ML in 2006/07. This represents 30% of the total inflows into the basin, compared with 37% in 2005/06. This water comprises consumptive water that was not used under entitlements and the EWR (environmental entitlement, passing flows, and any water above cap).

34 Millicent Coast basin

This chapter sets out the accounts for the Millicent Coast basin. For detailed information regarding the manner in which they have been compiled, refer to Chapter 5.

34.1 Millicent Coast basin summary

Rainfall was again low in the Millicent Coast, recording between 60% and 80% of the long term average. The low rainfall and lack of surface water led to a 28% increase in the use of groundwater, with the majority being extracted from the Neuarpur WSPA. This WSPA is exhibiting a long term declining trend in water level and a management plan to mitigate this is being reviewed.

34.2 Responsibilities for management of water resources

Table 34-1 shows the responsibilities of various authorities within the Millicent Coast basin. Where an area of responsibility is left blank, it is not applicable to the corresponding authority.

Table 34-1 Responsibilities for water resources management within the Millicent Coast basin, 2006/07

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 Millicent 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 Rainfall, inflows and storages in 2006/07

In 2006/07, rainfall across the Millicent Coast basin ranged between 60% and 80% of the long term average. This was approximately 20% less than over the previous two years. No reliable stream flow data exists for the Millicent Coast basin.

34.4 Total water resources in the basin

The total volumes of water available and supplied from water resources in the Millicent Coast basin are shown in Table 34-2. The volume of the surface water resource has notionally been set to the water diverted from streams in 2006/07.

Table 34-2 Summary of total water resources and water use in the Millicent Coast basin, 2006/07

Water source	Total water resource (ML)[1]	Total use (ML)
Surface water	100	100
Groundwater[2]	49,000	33,100
Recycled water	40	40

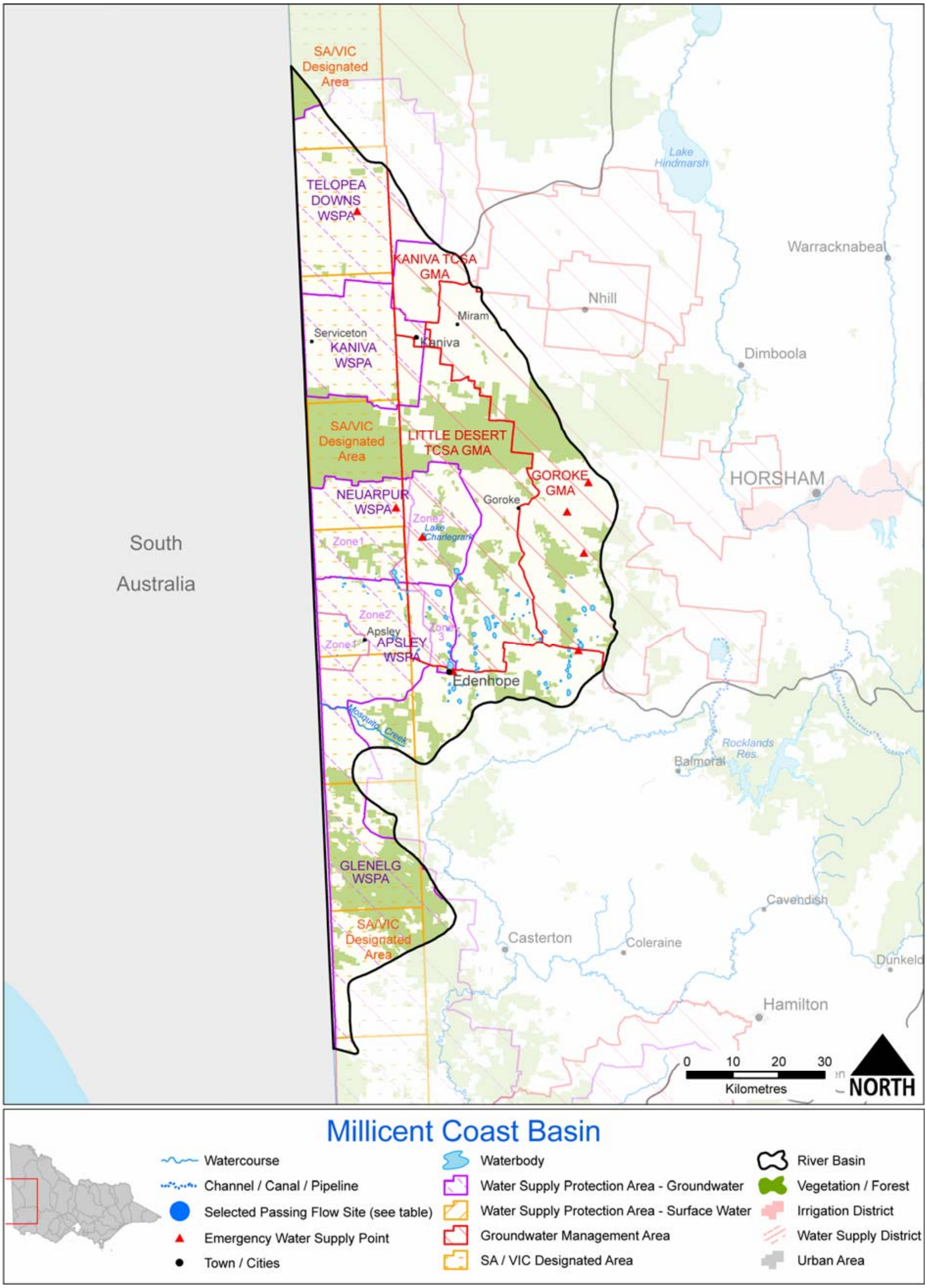
Note:

(1) For groundwater, the total water resource is the total entitlement limit as presented in Table 34-3.

(2) The total groundwater available for consumption and total groundwater use has been apportioned based on the percentage of the total surface area of the individual groundwater management units within the basin, as discussed in Chapter 5. This represents a change in approach from the State Water Report 2005/2006.

34.5 Location of water resources

Figure 34-1 Map of the Millicent Coast basin



34.6 Surface water resources

34.6.1 Water balance

There is no reliable estimate of the average annual inflows in the Victorian Millicent Coast basin, although 4,000 ML a year was estimated for the National Land and Water Resources Audit (National Land and Water Audit, 2001). As there is no gauging within the Millicent Coast basin in Victoria, an estimate of 2006/07 inflows could not reliably be made.

Currently limited information is available for surface water availability and use, therefore a water balance has not been included for the Millicent Coast basin.

34.6.2 Small catchment dams

No information regarding small catchment dams is readily available within the Millicent Coast basin.

34.6.3 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 2006/07.

34.6.4 Volume diverted

The only surface water licences utilised in the Millicent Coast basin are licences on unregulated streams. In 2006/07, licensed volume totalled 100 ML and use was estimated to be 100 ML.

