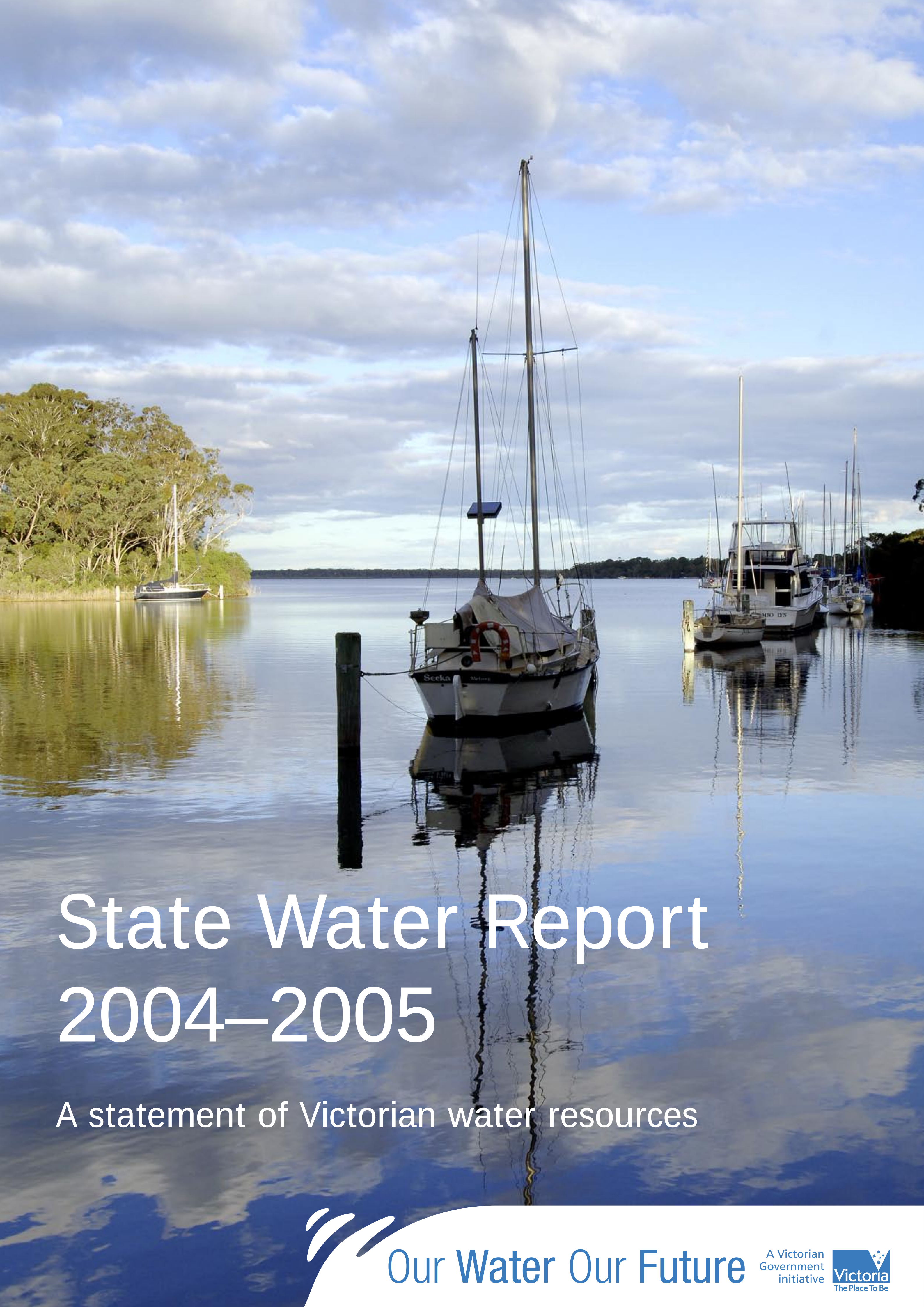


State Water Report 2004–2005

A statement of Victorian water resources

Our Water Our Future

A Victorian Government initiative

Victoria The Place To Be

State Water Report 2004/05

A statement of Victorian water resources

Published by the Victorian Government Department of Sustainability and Environment

Melbourne, June 2006

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

Printed by Impact Printing.

ISSN: 1833-640X

For more information contact the DSE Customer Service Centre 136 186

Acknowledgements

Sinclair Knight Merz – Data compilation

Ann White - Editor

Foreword

The publication of the State Water Report is one of the key outcomes from the Victorian Government's 2004 *Our Water Our Future* action plan. Strategies outlined by the landmark plan are designed to ensure healthy, secure and reliable water resources across Victoria over the next 50 years.

A number of policy initiatives stemming from *Our Water Our Future* that affect the allocation and use of Victoria's water resources have been completed since the publication of the first State Water Report for 2003/04. The most important is the passing of the *Water (Resource Management) Act 2005*, which for the first time establishes a legal basis for the environment's share of the State's water resources. This is achieved through the creation of the Environmental Water Reserve by the Government for all rivers in recognition of the role that water flows and volumes play in river health.

Determining how a finite volume of water is shared between the needs of people and the needs of the environment draws limits around the amount of water that is available for consumptive use. This is the focus of five regional sustainable water strategies that will be developed. Each strategy will draw on the data and trends compiled in the State Water Report.

Agriculture, industry and water managers are becoming better equipped to manage their share of water resources through the opening up of a market to trade water entitlements. However, equitable sharing of water and a well-structured water market depend on accessible, accurate monitoring and reporting. The annual State Water Report is a key element of such reporting: it compiles a complete picture of water entitlements, allocation, status and trends across the State and makes our data publicly accessible. Open and transparent reporting will aid all parties in managing their share of Victoria's surface water and groundwater.

This is the second annual State Water Report. The first edition for 2003/04 is now sought after as an indispensable reference for anyone wanting an overview of Victoria's water resources.

John Thwaites

John Thwaites

Minister for Water

Contents

Introduction

This is the second State Water Report on Victoria's water resources. It is part of the continued delivery of the State Water Accounts announced in the Victorian Government's 2004 *Our Water Our Future* action plan (Action 2.18).

The State Water Report makes an important contribution to ensuring our water resources are managed sustainably. It provides a complete picture of water allocation and use across Victoria for the 2004/05 year at the bulk supply level. The water accounts in this report draw on information from water authorities, Department of Sustainability and Environment, the Essential Services Commission, the Murray Darling Basin Commission and catchment management authorities.

The report provides an overview of a number of *Our Water Our Future* policy initiatives affecting the allocation and use of Victoria's water resources that have been completed since publication of the State Water Report 2003/04. It also provides information for reference purposes about water-related studies completed in that period.

The State Water Report 2004-05 is divided into three parts:

Parts 1 and 2 provide a detailed picture of Victoria's water resources throughout the 2004/05 year. Part 1 gives a statewide overview of how much water was available, how much was provided to the environment, how much was supplied for consumption and what restrictions were placed on its consumption due to scarcity.

Part 2, which forms the largest segment of the report, comprises a water account for each of Victoria's 29 river basins. The accounts are prefaced by an introduction and overview chapter that presents the structure, assumptions and limitations of the data in each basin account.

Part 3 looks at each of the major environmental and policy influences that are shaping this and future editions of the State Water Report. The current health status of Victoria's rivers and the establishment and management of the Environmental Water Reserve, a key instrument in managing the environmental components of water resources, are discussed in Chapter 35. The latest assessment of climate change and its influence on water resource planning are presented in Chapter 36.

Chapter 37 briefly describes the program to develop five regional sustainable water strategies. Each will determine how water resources in each region are managed into the future, given the challenges of climate change and the need to maintain healthy rivers. A brief summary of the first such strategy, the draft Central Region Sustainable Water Strategy (April 2006) currently published for public comment, is also provided.

Management of our water resources cannot be achieved without adequate monitoring, reporting and accounting. These mechanisms and methods facilitate water resource planning, illustrate the degree of accountability of water resource managers, and indicate if parties are complying with their obligations and entitlements. Importantly, our efforts in monitoring, reporting and accounting continue to be improved. Chapter 38 presents recent and planned initiatives in each, and outlines future directions for water accounting. In line with these developments, the shape and contents of future State Water Reports will also evolve, and this is discussed in Chapter 39.

The State Water Report 2004/05 is also available in a new web-based format at www.dse.vic.gov.au.

Part 1
Overview of Victorian Water Resources 2004/05

Part 1 of the State Water Report provides a statewide overview of Victoria's water resources during 2004/05:

- How much water was available.
- How much water was provided to the environment.
- How much water for consumption was taken from reservoirs, streams and aquifers under entitlements issued by Government.
- What water restrictions and bans resulted from prolonged dry conditions and depleted reservoirs across the State.

1 Water Availability

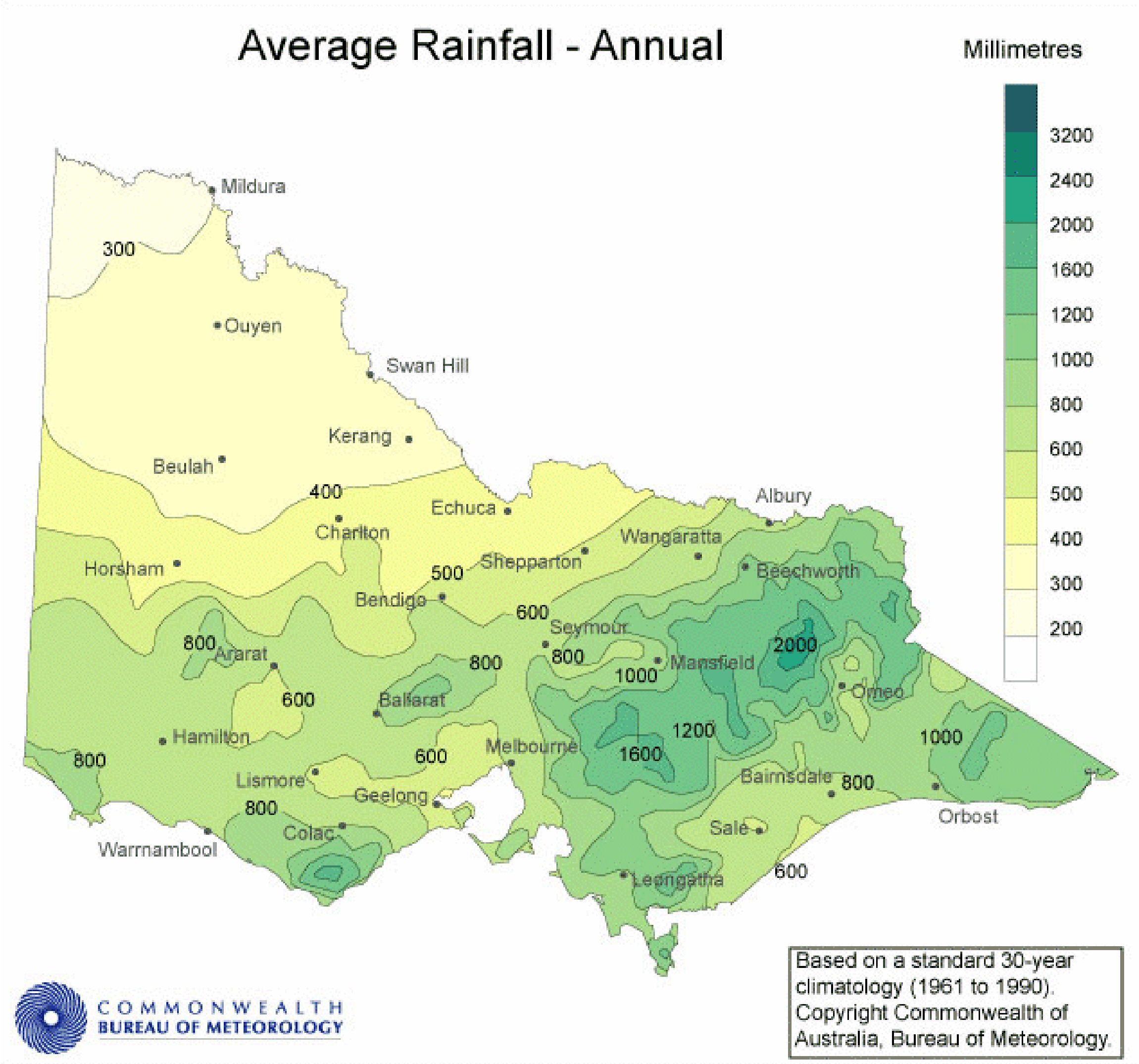
This chapter presents a description and analysis of how much water was available in Victoria during 2004/05, and how this compares with previous years. Rainfall, streamflow, reservoirs and groundwater resources are reported.

1.1 Rainfall

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

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

Figure 1-1 Victorian Average Annual Rainfall



Victoria's rainfall during 2004/05 is shown in millimetres in Figure 1-2, and is compared to the average rainfall in Figure 1-3. Rainfall conditions were close to average across most of the State in 2004/05. Regions of slightly higher than average rainfall were observed around metropolitan Melbourne, along the River Murray in Central Victoria and isolated areas elsewhere. Rainfall conditions were well below average (60-80%) along the River Murray near Mildura.

Figure 1-2 Victorian rainfall in 2004/05 (mm)

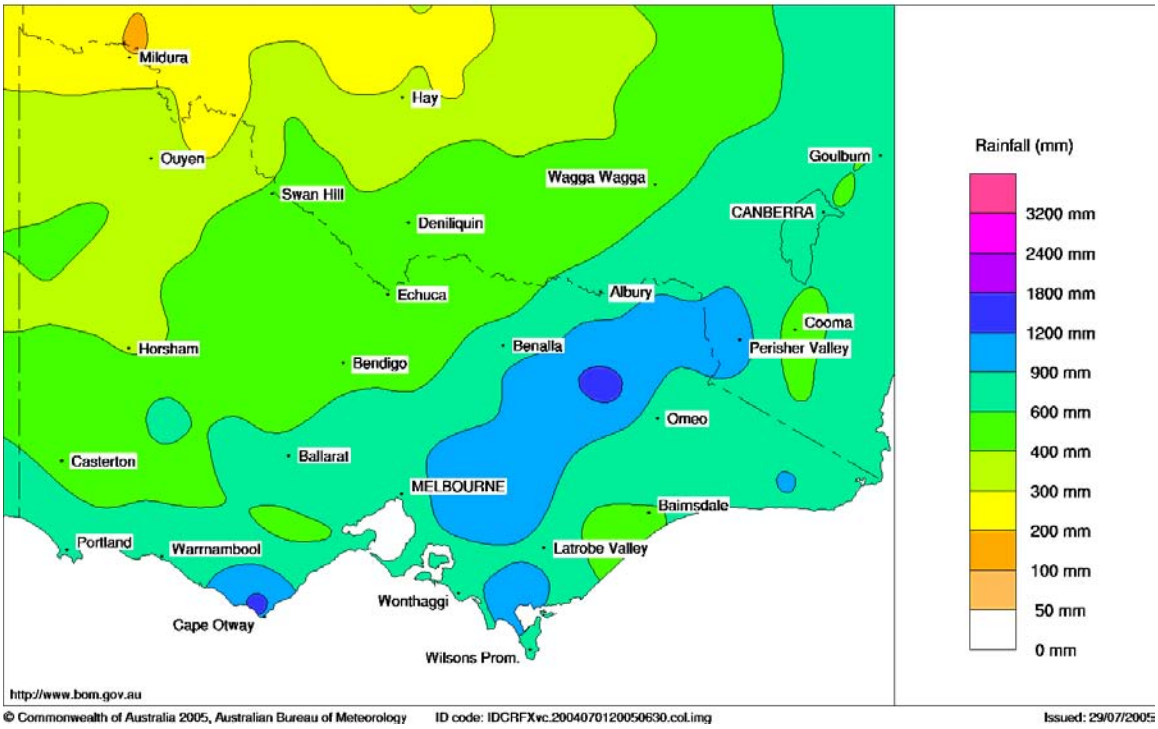
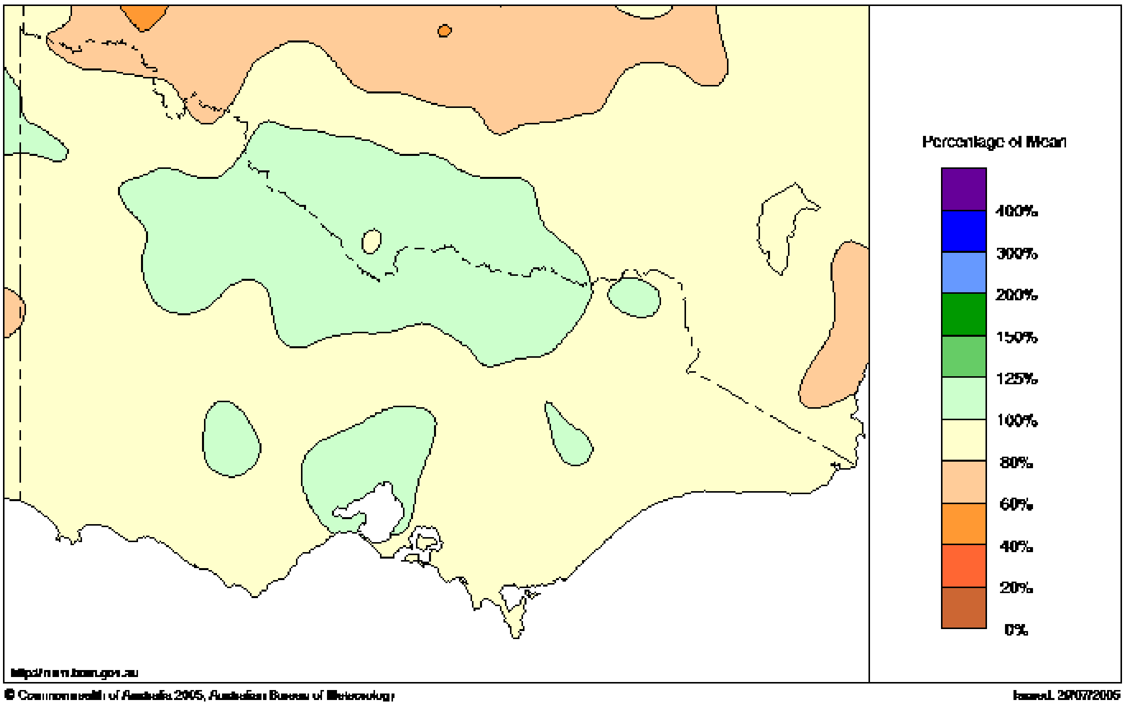


Figure 1-3 Victorian rainfall in 2004/05 relative to average rainfall



The pattern of near average rainfall in many parts of Victoria for 2004/05 is similar to that of the eastern half of New South Wales and the southern part of South Australia (Figure 1-4) where rainfall ranged from between 20% below average to 20% above average. Rainfall in Victoria was much closer to average rainfall conditions than much of central Australia, which experienced well below average rainfall.

These average rainfall conditions in Victoria in 2004/05 have improved longer-term rainfall totals (see Figure 1-5). Over the past three years, northern Victoria has experienced average cumulative rainfall totals, whilst conditions in southern Victoria over this three year period remain below average. The implications of this pattern of rainfall on river flows and water supplies are discussed in the following chapter.