34.7 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 34-3.

The main water supply in the Millicent Coast basin is groundwater. The Millicent Coast basin contains the whole Kaniva WSPA, Neuarpur WSPA, Apsley WSPA and Little Desert GMA, as well as part of the Glenelg WSPA, Telopea Downs WSPA, Kaniva TCSA GMA and Goroke GMA.

Groundwater use was not consistent across the basin, with some GMUs experiencing an increase in use and others a decrease. Extractions in the Neuarpur WSPA increased by 42% and totalled 22,182 ML in 2006/07, comprising approximately two-thirds of all licensed groundwater use in the basin. The Neuarpur WSPA is showing signs of a long term declining trend in water levels and a management plan is being reviewed by the Department of Sustainability and Environment. The Glenelg WSPA's water level is also decreasing and a management plan is being developed.

Groundwater entitlements and use for unincorporated areas have not been included in the 2006/07 water accounts.

Table 34-3 Licensed groundwater volumes, Millicent Coast basin 2006/07

WSPA/GMA[(1)]	GMA/WSPA depth limits[(2)] (m)	Entitlement limit[(3)] (ML/year)	Licensed entitlement[(4)] (ML/year)	Metered use (ML)	Estimated use in unmetered bores (ML)	Total licensed groundwater use (ML) 2006/07	Total licensed groundwater use (ML) 2005/06
Goroke GMA (37%)	Tertiary confined sand aquifer	807	807	0	0	0	0
Kaniva TCSA GMA (17%)	Tertiary confined sand aquifer	187	187	0	0	0	0
Little Desert GMA (100%)	Tertiary confined sand aquifer	1,100	1,100	0	0	0	0
Apsley WSPA (100%)	All depths	4,285	4,285	1,772	0	1,772	2,120
Glenelg WSPA (30%)	All depths	9,704	9,704	4,361	0	4,361	2,235
Kaniva WSPA (100%)	25-140	3,673	3,673	2,142	0	2,142	2,360
Neuarpur WSPA (100%)	50-175	24,696	24,696	22,182	0	22,182	15,600
Telopea Downs WSPA (61%)	All depths	4,557	4,557	1,402	0	1,402	2,509
Total		**49,009**	**49,009**	**31,859**	**0**	**31,859**	**24,824**

Notes:

(1) The percentage of the GMA/WSPA by surface area within the river basin is given in parentheses. All water volumes in this table represent the total volume for the GMA/WSPA multiplied by this percentage. This represents a change in methodology compared with the figures presented in the State Water Report 2005/2006. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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

(3) The entitlement limit represents the sum of licensed entitlements for the respective GMA/WSPA, except where the GMA/WSPA has a permissible consumptive volume (PCV) as outlined in the Central Region Sustainable Water Strategy.

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

An estimate of domestic and stock groundwater use is provided in Table 34-4.

Table 34-4 Number of domestic and stock bores and estimated use, 2006/07

WSPA/GMA	No. of domestic and stock bores[(1)(2)]	Estimated domestic and stock use (assuming 2ML/bore) (ML)
Goroke GMA (37%)	0	0
Kaniva GMA (17%)	0	0
Little Desert GMA (100%)	0	0
Apsley WSPA (100%)	135	270
Glenelg WSPA (30%)	30	60
Kaniva WSPA (100%)	112	224
Neuarpur WSPA (100%)	299	598
Telopea Downs WSPA (61%)	61	122
Total	**637**	**1,274**

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 volume in Table 34-3.

(2) The numbers of domestic and stock bores are those registered in the state database as being drilled since 1965, multiplied by the surface area percentage in the basin. Those GMAs/WSPAs with less than 5% surface area within the basin have not been included.

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 34-5.

Table 34-5 Urban groundwater usage

Town supplied	Licensed volume (ML)	Metered use 2006/07 (ML)	Metered use 2005/06 (ML)
Boikerbert (Apsley)	40	47	40
Edenhope (emergency bores)(1)	n/a	142	107
Goroke	86	76	74
Kaniva	600	279	216
Leeor (Serviceton)	25	14	12
Lillimur	32	11	23
Mirampiram (Miram)	7	2	3
Total	**790**	**572**	**475**

Note:

(1) GWMWater and the Department of Sustainability and Environment are currently working on defining a licensed volume for Edenhope's groundwater supply.

34.8 Drought contingency measures

A range of drought contingency measures were undertaken in the Millicent Coast basin in 2006/07. These include

- restricting urban and rural water use (discussed below)
- providing emergency supply points.

No rights were qualified in the Millicent Coast basin in 2006/07.

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

Restrictions on water use in the Millicent Coast basin are outlined in Table 34-6.

Groundwater use was unrestricted in the basin during 2006/07.

Table 34-6 Seasonal allocations and restrictions on water use in Millicent Coast basin, 2006/07

Type of restriction	Area	Nature of restriction
Urban	Edenhope	Stage 1 restrictions from July 2006 to June 2007
Diversions from unregulated streams	Lake Charlegrark, Lake Wallace and Lake Yampitcha	Irrigation ban October 2006 to June 2007

34.10 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 and is not included in Table 34-7.

Table 34-7 Volume of recycled water

Treatment plant	Volume produced (ML)	Volume recycled (ML)	% recycled (excl. within process)	End use type for recycled water (ML)				Volume discharged to the environment (ML)	Release to ocean/ Other (ML)(3)
				Urban & industrial	Agriculture	Beneficial allocation(1)	Within process(2)		
Edenhope	42	42	100%	42	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 2006/07	**42**	**42**	**100%**	**42**	**0**	**0**	**0**	**0**	**0**
Total 2005/06	**62**	**62**	**100%**	**62**	**0**	**0**	**0**	**0**	**0**

Notes:

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

(2) Water reused in wastewater treatment processes, e.g. backflushing of filters. This value is not included in the total percentage recycled, consistent with its treatment in the ESC's Performance Report. This represents a change in methodology from the figures presented in the State Water Report 2005/2006.

(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.

34.11 Water for the environment

34.11.1 Environmental Water Reserve (EWR)

In 2006/07 the Millicent Coast basin EWR comprised all water in the basin not allocated for consumptive use.

34.11.2 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 not diverted flows to South Australia.

Part 3
Directions for Victorian water resource management and reporting

Amidst new understanding of the far-reaching impacts of climate change, the most significant issue being addressed by the Victorian Government is the need to secure future water supplies for all Victorians.

While contingency plans have provided short term remedy to drought, the release of *The Next Stage of the Government's Water Plan* (the Water Plan) in June 2006 identifies six major infrastructure investments that will ensure continuity of supply.

Balancing water consumption requirements between all users, including the environment, is always a challenge. Climate change compounds this challenge. Research into, and understanding of, the impacts of changing climatic conditions on water availability have become critical in planning for the future. Detailed modelling and projections to the year 2050 have informed current decision-making and the development of the Water Plan.