Figure 1-4 Australian rainfall, percentage of mean, 1 July 2004 to 30 June 2005

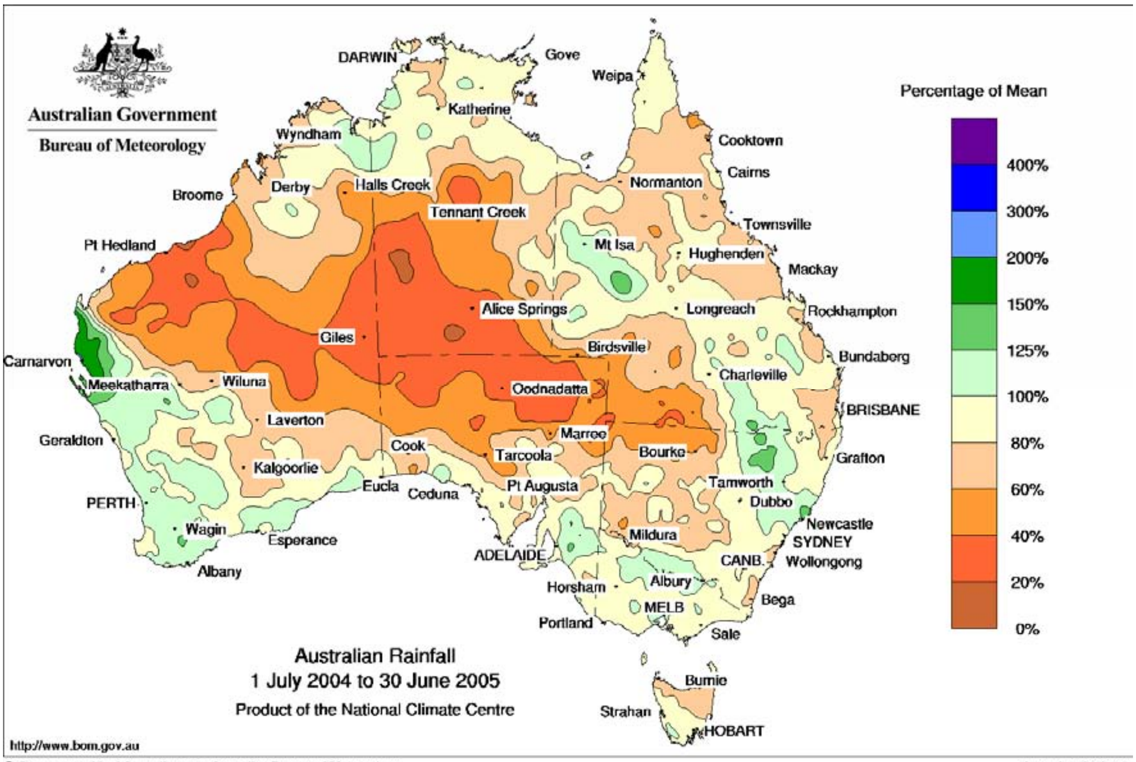


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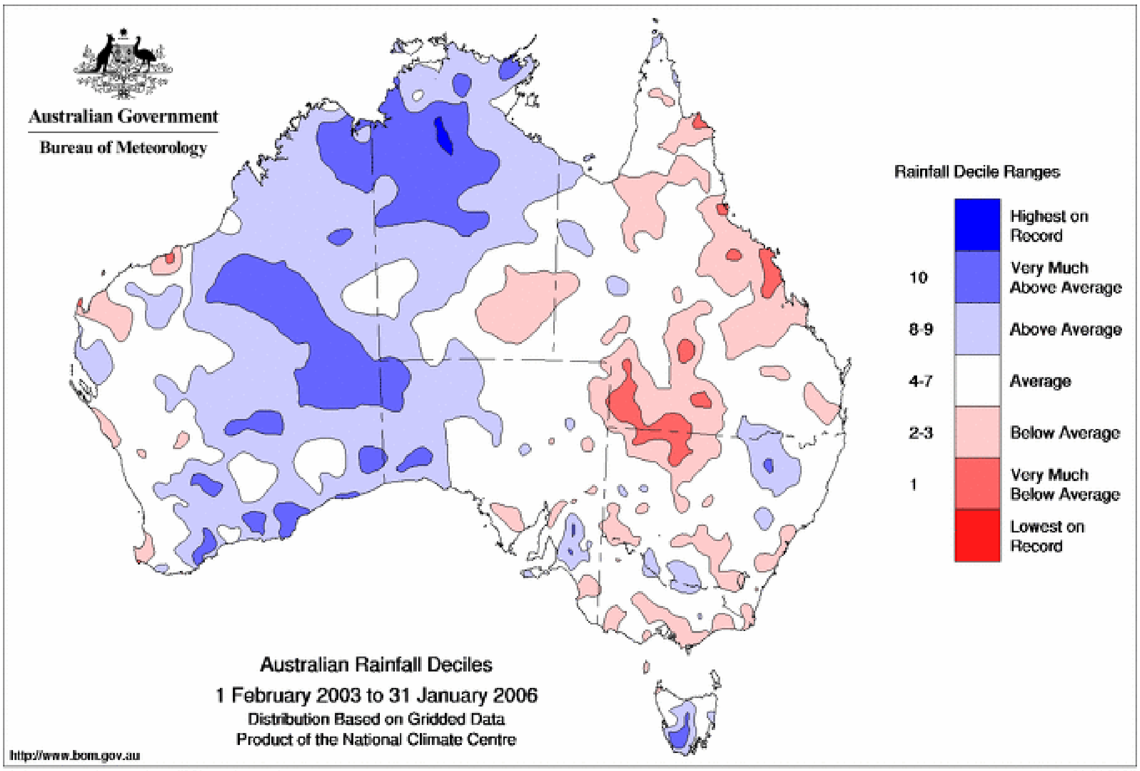
Figure 1-5 Australian rainfall deciles, 1 February 2003 to 31 January 2006



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1.2 Streamflow

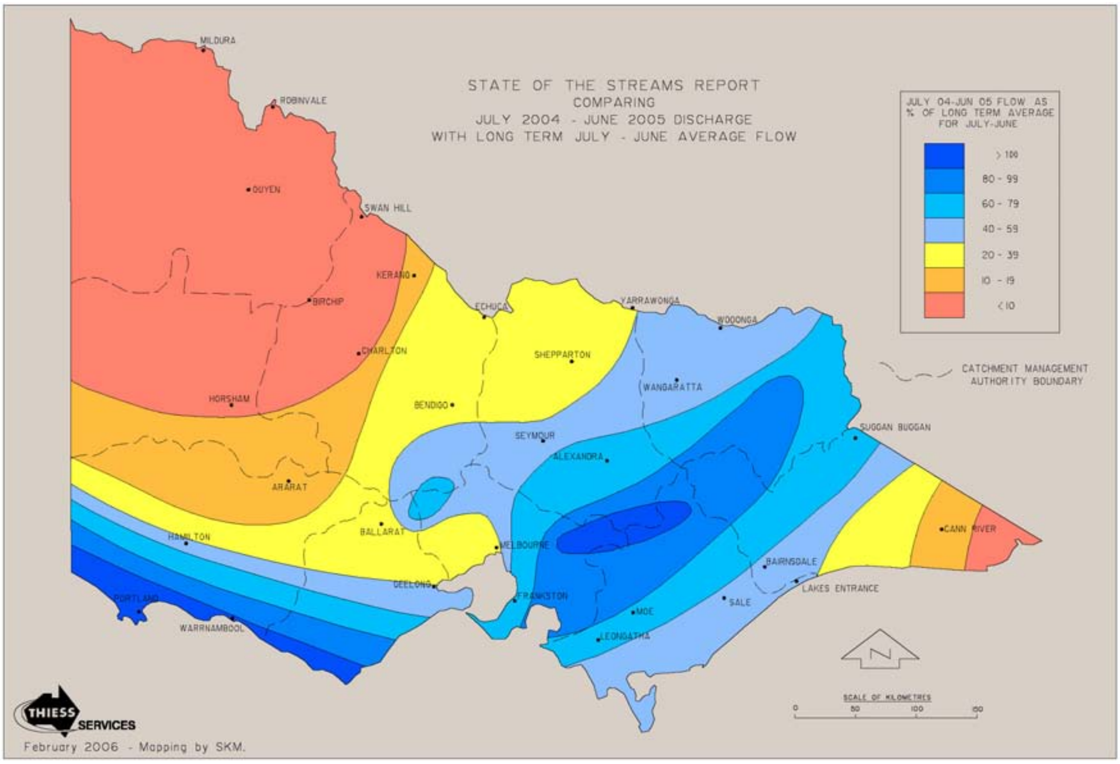
The close to average rainfalls in Victoria for 2004/05 described above did not correspond to average streamflows in many regions.

Whilst average and above-average streamflows were observed in a narrow strip along the south-west coast of Victoria and in parts of the Victorian high country (Figure 1-6), most of the state experienced less than average streamflow. North-west Victoria and part of east Gippsland experienced less than 20% of long-term average streamflow, and a significant proportion of central Victoria, including the Ballarat and Bendigo regions, again recorded as low as 20-39% of the long-term average streamflow.

Although streamflows were relatively low in 2004/05, they nevertheless increased from the previous year.

Local factors influence how much rainfall ends up as streamflow, and these factors vary from river basin to river basin. These local influences include the duration of the drought, the pattern of individual rainfall events and the impact of regenerating forests after the 2003 bushfires. The streamflow data for each basin presented in Table 1-1 is taken from the water balance for each basin in the second part of this report. The table includes a comparison with the streamflow in 2003/04 and the average streamflow over the long term. The East Gippsland river basin, which had close to average rainfall (80-100%), produced streamflows that were very much below average and estimated at only 14% of average annual inflows in 2004/05. This phenomenon was observed to a lesser extent across most of southern Victoria. In the Maribyrnong basin, for example, streamflows were only 32% of the long-term average despite above average rainfall.

Figure 1-6 Streamflow in 2004/05 expressed as a percentage of long-term average flow(1)



Note:

(1) Figure shows 2004/05 streamflow as a percentage of long-term average streamflow, based on data from 28 selected streamflow gauges evenly distributed across Victoria. Some of these gauges are located downstream of major storages where water is extracted and so are not directly comparable to the river basin flows listed in Table 1-1.

Table 1-1 Streamflow in 2004/05 compared with long-term average

Basin	Average Annual Streamflow (ML) (1)	2004/05 Streamflow		2003/04 Streamflow	
		(ML) (2)	(% of average) (2)	(ML) (2)	(% of average) (2)
Murray	3,179,000	4,578,700	144%	4,057,200	128%
Kiewa	339,500	324,300	96%	323,800	95%
Ovens	1,692,000	1,510,400	89%	1,609,800	95%
Broken	326,000	251,300	77%	270,800	83%
Goulburn	3,366,000	2,366,600	70%	2,813,300	84%
Campaspe	305,000	119,200	39%	158,800	52%
Loddon	415,000	161,000	44%	168,500	41%
Avoca	136,200	25,200	19%	33,900	25%
Mallee	0	0	not applicable	0	not applicable
Wimmera (3)	316,400	73,900	23%	107,300	34%
East Gippsland	1,122,000	159,300	14%	160,500	14%
Snowy (4)	1,447,285	530,200	37%	544,600	38%
Tambo	570,000	97,400	17%	89,200	16%
Mitchell	1,355,000	614,000	45%	754,300	56%
Thomson	1,414,000	688,800	49%	843,900	60%
Latrobe (6)	903,000	780,500	86%	628,200	70%
South Gippsland	1,157,000	1,120,100	97%	908,200	78%
Bunyip	541,000	463,200	86%	432,500	80%
Yarra (6)	1,054,000	1,008,700	96%	755,700	72%
Maribyrnong (6)	112,000	37,300	33%	36,700	33%
Werribee (6)	107,000	83,600	78%	43,700	41%
Moorabool (6)	95,000	108,000	114%	34,300	36%
Barwon (6)	330,000	189,200	57%	155,900	47%
Corangamite	316,000	263,000	83%	97,600	31%
Otway Coast	884,000	981,420	111%	891,600	101%
Hopkins	635,000	395,100	62%	251,100	40%
Portland Coast	361,000	607,200	168%	209,700	58%
Glenelg (3)	964,000	177,200	18%	467,200	48%
Millicent Coast (5)	not available	200	not available	200	not available
Total	**23,442,400**	**17,715,000**	**76%**	**16,848,300**	**72%**

Notes:

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

(2) Catchment inflow as shown in each basin water balance in the 2004/05 State Water Accounts, excluding interbasin transfers, irrigation return flows and recycled water.