In addition, key programs across all areas of water resource management and conservation in Victoria have been initiated and extended in 2006/07. These include improvements in the continued roll-out of the state's sustainable water strategies, improved understanding and management of groundwater resources, improved processes for securing water for the environment, expansion of water conservation rebate schemes in urban areas and ongoing reduction of water use by non-residential users.

The Victorian Government continues to improve its water accounting and reporting framework in a manner that is consistent with the Australian Government's National Water Initiative, ensuring accurate information about the state's water availability and use is accessible.

35 Challenges for water resource management in Victoria

The impact of drought was more far-reaching and dominant in 2006/07 than in any of the previous 11 years of below-average rainfall. Rainfall and streamflows across all of Victoria have been significantly diminished, resulting in depleted storage levels in most basins.

As in 2005/06, the cumulative reduction in storage levels and ongoing rainfall deficiencies during 2006/07 indicate that the typical cycle of drought and rain may have been exacerbated and distorted by climate change. As a result, water resource and drought management planning activities initiated in 2005/06 to ensure the sustainable management of water resources were expanded in 2006/07 with new investments to secure long term water supplies for the state.

35.1 Securing water supplies – *The Next Stage of the Government's Water Plan*

In June 2007 the Victorian Government released the next stage of its Water Plan.

Approximately $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 water that would otherwise be lost
- expand Victoria's water grid – the network of rivers, channels and pipes linking our major water systems. Construction commenced on the Bendigo Link of the Goldfields Superpipe in February 2007
- 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. Construction of the upgrade commenced in September 2007
- 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.

Full details of the next stage of the *Our Water Our Future* action plan are available on www.ourwater.vic.gov.au.

35.2 Regional sustainable water strategies

Ongoing development of regional sustainable water strategies remains a focus of the Victorian Government as an important part of Victoria's new planning framework for determining large scale, long term changes in water use.

The Central Region Sustainable Water Strategy (CRSWS) has now been developed following community input over an 18 month period and a review by an independent panel. The development of the strategy for the northern region began in January 2008, and the western and eastern sustainable water strategies will be initiated in 2008.

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 to provide safe, reliable water supplies for all users.

35.2.1 Central Region Sustainable Water Strategy

The CRSWS was released in October 2006. The Department of Sustainability and Environment, water businesses and catchment management authorities are currently implementing the range of actions identified in the strategy.

An annual review of the strategy was undertaken to assess water availability and demand compared with forecasts and evaluate progress in achieving targets stated in the CRSWS for water conservation, recycling and environmental flows.The results were published in the *Central Region Sustainable Water Strategy – Annual Review 2006/07* released in April 2008.

The findings noted that in general the actual supply/demand balance for 2006/07 for all systems fell at the lower end of the range defined by the projections presented in the CRSWS. On the basis of one year's data, the long term forecasts underlying the CRSWS remain valid, and a comprehensive review of the CRSWS is not deemed necessary in the immediate future.

The review found volumes of recycled water provided by water businesses were consistent with their stated targets. Similarly, the review found that targets for residential and non-residential water conservation are on track.

Several environmental targets for 2007 were not met, due largely to prioritisation of resources to secure urban supply through qualification of rights. The ability to deliver environmental flows is dependent on the continuing drought.

35.2.2 Northern Region Sustainable Water Strategy

In January 2008 the Minister for Water released the Northern Region Sustainable Water Strategy (NRSWS) Discussion Paper. The NRSWS is being developed in collaboration with catchment management authorities, local government, urban and rural water businesses, 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.

The draft strategy is due for release in mid-2008 for public comment. A final NRSWS is expected in early 2009.

35.2.3 Eastern and Western Region Sustainable Water Strategies

The Department of Sustainability and Environment will develop the Eastern and Western Region Sustainable Water Strategies (ERSWS and WRSWS) during 2008.

The strategies, which focus on key regional water resource planning issues, will be developed in collaboration with catchment management authorities, local government, urban and rural water businesses, other stakeholders and the community.

35.3 Research and knowledge

Changing climate and prolonged drought have placed new emphasis on the importance of accurate research, modelling and the ability to make informed projections about future water availability and use. This sort of knowledge and learning has been fundamental in the development of the Water Plan, the regional sustainable water strategies and shorter-term planning decisions relating to seasonal water allocations, conservation programs and groundwater use.

The demand for these capabilities has inadvertently contributed to a shortage of human resources who have professional training and education in these areas. This challenge will need to be addressed in years to come to ensure the accuracy of planning and projections in Victoria's water resource management.

35.4 Murray-Darling Basin Sustainable Yields Project

The CSIRO is currently undertaking the Murray-Darling Basin Sustainable Yields Project, assessing water availability in 18 contiguous regions comprising the entire Murray-Darling Basin. The project was commissioned by the previous Prime Minister, John Howard and Murray-Darling Basin state Premiers following the November 2006 Summit on the Southern Murray-Darling Basin. The project is assessing the water available under a range of future climate and development scenarios. The CSIRO is progressively reporting on each of the regions, with the Wimmera and Ovens regions of Victoria available as of February 2008.

35.5 Bushfire impacts on water quality and quantity

Victoria experienced a severe 2006/07 fire season, during which a number of significant fires impacted over 1,190,000 hectares of the state. The fires in eastern Victoria burned for a record 69 days and affected 1,048,238 hectares of private and public land. These fires had the longest duration in Victoria's recorded history.

The 2006/07 bushfires caused significant water quality issues in some catchments. The Mitchell in East Gippsland was one of the most affected catchments, with highly turbid river water forcing East Gippsland Water to undertake a range of contingency measures to ensure urban water supplies.

Further work is being considered by the Department of Sustainability and Environment to build on previous research undertaken by the Department and the Murray Darling Basin Commission into the water quantity and quality impacts of major bushfire events.

35.6 Review of retail water industry structure in Melbourne

In August 2007, the government asked the Victorian Competition and Efficiency Commission to make recommendations on the best retail structure for the efficient and least cost provision of upgrades to Melbourne's water supply. Recommendations were also requested as to ongoing safe, reliable, sustainable water and sewerage services to Melbourne within the context of significant infrastructure investment to augment Melbourne's water supplies.

In the future, Melbourne will be part of an increasingly interconnected water 'grid' and will have access to a portfolio of water sources, each with a different risk/cost profile. Water supply sources will include catchments, rivers and storages, as well as manufactured water (desalinated water, and potentially recycled water for non-potable uses such as non-residential or environmental flows). Transfer infrastructure will include the existing gravity-fed systems plus new interconnecting pipelines requiring pumping. These changing conditions present new challenges and opportunities for Victorian water management.

The construction and operation of the augmented water supply system will come at a cost over the next few decades and will need continued efficiencies. Longer term reforms therefore need to be investigated with the objective of achieving maximum efficiencies across the water sector and enabling informed consumption decisions to mitigate water price impacts.

35.7 Urban water conservation initiatives

As part of the *Our Water our Future* action plan, the Victorian Government is conducting water conservation programs for settlements connected to the reticulated water supply system. These programs are helping to reduce consumption of potable water and establish more sustainable water consumption patterns.

35.7.1 Water Smart Gardens and Home Rebates Scheme

Initiated in 2003, the Water Smart Gardens and Home Rebates Scheme provides rebates for indoor and outdoor water savings devices ranging from water efficient showerheads and shower timers through to domestic water tanks. Since its inception, the following large tank reconfigurations were added as rebatable products:

- $1,000 for a 5,000+ litre tank connected to toilet <u>and</u> laundry
- $900 for a 5,000+ litre tank connected to toilet <u>or</u> laundry
- $500 for a 2,000-4,999 litre tank connected to toilet and/or laundry.

In July 2007 the scheme was extended for a further four years and expanded to include rebates for hot water recirculating devices and for new showerhead devices costing over $100. Furthermore, a basket of selected products with a combined value of $100 – rainwater diverters, waterless car cleaning products, shower timers and toilet flush interrupter devices – qualify for a $30 rebate.

35.7.2 Schools Water Efficiency Program

Commenced in 2006, the Schools Water Efficiency Program is designed to help schools undertake an audit of their internal water use. Where potential water savings are identified, schools undertake low cost water efficiency improvements at no up-front cost. These improvements include fitting flow-control valves and fixing leaky taps.

35.7.3 Stormwater and Urban Water Conservation Fund

Launched in 2004, the three year Stormwater and Urban Water Conservation Fund was established to demonstrate a variety of approaches to saving potable water.

Demonstration projects have shown how potable water can be saved through the use of local stormwater, recycling, water conservation and education in a range of urban settings, e.g. recreational open space, community gardens, schools, buildings, business, industry and health facilities.

The fund is meeting its objectives to reduce demand for potable water for purposes other than drinking, and to support the use of non-potable water that is fit for purpose while protecting public health and the environment, and significantly improve the integrated management of water resources.

The new Stormwater and Urban Recycling Fund was launched in Februrary 2008; it is designed to support the development of local stormwater and urban recycling projects that will reduce demand for drinking water for uses other than drinking.

35.7.4 Pathways to Sustainability

In October 2003 Melbourne's retail water businesses formally commenced a program targeting Melbourne's highest non-residential users of water, i.e. Melbourne's Top 200 customers. These customers currently use 38.5 gigalitres per year, which is approximately 10% of Melbourne's water or approximately 1% of the state's water. The Pathways to Sustainability program required customers to develop a water management action plan by 30 June 2007.

Since 2001/02, Melbourne's Top 200 reduced their usage by 7.6 gigalitres, or almost 17%.

35.7.5 Other non-residential conservation programs

Pathways to Sustainability was such a success that in 2006/07 the Victorian Government made it mandatory for all non-residential users consuming greater than 10 ML per annum to develop a water management action plan (waterMAP) by 31 December 2007.

Other water conservation related programs targeting non-residential users include:

- a $1.25 million program seeking to achieve water savings of over one gigalitre through optimising cooling tower maintenance and operating processes
- a $1 million program to encourage best practice in laundries and target water reductions of 500 gigalitres
- $3.9 million to upgrade hospitals and aged care facilities to save energy and water
- promoting the use of recycled water by industry where it is 'fit for purpose'. The government announced over $6 million worth of initiatives in the 2007/08 budget to replace the use of 3.5 gigalitres of drinking water with recycled water
- installing smart meters in the premises of Melbourne's Top 200 customers to provide real-time meter reading information about water consumption, allowing better and quicker decisions around investing in water saving equipment.

35.8 Groundwater management and reform in Victoria

Investment in groundwater resource appraisals by the Victorian Government and the rural water businesses continued over 2006/07 and has improved understanding of aquifer properties and responses to changes in extraction regimes. In addition, the expansion of metering programs has provided detailed data about groundwater use. This has greatly enhanced understanding of groundwater and the extraction-recharge cycle, the increasing demands for groundwater and the use of entitlements to access reserves. The challenge is to ensure that decisions concerning the sustainable management of groundwater resources are underpinned by sound scientific and technical advice and are able to be reviewed and updated as necessary.

A key emphasis in groundwater reform and future policy development will be to ensure that extractions from aquifers are sustainably managed so that supplies do not fall below predetermined levels. This means ensuring that extractions fall within limits defined by the 'sustainable yield' of the aquifer, which is the renewable part of the groundwater resource. Sustainable yield is identified after allowing for acceptable impacts on users, the surface environment and the resource itself. Extractions from aquifers are progressively being capped to stabilise use within all GMAs.

35.8.1 State observation bore monitoring refurbishment program

The State Observation Bore Network (SOBN) comprises approximately 2,500 groundwater bores which are used for routine measurement of groundwater levels as part of the State Groundwater Monitoring Program. This program enables the Department of Sustainability and Environment to:

- characterise the groundwater resource across the state and how the resource changes over time
- promptly identify emerging problems with the resource or the aquifer and identify where the groundwater resource is being used unsustainably
- assess known problem areas where land use and water use practices affect the groundwater resource
- understand and better quantify the components of the water balance including interactions with surface systems, and the response to stress in an aquifer or interconnected surface water system
- evaluate the effectiveness of management activities.

A number of bores which form part of the SOBN are nearing or have passed their useful life, with the bore casing or screens having either failed or showing signs that they will soon fail. Some of these bores are required to support existing or proposed groundwater management plans, whilst others form part of the regional monitoring network.

Through the *Our Water Our Future* action plan, the Victorian Government has made a commitment to upgrade and maintain the state's groundwater observation bore network through the SOBN refurbishment program. The program entails the strategic replacement, refurbishment, decommissioning and installation of new SOBN bores. The total replacement value of the network is estimated at over $100 million. The on-ground works to support refurbishment of the network did not commence during 2006/07 because tenders for the management of drilling works were unable to be let. This was due to the drought causing high demand for drillers by farmers seeking drought relief through groundwater supplies.

In 2006/07 eight consultancies began assessing the monitoring and SOBN refurbishment needs of 26 key groundwater management units across the state. This work has highlighted significant shortfalls in the extent and distribution of the current observation network. Over 500 new bores have been recommended to be constructed, along with nearly 50 bores to be decommissioned that have failed or are nearing the end of their useful life. The Victorian Government is working closely with rural water businesses to determine the priorities for drilling works.

In conjunction with the refurbishment program, a comprehensive review of the SOBN is being undertaken. The findings of the are guiding the future direction of groundwater monitoring in Victoria.