(3) Data shown over the period 1 November 2004 to 31 October 2005, in accordance with Bulk Entitlement specifications.

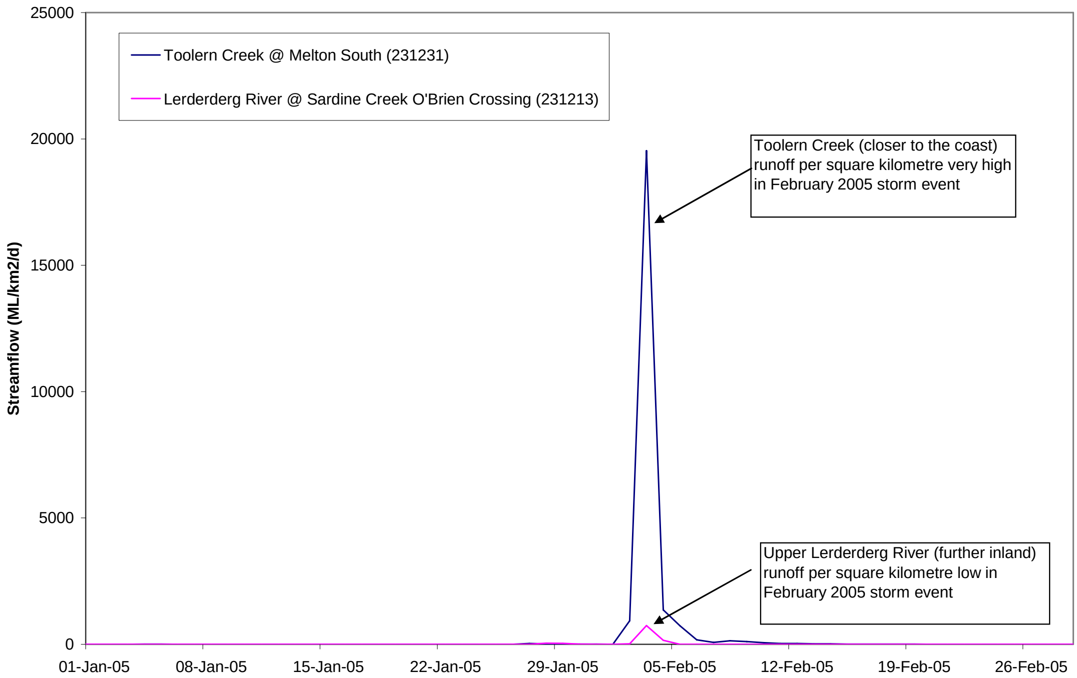
(4) Volumes shown for Snowy Basin exclude catchment inflows from NSW (i.e. above Burnt Hut Crossing [gauge 222013])

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

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

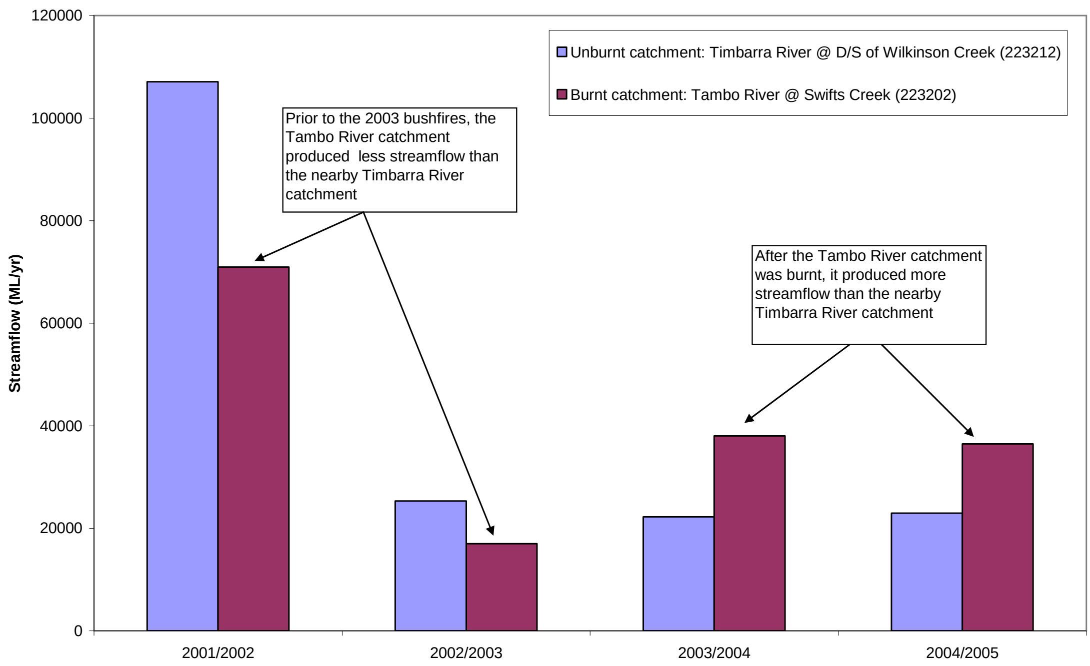
Streamflows in the south-west of Victoria were particularly high near the coast primarily because of single storm events. An example of this is shown in Figure 1-7, which shows daily flows for two catchments in the Werribee River basin. Toolern Creek, which is located around 30 kilometres from the coast, received more than its average annual flow in one day in February 2005, whereas 30 kilometres further inland on the Lerderderg River, the storm produced a peak flow event, but of greatly lower intensity. This pattern was repeated across the south-west of Victoria.

Figure 1-7 Streamflow variation in south-west Victoria with distance from the coast



The effect of the 2003 alpine area bushfires on streamflow was starting to become apparent in 2004/05. In the Tambo River basin in Gippsland, examination of two nearby catchments, one burnt and one unburnt, revealed some striking differences before and after the bushfires (see Figure 1-8). The Tambo River upstream of Swifts Creek had a run-off around 30% lower than the nearby Timbarra River catchment in the two years prior to the bushfires. After the 2003 bushfires, the largely burnt Tambo River catchment had a run-off around 70% higher than the unburnt Timbarra River catchment. If this effect continues as expected, bushfire-affected areas will continue to generate higher than pre-bushfire yields for another few years until the canopy re-establishes itself, and then reductions in yield will occur over the next few decades.

Figure 1-8 Effect of the February 2003 bushfires on annual streamflows



Annual streamflow at four stream gauges in Victoria is illustrated in Figure 1-9, Figure 1-10, Figure 1-11 and Figure 1-12 which contrast the historical long-term average streamflow with the average streamflow for the current drought period (1997–2005). The four rivers shown – the Wimmera, Loddon, Werribee and Moorabool rivers – have all recorded low streamflows throughout the drought.

Figure 1-9 Annual Streamflow at Wimmera River

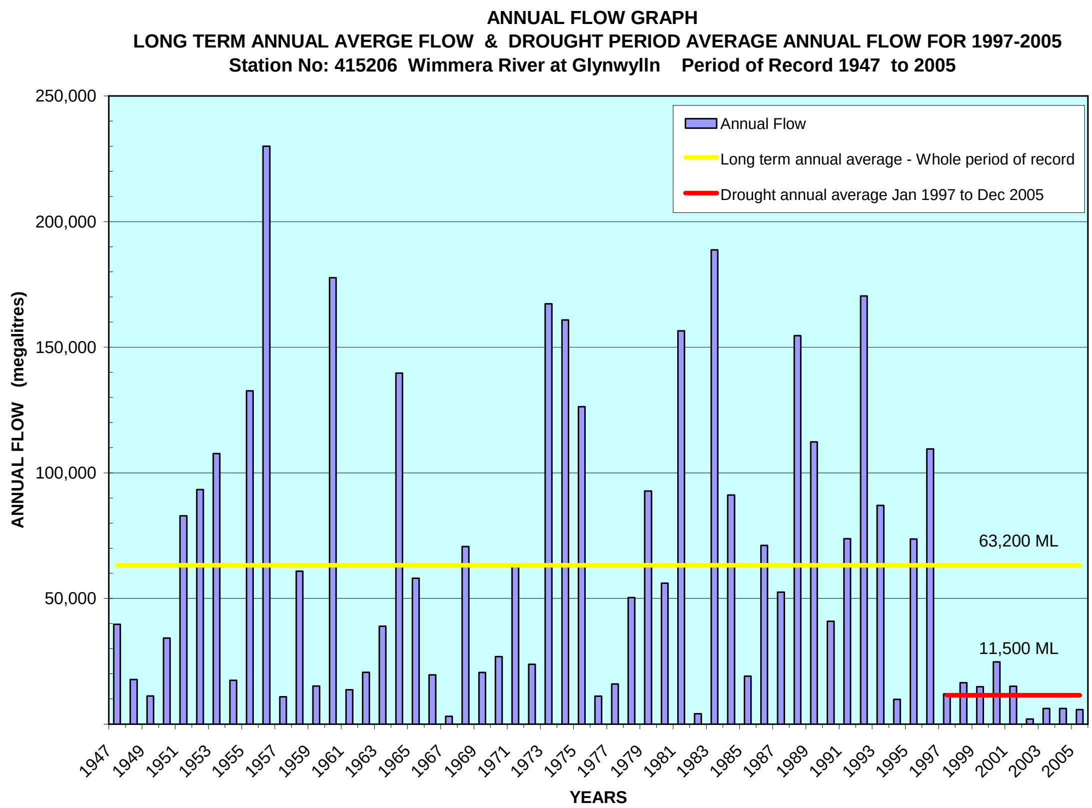


Figure 1-10 Annual Streamflow at Loddon River

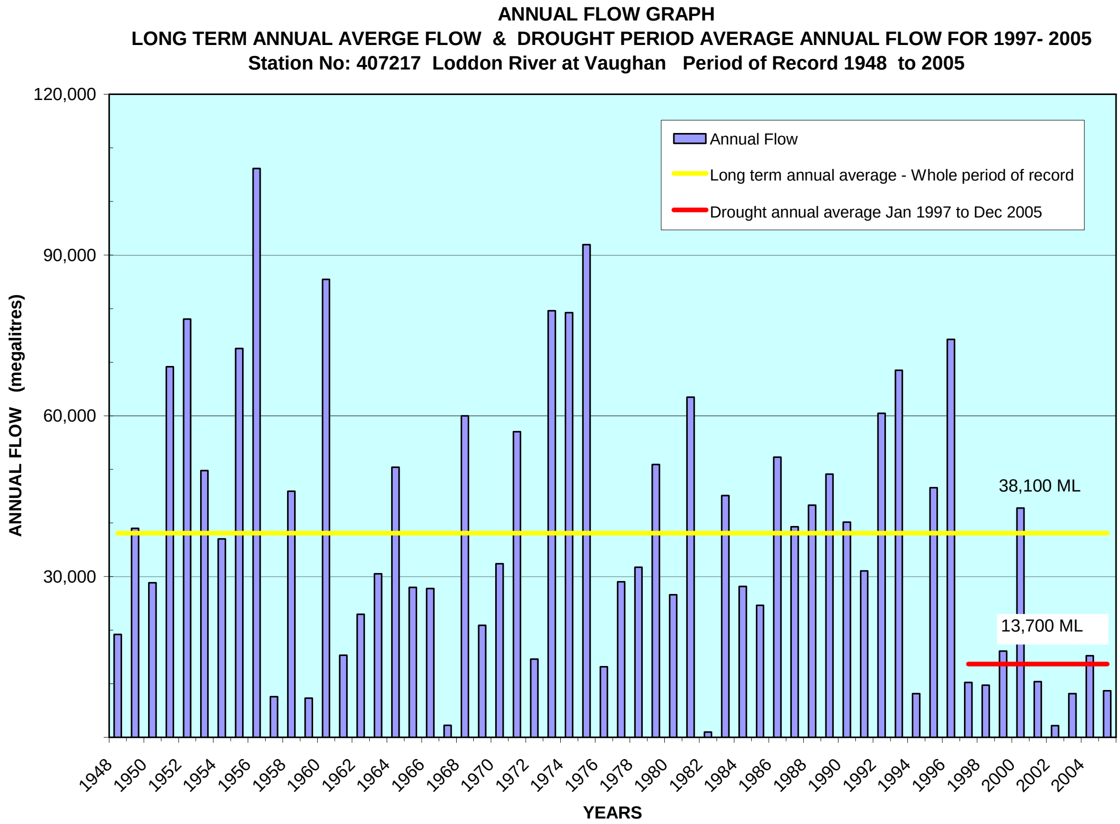


Figure 1-11 Annual Streamflow at Werribee River

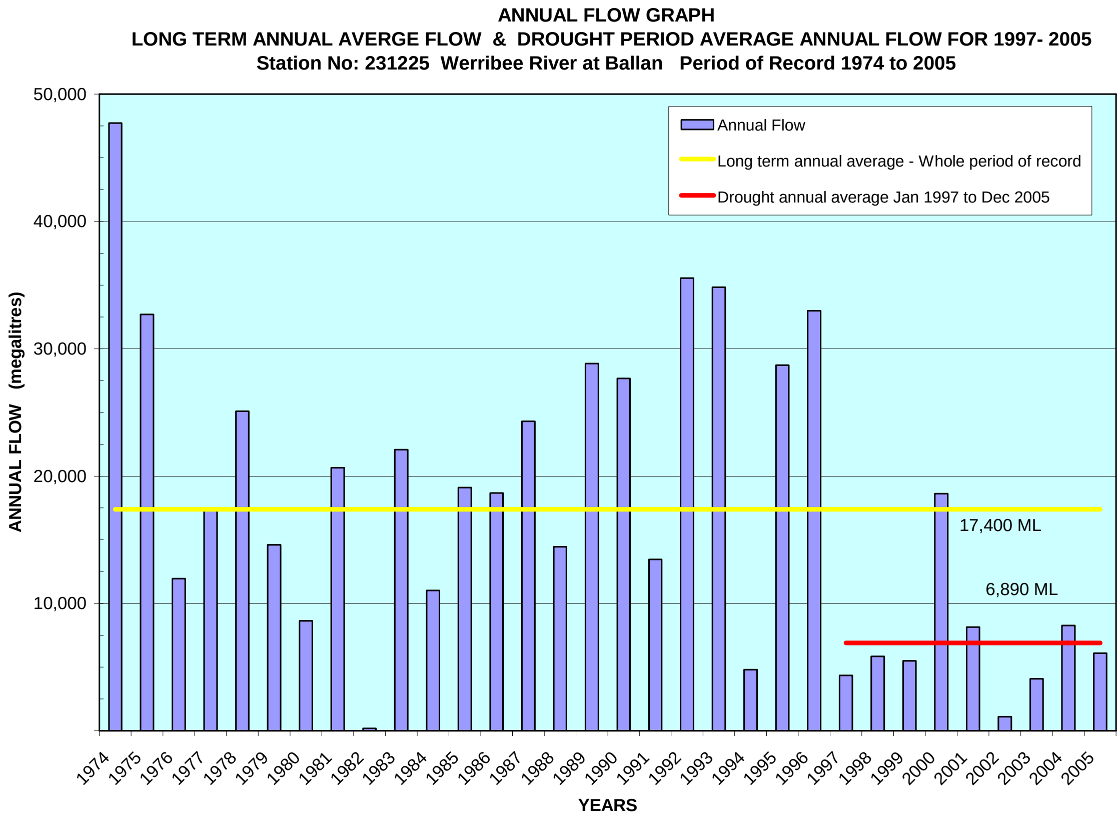
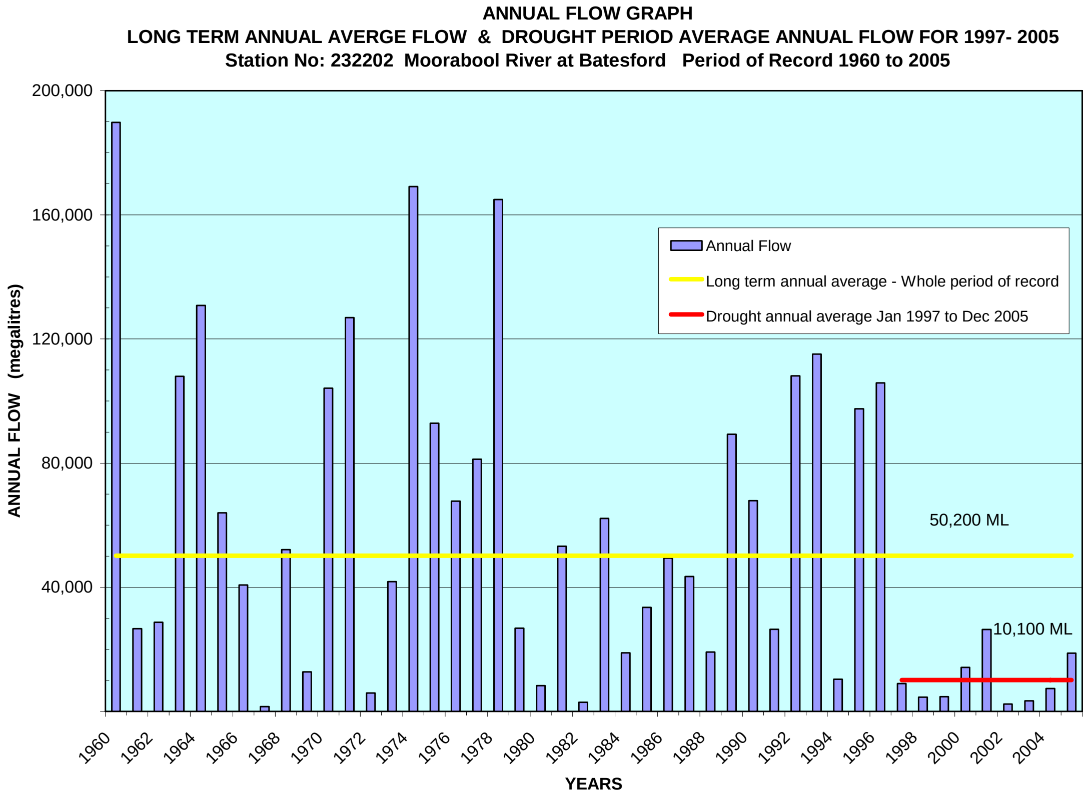


Figure 1-12 Annual Streamflow at Moorabool River



The Wimmera River is a key water source for the region and the low streamflows have impacted on irrigators, domestic and stock supply, and urban towns, with all experiencing high levels of water restrictions. The Loddon River and associated reservoirs is an important source of water for towns and licenced diverters, and also provides water for irrigation in the Goulburn system. The Werribee river is a key source of water for irrigators in the Bacchus Marsh and Werribee Irrigation districts, who produce much of the fruit and vegetables for Melbourne. The Moorabool River is the main source of water for Ballarat and Geelong. The prolonged lower than average streamflows have resulted in water restrictions for Geelong as well as for Ballarat and surrounds for a number of years.

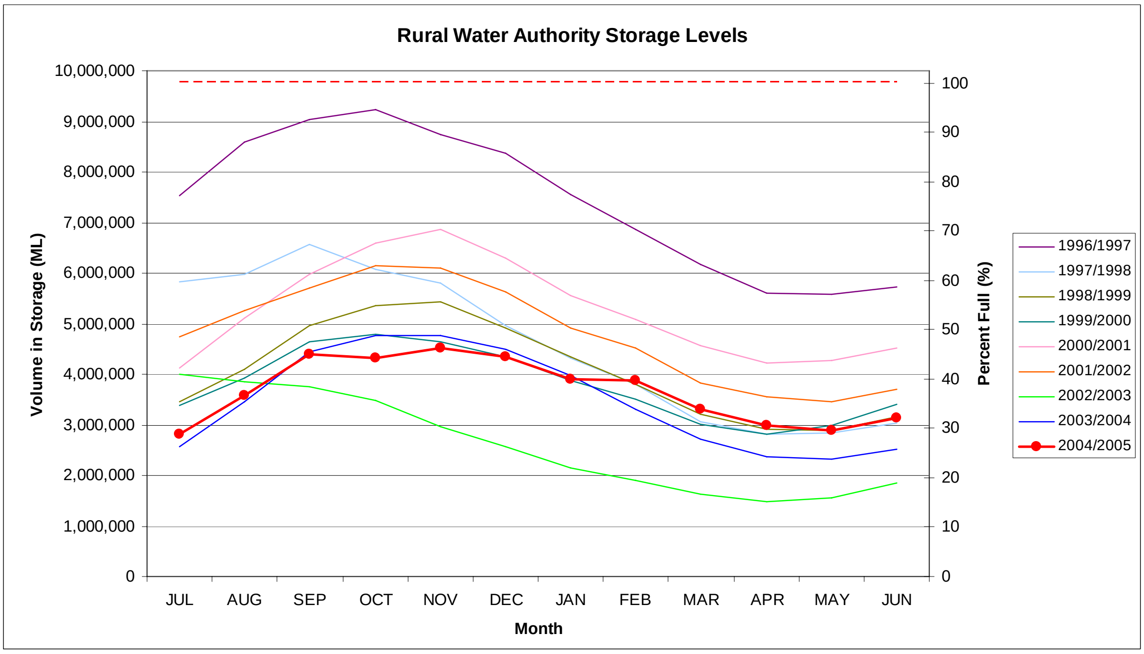
1.3 Reservoirs

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

Victoria's major water storages hold around 11,540,000 ML when completely full. This includes 1,773,000 ML for Melbourne and 9,767,000 ML for rural and regional urban water supplies, and is well in excess of what these storages supply in any one year. For example, Melbourne's total water consumption in 2004/05 (while Stage 2 water restrictions were in place for much of the period) was around 441,000 ML, which is about 25% of its total storage capacity.