35.9 Managing water for the environment

The Victorian Government's *Our Water Our Future* action plan outlined key projects for enhancing the Environmental Water Reserve including:

35.9.1 Enabling donations for the environment

Water can be provided for the environment through private donations of water entitlements. In systems declared as water supply protection areas, entitlements include water shares or seasonal allocations; in undeclared systems, they include water rights, sales water, water allocations and section 51 licences.

Donations provide an opportunity for irrigators and other water users to be directly involved in environmental watering of priority sites. The first water donations occurred in 2004/05; in 2005/06 irrigators donated 5.6 gigalitres of unused water at the end of the irrigation season for emergency River Red Gum watering near Mildura.

Building on the success of these private donations, the government is currently investigating a range of incentives for water users to donate water to the environment, including:

- tax deductibility of water donations
- payment of transfer fees associated with water donations
- payment of other fees associated with holding water shares (in certain circumstances).

As caretakers of river health, all catchment management authorities and Melbourne Water will be able to receive donations of water on behalf of the environment. Any future incentives will be developed on a catchment-specific basis, depending on the environmental values of the sites receiving the donated water and the most cost-effective method of sourcing additional water.

35.9.2 Streamflow management plan tenders

To help improve environmental flows in priority unregulated rivers, the Victorian Government conducted a pilot project in the Olinda, Stringybark, Pauls, Steels and Dixons Creeks. Draft streamflow management plans (SFMPs) had been prepared for these rivers and stipulated that the environmental flows recommended in the drafts would be implemented in five years. The streamflow tender trialled a method of providing government investment in achieving the intended outcomes of these plans.

Under the streamflow tender, the government provided financial assistance to licence holders for changes to licence conditions that will achieve earlier implementation of the environmental flows. This was undertaken in one of two ways:

- Licence holders could opt to be managed to the improved environmental flows – four years in advance of the flow levels set in the plans. This means that a licence holder would be placed on ban from pumping water when streamflows reach the environmental flows set in the draft SFMP for their area.
- Licence holders could nominate to reduce the volume of their licence. (In some cases, this resulted in total surrender of the licence).

Both outcomes resulted in improved environmental flows in each catchment.

The streamflow tender was run in mid-2007. Participation was highest in the Olinda and Stringybark Creeks catchments where more than half of the improvements achieved by the plans over five years will be achieved from 1 July 2008 – four years early. Across these two creeks, a total of 55 ML of water was surrendered for the environment. Participation was lower in Pauls, Steels and Dixons Creeks, and only a modest improvement in environmental flows was achieved. In general, licence holders thought that the streamflow tender was a good idea and over 75% of licence holders in all three catchments believed they would be likely to participate in a future tender.

The tender process is currently being evaluated for its success in achieving environmental flow outcomes. Further trials of methods for delivering government investment are planned in several high priority unregulated rivers during 2008.

36 Water accounting and reporting

36.1 Water accounting in theVictorian Water Accounts 2006-2007

The 2006/07 state water accounts in Part 2 of this report are an example of annual water resource accounting at the river basin and aquifer scale. Water accounting is an evolving concept and presents a number of challenges compared with traditional financial accounting, not the least of which is the impossibility of obtaining 100% accuracy in water measurement. Work is underway at a national level under the auspices of the Water Accounting Development Committee to progress water accounting and Victoria is an active participant in this process.

Significantly, the 2006/07 state water accounts reflect improvements on the 2005/06 accounts in:

- accounting for groundwater
- accounting for small catchment dams.

These improvements have not only increased the accuracy and robustness of the figures presented in the *Victorian Water Accounts 2006-2007*, but also provide an important input to the current water accounting debate. Improvements in terms such as base data, methodologies and accounting frameworks will continue to occur; future Victorian Water Accounts will be broadened to include a more complete record of transactions associated with holding and transferring bulk water and environmental flows.

36.1.1 Water accounting rules and chart of accounts

The 2006/07 state water accounts are largely based on a set of formal water accounting rules and a chart of accounts developed for the Department of Sustainability and Environment and applied to the 2005/06 state water accounts. While these rules related solely to data collected for and presented in the *State Water Report 2005/2006* and were not intended to be used for any other purpose, they have informed the development of the 2006/07 state water accounts.

The water accounting rules provide for rigour and consistency. They prescribe how the accounts are prepared, the general principles applied during preparation, and how volumes of water resources (in storage, inflows, diversions, usage, losses and basin outflows) and entitlements (permanent and temporary transfers, volumes diverted) are treated within the water accounts.

The chart of accounts preserves the discipline of a double entry accounting system; both entries are posted to accounts that relate to one combined statement of water storage and water flows. The chart of accounts uses the basin as the 'entity' that the accounts are being prepared for. Each account is assigned to one of six elements in the basin accounts:

- water available for use – 'volume in storage' accounts
- water inflows – including catchment inflows and treated wastewater discharged to rivers
- water diversions/water usage – urban diversions, licensed diversions from unregulated streams
- water losses – evaporation from major storages, in-stream losses
- water entitlements – temporary trades, volumes diverted under a given bulk entitlement
- water passed at outlet of basin – ceding to New South Wales, outflows to another basin.

The rules and chart of accounts provide an accurate and transparent system for recording State Water Report data. They will also provide important discussion points in the broader conceptual water accounting discussions taking place at a national level through the Water Accounting Development Committee.

36.1.2 Accounting for groundwater

Previous State Water Reports have discussed challenges for water accounting posed by groundwater. These challenges relate to:

- accounting for groundwater within the boundaries of river basins where an aquifer underlies more than one basin
- double counting of water where groundwater and surface water interconnections exist
- management of GMAs and WSPAs using extraction rates and groundwater levels, rather than aquifer volumes.

Progress on the first challenge has been made in the *Victorian Water Accounts 2006-2007*. The second and third challenges remain, and may be informed by development of national water accounting standards particularly in relation to measurement uncertainty. In the *Victorian Water Accounts 2006-2007*, groundwater is allocated to basins on the basis of the percentage of the surface area of a GMU that lies beneath a given basin. While it is acknowledged that this approach has its limitations – groundwater bores are unlikely to be evenly distributed across a GMU – this form of accounting for groundwater overcomes the issue of double-counting in previous reports.

36.1.3 Accounting for small catchment dams

The measurement and reporting of small catchment dams is problematic as most diversions from them are not metered and their exact location within basins is not known with a high degree of certainty.

For these reasons, the State Water Reports have used the estimated average impact (usage and losses) of small catchment dams. While this approach did not reflect the actual impact, it was considered appropriate as the state was experiencing broadly average conditions. The data collected for the *Victorian Water Accounts 2006-2007*, however, demonstrated that 2006/07 could not be considered an average year. Rainfall was much lower than average, streamflow was significantly lower than previous years and, as a result, diversions were lower.