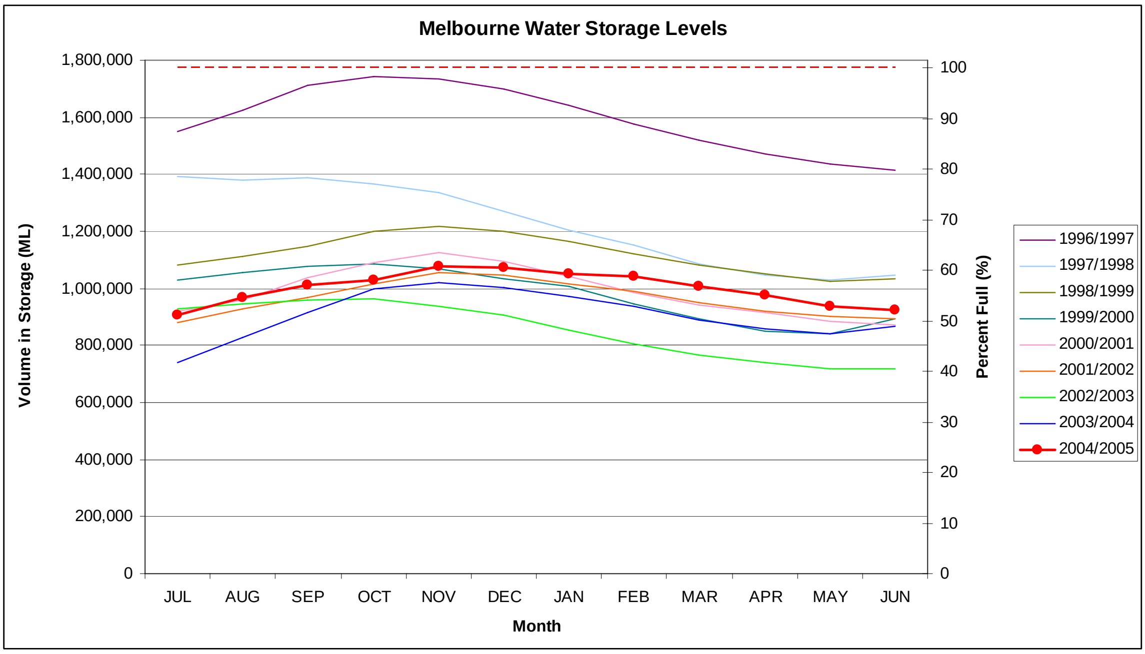
The total volume of water in major rural reservoirs increased over the winter/spring filling period and decreased over summer/autumn as water was released from the reservoirs to supply mainly irrigation demands (see Figure 1-13). Storages at the start of July 2004 held 2,525,000 ML (26% of capacity). A year later at the end of June 2005, these storages were holding slightly more (3,127,000 ML or 32% of capacity), but were still well below full.

Figure 1-13 Volume in major rural water authority storages during 2004/05 (plotted against previous years)



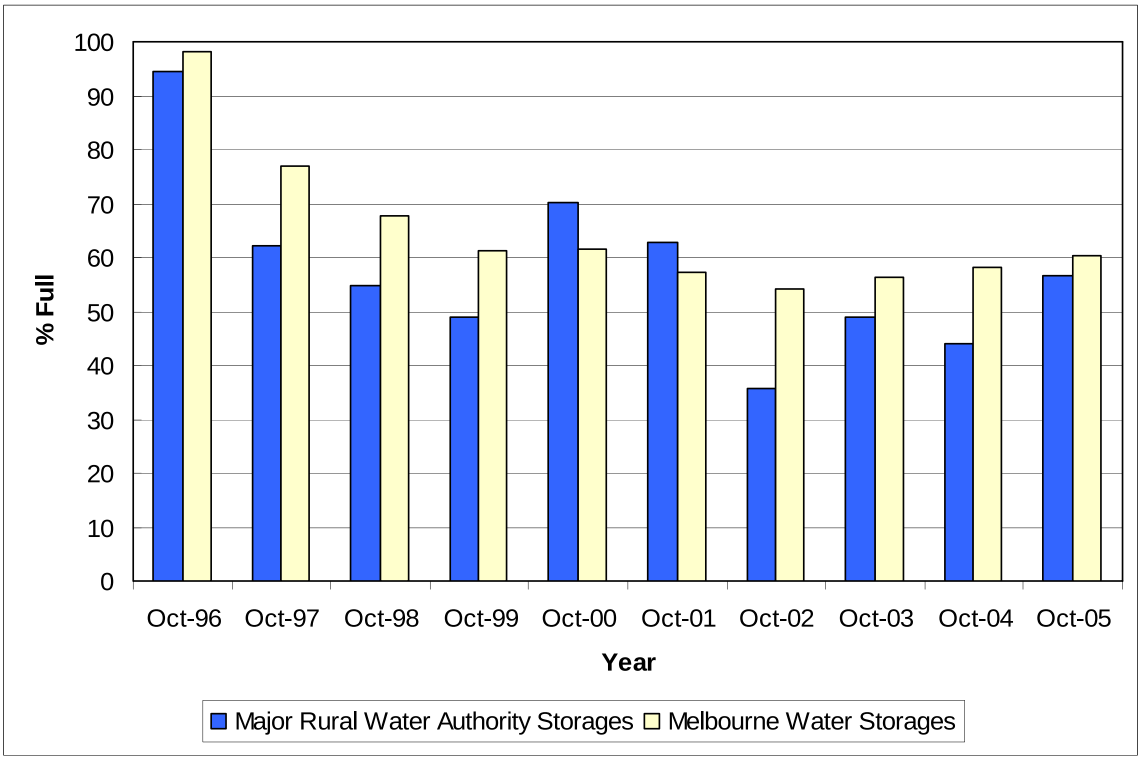
Melbourne's water storages increased from 868,800 ML (49% of capacity) at the start of July 2004 to 925,800 ML (52% of capacity) at the end of June 2005, as shown in Figure 1-14.

Figure 1-14 Volume in Melbourne Water Corporation storages during 2004/05 (plotted against previous years)



Storage levels at the end of October from 1996 to 2005 are shown in Figure 1-15. Data for the end of October is shown as this is generally when storage levels are at their highest for the year after receiving winter/spring rainfall and run-off, and before they start to be drawn down for the summer period. Late spring in 1996 was the last time that many of Victoria's major reservoirs were full or close to full. Storage levels generally declined from 1996 to 2002 when storages reached their lowest levels and have shown signs of increasing over the past three years.

Figure 1-15 Water stored in reservoirs at the end of October, 1996 to 2005 (shown as a percentage of total storage capacity)



1.4 Groundwater

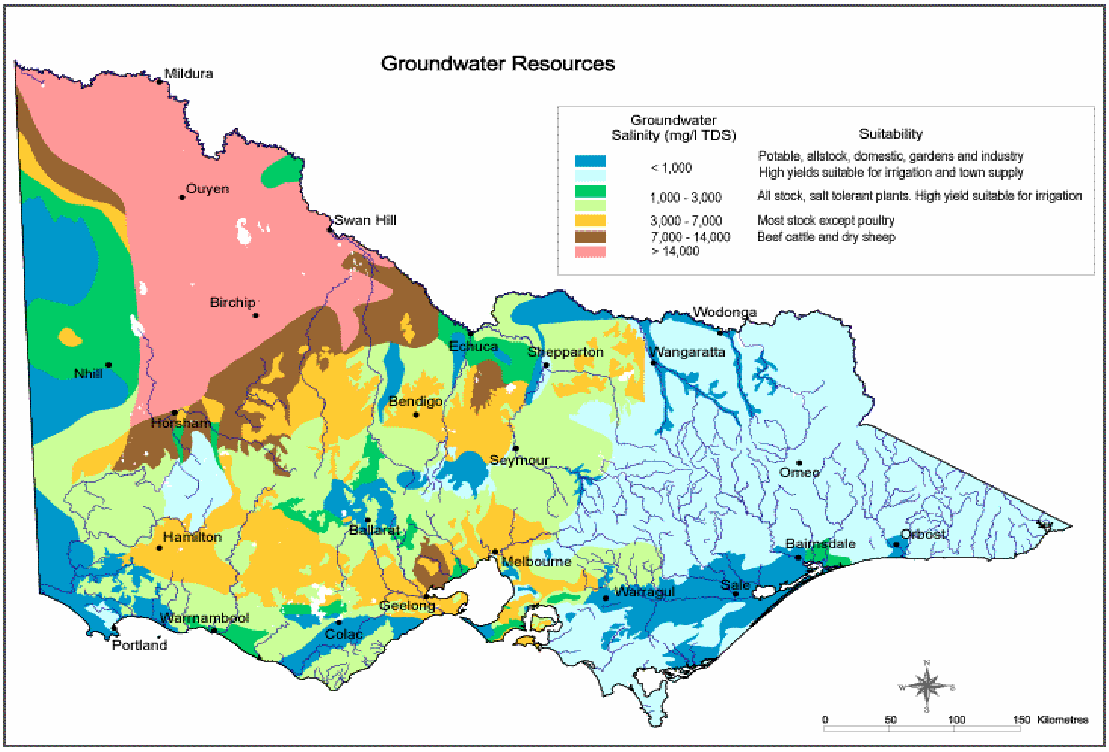
Historically, groundwater was used mainly to supplement surface water supplies during periods of low rainfall and drought. More recently, groundwater is being recognised as a primary water source, particularly where an upper limit has been placed on surface water extraction, or there is little or no surface water available in an area.

In comparison to our surface water resources, Victoria's useable groundwater resources are small (about 10% of surface water resources). Figure 1-16 identifies the location and quality of Victoria's groundwater resources.

Groundwater and surface water are closely linked. Much of the rain that falls on the land percolates into soil and aquifers. Many aquifers then flow into rivers, contributing to the baseflow of these rivers. These processes can occur over a number of months or as long as thousands of years, where 'ancient water' stored in an aquifer moves much more slowly. It is estimated that Victorian aquifers are recharged with around 1,000,000 ML of water annually.

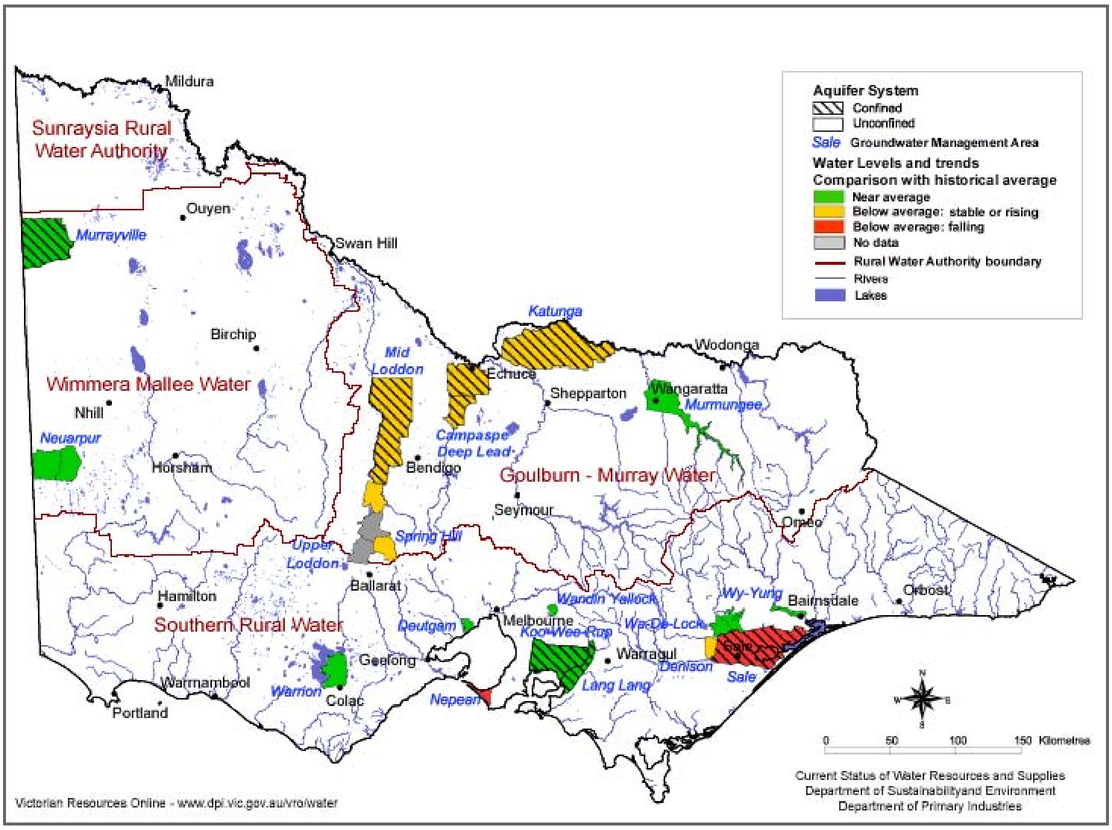
The Victorian Government's *Our Water Our Future* action plan (Department of Sustainability and Environment, 2004) recognised that where an aquifer is highly connected to surface water, a decline in groundwater levels will also affect the connected surface water. The Government is establishing Environmental Water Reserves for aquifers to protect the integrity of the aquifer, its interaction between surface water and groundwater and the needs of groundwater-dependent ecosystems. A project to better understand the interactions between groundwater and surface water is currently being undertaken by the Department of Sustainability and Environment.

Figure 1-16 Location and quality of Victoria's groundwater resources



Trends in water and pressure levels in 19 key groundwater systems are monitored around the State on a quarterly basis. Trends at the end of summer 2005 are shown in Figure 1-17 and reflect the seasonal effects of pumping.

Figure 1-17 Groundwater storage situation at end of February 2005



Levels for the Warrion, Wandin Yallock, Koo Wee Rup, Wa De Lock, Wy Yung, Murmungee and Deutgam (coloured green in Figure 1-17) were at long-term average levels or agreed management levels for this time of year. In most other groundwater management areas, levels were at the lowest ever recorded.

As with streamflows, the relationship between annual rainfall and average groundwater recharge is not directly proportional. The antecedent soil moisture conditions are a dominant factor in dictating the volume and rate of groundwater recharge. Dry soils enable greater volumes of water to be stored in the soil layers above the watertable where it can be subsequently lost to evaporation and transpiration. Importantly, soils need to be sufficiently saturated to enable infiltrating water to pass below the root zone and recharge the groundwater system. In other words, the soil water holding capacity has to be exceeded to enable recharge. This effect is exacerbated during extended dry periods such as those observed in some groundwater management areas since 1993.

In areas where groundwater is more intensively extracted, the decline in groundwater storage resulting from the combined effect of pumping and reduced recharge is more pronounced, for instance the Upper and mid-Loddon, Katunga, Campaspe, Sale, Condah and Deutgam groundwater management areas.

1.5 Conclusion

Even though most of Victoria experienced average rainfalls in 2004/05, it resulted in less-than-average streamflows and aquifer recharge because of depleted soil moisture. The continuing low level of streamflow is the result of nine years of below-average rainfalls and streamflows.

There was a small improvement in the amount of water in Victoria's streams in 2004/05 compared with the previous year. This was reflected in a small improvement in the amount of water held in Victoria's reservoirs at October 2004.

Recovery of Victoria's reservoirs and aquifers requires several consecutive years of above-average rainfalls to restore soil moisture and revive streamflows and aquifer recharge. Lake Eppalock and the Wimmera-Mallee, Werribee and Rosslynne reservoirs remained at very low levels.

The effect of reduced water availability on water users and the environment is discussed in the following three chapters.

2 Water for the Environment

2.1 The Environment's Share of Water

In 2004/05, the environment did not have a formal right to water in rivers and aquifers, except where discrete volumes for specific purposes where a bulk entitlement had been granted to the Minister for Environment. However, the *Water (Resource Management) Act 2005* amended the Water Act 1989 to create, amongst other things, a legal right for the environment's water through the creation of the Environmental Water Reserve, which is described in Chapter 35. Future State Water Reports will report on the amount, allocation and use of the Environmental Water Reserve in each river basin.

For 2004/05, the environment's water is reported as follows:

(a) Discrete amounts of water in a river basin defined under separate legal entitlements. These are referred to as 'environmental entitlements' for the purpose of this report. Although not strictly falling under this definition, the Barmah-Millewa Forest environment account is reported together with environmental entitlements. This document reports on the allocation and delivery of these environmental entitlements, i.e. their implications on the resource. It does not report on whether or not the delivery of this water was effective in meeting environmental objectives.

(b) Water which flows in a stream as a consequence of a water authority or licensee meeting the obligations associated with their right to take water from the stream. Examples of this are the flow that the authority must pass at its weirs or reservoirs before it can take any water, and the flows that occur which are in excess of the capacity of the authority's water harvesting works. This document reports only on the volume of total flow that passes the outlet of each river basin. This is equal to the total flow in the river basin less any water extracted for consumptive uses, seepage and evaporation. Future improvements in water accounting (see Chapter 38) will enable better reporting of these environmental flows, for example by distinguishing between the different components of flows such as environmental minimum flows, above-cap spills and inter-valley transfers of traded water.

Chapter 35 reports on recent changes to the definition of the environment's water and the introduction of an Environmental Water Reserve for each river basin.

2.2 Environmental Entitlements

Table 2.1 lists the environmental entitlements in place in 2004/05. The use of this water in each basin is described more fully in the State Water Accounts.

The Snowy environmental entitlement came from a number of water savings projects within the Murray and Goulburn water supply systems. By the end of June 2005, the Snowy environmental entitlement was 21,500 ML. This is the first Victorian water contributed to the joint Victorian and New South Wales governments' target of recovering water for the Snowy and Murray rivers under the Snowy Agreements. Whilst this entitlement allowed Snowy environmental flows to be made from July 2005, environmental water was released to the Snowy River during 2004/05 (and the previous two years), using water borrowed from the Snowy Scheme under the terms of the Snowy Agreements.

The Barmah-Millewa Forest is one of the most significant ecological assets of the Living Murray Initiative. Because of an absence of significant natural floods due to the effect of river regulation and the extended period of drought, arrangements were approved by the Murray-Darling Basin Ministerial Council in 1993 to maintain the forest ecosystem. Under these arrangements, Victoria and New South Wales each contribute 50,000 ML of water each year to a Barmah-Millewa Forest environment account. Later, a provision was made to allocate a further 25,000 ML of water from each state to the account in years when Victoria's Murray seasonal allocation reaches 130%. Operating rules have been developed for the account. These include rules for storage, accumulation, spillage and borrowing of water for the account as well as triggers for use of water held in the account. These rules are designed to achieve the desired frequency, duration and seasonality of flooding of the forest for long term sustainability of the forest/wetland ecosystem. No releases were made from the Barmah-Millewa Forest environment account in 2004/05 because the release triggers were not activated.

A new environmental entitlement of up to 32,240 ML/year was established in late 2003/04 for the Wimmera and Glenelg rivers and the first allocation made in 2004/05. This entitlement is the environment's share of water savings from the Northern Mallee pipelining project. By the end of June 2005, the 2004/05 allocation under this entitlement was 11,987 ML. This volume is considerably less than the full entitlement of 32,240 ML because of the low seasonal allocations to all Wimmera-Mallee system entitlement holders resulting from the extremely low level of the reservoirs. Water availability and the use of this entitlement during 2004/2005 is described in the Wimmera and Glenelg basin Water Accounts in Part 2 this report.

Environmental entitlements prepared during 2004/2005 and completed in 2005/06 were for the Thomson River, the Loddon River and an increase in the Wimmera/Glenelg rivers' entitlements.

Table 2-1 Environmental entitlements, allocation and summary of use in 2004/2005 (in ML)

Environmental Entitlement	Entitlement at 30 June 2005 A	2004/05 Allocation B	Allocation Carried Over from 2003/04 C	Total Water Available in 2004/05 B+C	Water Used in 2004/05 D	Carried Over to 2005/06 B+C-D
River Murray – Flora and Fauna	27,600	27,600	0	27,600	27,590	0[1]
River Murray – Barmah/Millewa Forest [2]	75,000[3]	50,000	125,000	175,000	0	175,000
Wimmera and Glenelg Rivers[3]	32,240	11,987	0	11,987	7,554	4,433
Snowy River – Victorian component[5]	21,500[6]	21,500	5,100	0[7]	0	26,600

Notes:

(1) Unused water cannot be carried over under the conditions for this entitlement.

(2) The Barmah-Millewa forest account is not strictly an environmental entitlement, but has been included in this table for convenience – refer to chapter 35 for definition.

(3) Entitlement consists of 50,000 ML of high reliability water and 25,000 ML of low reliability, which is matched with an equivalent entitlement in NSW.

(4) The Glenelg River received an additional 3,300 ML in compensation flow not recorded in this table. This volume was used in conjunction with the entitlement towards meeting environmental objectives in the Glenelg River.