A report was commissioned soon after the 2006/07 year ended to study the likely effect of the drought on small catchment dams during the year. The study estimated that in most cases diversions from small catchment dams fell compared to the average, with 22 basins experiencing reductions in usage ranging from 1% to 57%. Although the measurement of small catchment dams remains uncertain, lower usage figures adopted in 2006/07 are more likely to reflect actual conditions and are an improvement in the accounting method.

36.2 Victorian Water Register

Coinciding with the unbundling of water entitlements in northern Victoria on 1 July 2007, the water registers operated by Goulburn-Murray Water, Lower Murray Water and the First Mildura Water Trust were replaced by a single Victorian Water Register. Unbundling of entitlements in Southern Rural Water's regulated systems (in the Thomson and Werribee basins) is planned for 1 July 2008. Those entitlements will then be placed in the Victorian Water Register.

All other Southern Rural Water and Melbourne Water entitlements will remain bundled and the intention is to incorporate them into the register by the end of 2008.

The Water Register is underpinned by a rigorous accounting framework 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 accounting framework enables water shares, allocation, water use and transfers of water shares and allocation to be recorded, analysed, reconciled, audited and reported. This includes information regarding owner, delivery system, trading zone, reliability, tenure, source and water authority.

The Water Register will ease the collection of data, simplify the compilation and improve the accuracy of future state water accounts.

The Water Register will play a key role in a pilot project the Department of Sustainability and Environment is undertaking to develop a water accounting system for the Broken and Goulburn Rivers. The pilot project will use the water register to test the water accounting concepts, standards and procedures being developed under the National Water Accounting Development Project established to develop a nationally consistent approach to water accounting.

36.3 State metering program

Accurate water accounts rely on accurate and complete data surrounding 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 government subsequently introduced the following metering thresholds for existing unmetered water extractions, 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 government's metering program contributes $400 to the cost of metering each site. The program commenced in 2005 and approximately 2,150 meters (or 65% of the estimated total number of meters) were installed by December 2007. The majority of the remaining meters are expected to be installed by June 2008, and the program completed by June 2009.

As the metering project progresses, the accuracy of the figures in future reports relating to volumes of water extracted from groundwater aquifers and unregulated streams will be significantly improved. Metering will add a greater level of confidence in the water resource information presented in future reports. It will also assist water managers and water users to better understand usage patterns and help users comply with their entitlement and licensed volumes.

36.4 Bulk entitlement metering, compliance and reporting

To ensure that a water business operates within its entitlement volumes and meets other obligations regarding the taking of water, robust and independent arrangements for monitoring and verifying compliance with bulk entitlements are necessary. Work is underway to enhance existing compliance arrangements, including draft guidelines for developing bulk water entitlement metering plans. These plans will document how metering programs in water businesses will confirm compliance with obligations specified in individual bulk entitlements.

The metering plan work will form part of a broader compliance framework for bulk entitlements. It will define the roles and responsibilities required for an effective compliance framework and will include independent audit arrangements that determine if compliance with obligations under bulk entitlements has been achieved.

37 Future Victorian Water Accounts

Future Victorian Water Accounts will reflect and be informed by:

- national water accounting developments
- the outcomes of the Pilot Project for the Broken and Goulburn Rivers, which will test the further development of water accounting. The Pilot Project will develop a prototype water accounting system to enable the efficient production of information and reports in line with water accounting standards being developed under the National Water Accounting Development Project
- results of implementing actions and programs in the government's *Our Water Our Future* action plan and *Our Water Our Future – The Next Stage of the Government's Water Plan*
- progressive improvements at a state level in methodologies of measuring and recording water in, for example, urban consumption, groundwater, environmental water and small catchment dams.

Appendix A

Groundwater entitlement and use

Groundwater management unit[1]	Allocation limit as of 30/06/07 (ML)	Licensed volumes (as of 30/06/2007)							Domestic/stock		Total use (licensed + D&S)
		Licensed entitlements (ML)	No. of licences	No. of metered bores	Estimated no. bores yet to be metered	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	10,883	33	37	3	5,423	0		283	623	6,046
Neuarpur WSPA	24,696	24,696	52	106	0	22,182	0		299	658	22,840
WSPA (draft plan)											
Apsley WSPA	4,285	4,285	20	11	3	1,772	0		135	297	2,069
Kaniva WSPA	3,673	3,673	14	20	2	2,142	0		112	2,464	4,606
Telopea Downs WSPA	7,482	7,482	10	12	0	2,302	0		100	220	2,522
GMA											
Balrootan (Nhill) GMA	1,522	1,522	13	13	0	413	0		51	112	525
Goroke GMA	2,200	2,200	0	0	0	0	0		0	0	0
Kaniva GMA	1,100	1,100	0	0	0	0	0		0	0	0
Little Desert GMA	1,100	1,100	0	0	0	0	0		0	0	0
Nhill GMA	1,200	1,200	0	0	0	0	0		0	0	0
Unincorporated areas											
GWMWater	8,909	8,909	33	0	0	3,118			0	0	3,118
Southern Rural Water											
WSPA (approved plan)											
Nullawarre WSPA	25,100	25,100	208	158	0	22,188	0		1,197	2,394	24,582
Yangery WSPA	14,458	14,458	164	161	0	7,215	0		1,432	2,864	10,079
Koo-Wee-Rup WSPA	12,915	12,915	393	244	0	6,452	0		2,500	5,000	11,452
WSPA (draft plan)											
Bungaree WSPA	5,273	5,273	101	124	4	3,622	0		252	504	4,126
Condah WSPA	8,700	8,700	38	43	0	3,912	0		58	116	4,028
Denison WSPA	17,743	13,853	126	100	0	10,152	0		297	594	10,746
Deutgam WSPA	5,100	5,100	154	192	0	1,093	0		257	514	1,607
Glenelg WSPA	32,867	32,867	80	81	8	14,769	0		103	206	14,975
Sale WSPA	21,212	21,212	106	111	0	13,358	0		919	1,838	15,196
Wandin Yallock WSPA	2,924	2,924	185	206	0	792	0		163	326	1,118
Warrion WSPA	16,500	16,500	131	126	0	2,994	0		700	1,400	4,394
Wy Yung WSPA	9,070	9,070	61	73	5	1,895	0		116	232	2,127
Yarram WSPA	26,428	26,428	85	77	0	16,009	0		970	1,940	17,949

Groundwater management unit[1]	Allocation limit as of 30/06/07 (ML)	Licensed volumes (as of 30/06/2007)							Domestic/stock		Total use (licensed + D&S)
		Licensed entitlements (ML)	No. of licences	No. of metered bores	Estimated no. bores yet to be metered	Metered volume (ML)	Estimated non-metered use (ML)[2]	Method used to estimate non-metered use	No. of bores[3]	Estimated use (ML)[4]	
GMA											
Cardigan GMA	3,967	766	19	8	0	0	230	35% of licensed entitlement	481	962	1,192
Colongulac GMA	14,271	14,271	43	18	0	1,157	0		208	416	1,573
Corinella GMA	2,550	1,944	14	3	0	61	0		157	314	375
Cut Paw Paw GMA	3,650	537	8	3	0	0	161	35% of licensed entitlement	2	4	165
Frankston GMA	3,200	1,045	27	16	0	319	0		199	398	717
Gellibrand GMA	0	0	0	0	0	0	0		0	0	0
Gerangamete GMA[5]	20,000	20,000	1	0	1	11,807	0		5	10	11,817
Giffard GMA	5,705	5,705	15	18	0	3,719	0		171	342	4,061
Glenormistom GMA	5,042	5,042	34	9	0	1,044	0		125	250	1,294
Hawkesdale GMA	12,174	12,174	111	8	39	1,423	0		2,100	4,200	5,623
Heywood GMA	21,763	21,763	95	42	0	1,629	0		1,735	3,470	5,099
Jan Juc GMA	4,250	4,250	2	0	0	0	1,275	35% of licensed entitlement	6	12	1,287
Lancefield GMA	1,485	1,373	15	16	0	273	0		76	152	425
Leongatha GMA	6,500	1,471	31	6	0	625	0		114	228	853
Merrimu GMA	450	284	8	9	0	79	0		13	26	105
Moe GMA	8,200	3,864	85	11	0	1,447	0		197	394	1,841
Moorabbin GMA	2,700	2,525	47	51	0	1,987	0		238	476	2,463
Nepean GMA	6,013	6,013	68	58	0	3,645	0		1,766	530	4,175
Newlingrook GMA	1,977	1,968	5	3	0	70	0		10	20	90
Orbost GMA	1,200	1,200	3	4	0	540	0		0	0	540
Paaratte GMA	4,606	4,606	7	0	0	0	1,382	35% of licensed entitlement	4	8	1,390
Portland GMA	20,683	8,562	9	4	0	3,244	294	30% of non-urban licensed entitlement	63	126	3,664
Rosedale GMA	22,313	13,043	49	39	0	7,539	0		410	820	8,359
Stratford GMA[6]	27,643	35,450	8	5	0	19,182	0		410	820	20,002
Tarwin GMA	1,300	41	2	1	0	0	12	35% of licensed entitlement	806	242	254
Wa De Lock Zone GMA	30,084	26,735	241	127	0	10,509	0		482	964	11,473
Unincorporated areas											

Groundwater management unit[1]	Allocation limit as of 30/06/07 (ML)	Licensed volumes (as of 30/06/2007)							Domestic/stock		Total use (licensed + D&S)
		Licensed entitlements (ML)	No. of licences	No. of metered bores	Estimated no. bores yet to be metered	Metered volume (ML)	Estimated non-metered use (ML)[2]	Method used to estimate non-metered use	No. of bores[3]	Estimated use (ML)[4]	
Southern Rural Water	59,210	59,210	1,208	0	0	20,724	0		0	0	20,724
Gouburn-Murray Water											
WSPA (approved plan)											
Campaspe Deep Lead WSPA	46,251	46,251	228	192	0	34,762	0		86	172	34,934
Shepparton WSPA	232,155	232,155	1,456	813	0	109,247	0		1,245	2,490	111,737
Spring Hill WSPA	5,062	5,062	59	105	0	2,491	0		53	108	2,599
Katunga WSPA	59,734	59,734	450	121	0	30,801	0		232	476	31,277
WSPA (draft plan)											
Mid Loddon WSPA	37,200	37,200	192	95	0	22,851	0		93	244	23,095
Upper Loddon WSPA	13,408	13,408	245	132	0	6,193	0		124	260	6,453
GMA											
Alexandra GMA	1,714	1,714	19	5	25	0	1,028	60% of entitlement	7	16	1,044
Barnawartha GMA	2,100	2,100	14	4	0	0	291	60% of entitlement	10	20	311
Ellesmere GMA	2,280	2,280	34	13	24	0	1,368	60% of entitlement	13	26	1,394
Goorambat GMA	4,888	4,888	13	2	40	0	926	60% of entitlement	5	10	936
Kialla GMA	2,332	2,332	11	3	0	0	1,399	60% of entitlement	4	8	1,407
Kinglake GMA	2,015	2,015	114	18	22	0	1,209	60% of entitlement	61	124	1,333
Mullindolingong GMA	6,980	6,980	63	6	54	0	771	60% of entitlement	27	54	825
Murmungee GMA	16,710	16,710	356	82	46	0	7,075	60% of entitlement	165	340	7,415
Nagambie GMA	6,648	6,648	97	33	15	4,955	0		43	86	5,041
Unincorporated areas											
Goulburn Murray Water	46,234	46,234	2,414	777	800	16,182			3,233	6,466	22,648
Total	**1,041,986**	**1,001,001**	**9,927**	**4,755**	**1,090**	**460,308**	**17,422**	**0**	**25,123**	**48,385**	**526,115**

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 in line with previous State Water Reports.

(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.

(6) The allocation limit does not include all mine dewatering licences for the Latrobe Valley coal mines.

Appendix B

Storage levels

Basin	Reservoir	On stream or off stream?	Full storage capacity (ML)	% full at 1 July 2006	% full at 30 June 2007
East Gippsland	None	n/a	n/a	n/a	n/a
Snowy	None	n/a	n/a	n/a	n/a
Tambo	None	n/a	n/a	n/a	n/a
Mitchell	None	n/a	n/a	n/a	n/a
Thomson	Lake Glenmaggie	On-stream	190,410	16%	100%
	Thomson Reservoir	On-stream	1,068,000	39%	19%
Latrobe	Blue Rock	On-stream	208,188	81%	56%
	Lake Narracan	On-stream	8,000	100%	93%
	Moondarra Reservoir	On-stream	30,300	67%	97%
South Gippsland	Lance Creek Reservoir	On-stream	4,200	70%	18%
	Hyland Reservoir	On-stream	671	30%	27%
	Western Reservoir	On-stream	1,137	20%	3%
	Candowie Reservoir	On-stream	2,207	47%	10%
Bunyip	Tarago Reservoir	On-stream	25,000	85%	74%
Yarra	Upper Yarra Reservoir	On-stream	200,000	44%	50%
	O'Shannassy Reservoir	On-stream	3,000	51%	79%
	Maroondah Reservoir	On-stream	22,000	29%	37%
	Yan Yean Reservoir	On-stream	30,000	48%	18%
	Cardinia Reservoir	Off-stream	287,000	73%	50%
	Greenvale Reservoir	Off-stream	27,000	84%	65%
	Silvan Reservoir	Off-stream	40,000	83%	90%
	Sugarloaf Reservoir	Off-stream	96,000	57%	24%
Maribyrnong	Rosslynne Reservoir	On-stream	25,368	7%	4%
Werribee	Melton Reservoir	On-stream	14,364	20%	4%
	Merrimu Reservoir	On-stream	32,516	17%	13%
	Pykes Creek Reservoir	On-stream	22,119	8%	3%
	Djerriwarrh Reservoir	On-stream	983	64%	44%
Moorabool	Korweinguboora Reservoir	On-stream	2,100	4%	13%
	Bostock Reservoir	On-stream	7,480	3%	2%
	Lal Lal Reservoir	On-stream	64,495	26%	5%
	Wilsons Reservoir	On-stream	1,010	9%	2%
	Moorabool Reservoir	On-stream	6,738	1%	1%
	Upper Stoney Creek Reservoir	Off-stream	9,494	11%	46%
Barwon	West Barwon Dam	On-stream	21,000	13%	12%
	White Swan Reservoir	On-stream	14,107	37%	19%
	Gong Gong Reservoir	On-stream	1,902	35%	0%
	Wurdee Boluc Reservoir	Off-stream	40,431	39%	24%
Corangamite	None	n/a	n/a	n/a	n/a
Otway Coast	West Gellibrand Reservoir	On-stream	1,856	54%	45%
Hopkins	None	n/a	n/a	n/a	n/a
Portland Coast	None	n/a	n/a	n/a	n/a
Glenelg	Rocklands Reservoir	On-stream	348,310	2%	2%
	Moora Moora Reservoir	On-stream	6,300	32%	29%
	Konongwootong Reservoir	On-stream	1,920	47%	29%
	Hayes Reservoir	On-stream	2,700	27%	28%
Millicent Coast	None	n/a	n/a	n/a	n/a

Basin	Reservoir	On stream or off stream?	Full storage capacity (ML)	% full at 1 July 2006	% full at 30 June 2007
Murray	Lake Victoria (Victoria's share only)	On-stream	338,500	58%	48%
	Menindee Lakes (Victoria's share only)(1)	On-stream	865,500	0%	0%
	Lake Hume (Victoria's share only)	On-stream	1,518,250	32%	12%
	Lake Dartmouth (Victoria's share only)	On-stream	1,953,795	86%	19%
	Lake Culluleraine	On-stream	5,270	83%	81%
Kiewa	Rocky Valley	On-stream	28,294	28%	37%
	Lake Guy	On-stream	1,416	34%	23%
	Clover Pondage	Off-stream	255	11%	44%
	Pretty Valley Basin	Off-stream	500	100%	100%
Ovens	Lake William Hovell	On-stream	13,710	31%	100%
	Lake Buffalo	On-stream	23,900	32%	73%
Broken	Lake Mokoan	On-stream	362,450	29%	10%
	Lake Nillacootie	On-stream	39,950	58%	28%
	Loombah-McCall Say	On-stream	1,813	72%	66%
Goulburn	Lake Eildon	On-stream	3,334,158	22%	11%
	Goulburn Weir	On-stream	25,500	88%	94%
	Sunday Creek Reservoir	On-stream	1,700	36%	7%
	Greens' Lake	Off-stream	32,440	38%	45%
	Waranga Basin	Off-stream	432,632	31%	15%
Campaspe	Upper Coliban Reservoir	On-stream	37,480	4%	1%
	Lauriston Reservoir	On-stream	19,790	58%	17%
	Malmsbury Reservoir	On-stream	17,780	10%	4%
	Lake Eppalock	On-stream	304,651	5%	1%
	Campaspe Weir	Off-stream	2,624	77%	79%
Loddon	Newlyn Reservoir	On-stream	3,215	38%	4%
	Tullaroop Reservoir	On-stream	72,950	15%	9%
	Cairn Curran Reservoir	On-stream	147,130	5%	2%
	Laanecoorie Reservoir	On-stream	7,940	12%	18%
	Hepburn Lagoon	On-stream	3,001	10%	0%
	Evansford Reservoir	Off-stream	1,351	17%	11%
	Sandhurst Reservoir	Off-stream	2,590	49%	68%
	Spring Gully Reservoir	Off-stream	1,680	8%	4%
Avoca	None	n/a	n/a	n/a	n/a
Mallee	None	n/a	n/a	n/a	n/a
Wimmera	Taylors Lake	On-stream	33,700	47%	27%
	Lake Lonsdale	On-stream	65,480	0%	0%
	Wartook Reservoir	On-stream	29,300	42%	37%
	Lake Bellfield	On-stream	78,560	10%	14%
	Fyans Lake	On-stream	18,460	14%	20%
	Batyo Lake	On-stream	2,250	0%	0%
	Dock Lake	On-stream	4,420	0%	0%
	Green Lake	On-stream	5,350	0%	0%
	Pine Lake	On-stream	62,000	0%	0%
	Toolondo Reservoir	On-stream	92,430	0%	0%

Note:

(1) When the volume held in storage in the Menindee Lakes drops below 480,000 ML, the entire volume is held by New South Wales. Victoria will regain its share of the water in the Menindee Lakes when the volume next exceeds 640,000 ML.

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 Commission
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 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 entitlement limit: The amount of water which can be allocated in an aquifer under licences and is defined by the permissible consumptive volume.

Groundwater management unit (GMU): Either a groundwater management area (GMA) or a water supply protection area (WSPA).

Groundwater management area (GMA): A discrete area where groundwater resources of a suitable quality for irrigation, commercial or domestic and stock use are available or expected to be available.

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.

Melbourne Water Corporation: Provides bulk water and bulk sewerage services in the Melbourne metropolitan area and manages rivers and creeks and major drainage systems in the Port Philip and Westernport region.

Metropolitan retailers: Deliver retail water supply and sewerage services in the Melbourne metropolitan area.

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): The statutory mechanism to limit or cap the volume of water that can be allocated using the section 51 (take and use) licences issued under the *Water Act 1989*.

Potable water: Water that is suitable for drinking.

Precautionary principle: Erring on the side of caution in favour of a given entity. For example, where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

Qualification of rights: The Minister for Water has the power (under section 33AAA of the Water Act 1989) to qualify rights to water to maintain essential supplies to towns and rural communities. The Minister may declare a temporary qualification of rights where a water shortage exists in an area or water system. Where the water shortage is due to a long term change to water availability, a permanent qualification of rights may be declared but only following a long term water resources assessment which finds the long term water availability will have a disproportionate effect on water allocated for consumptive purposes or the Environmental Water Reserve. All rights qualified in 2006/07 were of a temporary nature.

Ramsar Convention: An international treaty that aims to conserve wetlands which have been listed for their international significance 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 business: Comprises water authorities, Melbourne Water Corporation and the metropolitan retailers.

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 passed legislation enabling all water rights and licences to be converted into water shares, beginning 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.