(5) The use of this entitlement is assigned two-thirds to the Snowy and one third to the Murray.

(6) 16,400 ML of this entitlement was granted in 2004/05. New Snowy entitlement is not available for use until the year following its establishment, when the full annual allocation is known.

(7) The total volume in the Snowy account was 26,600 ML, however this water was not available for use until after June 2005 when the Lake Jindabyne outlet works are completed and in accordance with Note 6.

2.3 Environment's Share of Total Flow at the Basin Outlet

Table 2-2 shows the proportion of annual flow remaining in the river at the basin outlet after water is extracted for all consumptive uses. This is a very coarse indicator of the Victorian rivers which are likely to be stressed due to extraction of water. The proportion varied from 2% in the Wimmera and Avoca river basins (although there were still substantial in-stream 'losses' some of which would be of benefit to the environment) to 99% in the East Gippsland basin. The 99% value for the Snowy basin means that only 1% of the Snowy River's flow in Victoria is taken out for consumptive use. This does not take into account the large volume of water taken out of the river by the Snowy Scheme in New South Wales.

This indicator of the environment's flow should be used with caution for several reasons:

- It provides no information about which components of the flow regime are affected by extractions of water for consumptive use. For example, Table 2-2 shows that the environment's share of the Mitchell River's flow is a large proportion, however the river is often stressed in summer in its lower reaches because water is extracted for irrigation and urban use.
- A high proportion of flow remaining in a river does not necessarily mean that there is water available in these rivers for additional consumptive use. River basins such as the Kiewa and Ovens rivers in north-east Victoria, which show a high proportion of flow remaining in the river, are included in the Murray-Darling Basin Cap because the River Murray is stressed. The Mitchell, Nicholson and Tambo rivers in Gippsland each have a high proportion of flow remaining in the river, however a limit on new consumptive entitlements has been placed on these streams to prevent the health of the Gippsland Lakes from further deteriorating. In some other river basins, poor water quality makes the water unsuitable for consumptive use, for example, the saline water in the Corangamite and Hopkins basins.
- The percentage of the environment's share of total flow is calculated at the basin outlet and does not incorporate the range of flows that occurs in different parts of the river at different times of the year. It also does not take account of in-stream use of water for the environment, such as in the Avoca River, where infiltration to groundwater, and flows to the floodplain and wetlands are a significant proportion of the total river flow.
- Victorian streams are highly variable, which means that from year to year the amount of water flowing in the river can vary dramatically. The variability of streams tends to increase towards the west of the State.

2.4 Conclusion

Statewide, the environment received about the same proportion of flow at the outlet of river basins as in 2003/04 and this pattern was largely reflected in individual river basins. However, there were some exceptions: the proportion of total flow remaining for the environment in the Avoca and Glenelg basins was at least 20% less in 2004/05 compared with the previous year, while the Bunyip, Yarra, Moorabool and Corangamite basins received at least 20% more.

The number and volume of environmental entitlements has increased since 2003/04 and will continue to increase as the Government enhances the Environmental Water Reserve in stressed rivers and improves the sustainability of Victoria's water supplies in accordance with the *Our Water Our Future* action plan. This document reports on the allocation, percentage available and volume released for environmental purposes. As an extension of current arrangements, the catchment management authorities will be required to report to the Minister for Environment on the effectiveness of the use of environmental entitlements. In priority systems, it is expected that an assessment of whether ecological objectives have been achieved by the use of environmental entitlements will be part of the catchment management authorities' reporting to the Minister for Environment.

Table 2-2 The environment's share of total flow at the basin outlet in 2004/05

Basin	2004/05			Proportion of Total Flow in 2003/04 (%)
	Streamflow if No Extractions (ML)	Environment's Share of Total Flow (ML)	Proportion of Total Flow (%)	
Murray (1)	4,578,700	955,000	21%	29%
Kiewa(2)	648,600	635,300	98%	100%
Ovens	1,510,400	1,452,900	96%	97%
Broken	251,300	113,400	45%	46%
Goulburn	2,366,600	449,700	19%	19%
Campaspe	119,200	9,900	8%	5%
Loddon	161,000	8,100	5%	7%
Avoca	25,200	1,100	4%	29%
Mallee (3)	-	-	-	-
Wimmera (4)	73,900	1,240	2%	2%
East Gippsland	159,300	157,500	99%	99%
Snowy (Vic. only) (5)	530,200	523,000	99%	99%
Tambo	97,400	88,900	91%	90%
Mitchell	614,000	594,600	97%	97%
Thomson	688,800	240,300	35%	37%
Latrobe	780,500	621,200	80%	78%
South Gippsland	1,120,100	1,077,600	96%	92%
Bunyip	463,200	433,600	94%	80%
Yarra (6)	1,008,700	607,700	60%	40%
Maribyrnong	37,300	16,700	45%	45%
Werribee	83,600	24,400	29%	25%
Moorabool	108,000	43,600	40%	14%
Barwon	189,200	125,300	66%	62%
Corangamite	263,000	245,300	93%	72%
Otway Coast	981,420	945,900	96%	96%
Hopkins	395,100	295,100	75%	62%
Portland Coast	607,200	585,700	96%	91%
Glenelg (4)	177,200	69,400	39%	73%
Millicent Coast (3)	200	not available	not available	-
Total	**18,039,320**	**10,322,440**	**57%**	**56%**

Notes:

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

(2) Includes the NSW share of Kiewa River flows under the Murray-Darling Basin Agreement (compare with Table 1-1 which includes Victoria's share only)

(3) No reliable estimate of flows available.

(4) Data shown over the period 1 November 2004 to 31 October 2005, in accordance with bulk entitlement specifications.

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

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

(7) Refer to notes on use of this information in section 2.3

3 Water Supplied for Consumptive Use

3.1 Victoria's Water Allocation Framework - Entitlements to Water

Water for consumptive use in Victoria is taken from reservoirs, streams and aquifers under entitlements issued by Government and authorised under the Water Act 1989. Generally, water for consumptive use is allocated to water authorities through the granting of bulk entitlements (water authorities then distribute the water to their rural or urban customers), and to individuals through the issuing of a licence.

There are some exceptions to this: some private power generating companies in the Latrobe Valley hold bulk entitlements, as does Southern Hydro and the Minister for Environment; and a few water authorities have licences to extract surface water and groundwater to supply urban areas.

There are also many situations in which private individuals have the right to take water for domestic and stock use without a licence, for example from a catchment dam or a groundwater bore.

Table 3-1 shows how water was committed under the various entitlements for consumptive use in Victoria in 2004/05. An improvement in the data collection methodology for the 2004/05 report makes any comparison of the total volume under entitlements in 2003/04 invalid. There has been an increase in the volume of bulk entitlements granted of about 260,000 ML. This volume does not represent new water as it is water authorities' historical but ill-defined rights to water converted to formal bulk entitlements. There has been a small increase in licensed volume in catchments and aquifers where water is still available within the allocation limits.

Table 3-1 Water allocated for consumptive use in Victoria - 2004/05

Entitlement	Volume 2004/05 (ML)
Surface Water	
Bulk entitlements (1)	5,071,510
Licences (2)	233,250
Private right (farm dams) (3)	523,200
Groundwater	
Licences	853,000
Total Water Entitlements	**6,680,960**

Notes:

(1) An estimate of the total volume of bulk entitlement granted as at 30 June 2005. Estimate is for an average year and is not adjusted for trade or long-term rolling averages.

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

(3) Estimate of water taken by farm dams in 2004/05 includes farm dams for commercial and irrigation use which require a licence (or registration) following amendment of the Water Act 1989 in 2001, but which are currently being processed.

3.2 Water Availability and Use

The size and use of Victoria's water resources for 2004/05 is summarised in Table 3-2. Stormwater re-use data was not available and has not been included in the 2004/05 accounts. However, the total stormwater resource is included as part of the surface water resource. Stormwater data will be included in future versions of this report as it becomes available.

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

Table 3-2 Victoria's water availability and water taken for consumptive use in 2004/05

	Surface Water (1) (ML)	Groundwater (ML)	Recycled Water (ML)
Total Resource	18,039,000	not available	469,000
Entitlement/Allocation	5,828,000	853,000	n/a
Water used	4,894,000	401,000	73,000

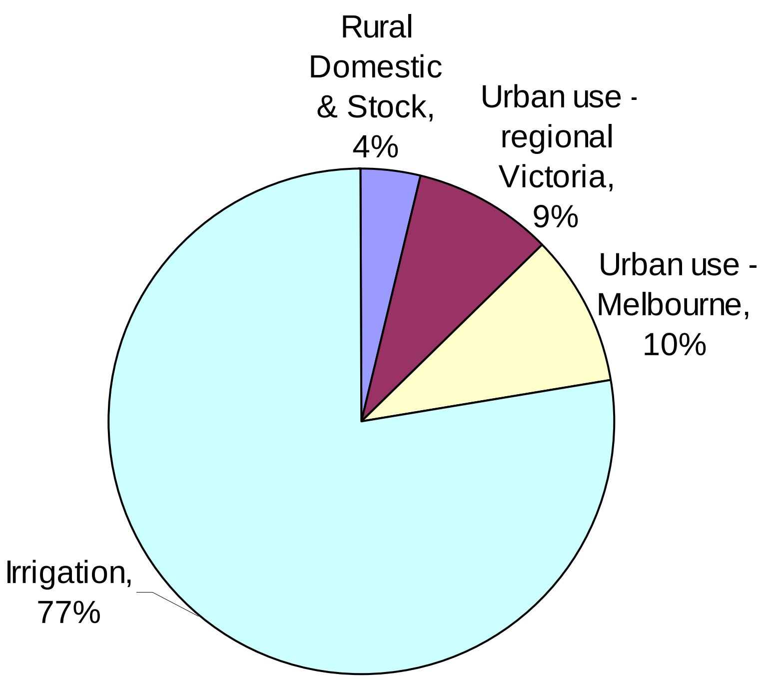
Notes:

(1) Catchment inflow as shown in each basin water balance in the 2004/05 State Water Accounts, excluding inter-basin transfers, irrigation return flows and recycled water.

(2) n/a: not applicable.

The distribution of water use in 2004/05 by user group is shown in Figure 3-1. Irrigation water use still accounted for 78% of the State's total water use. Water use in Melbourne was 10% of the State's total. The proportion of water use in Victoria in 2004/05 is typical of an average year.

Figure 3-1 Consumptive uses of water in Victoria, 2004/05



3.3 Surface Water Use and Compliance with Entitlements

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

Figure 3-2 River Basins in Victoria for the State Water Accounts

Compliance monitoring against obligations under bulk entitlements is currently undertaken by the resource manager in each basin. The resource managers are appointed by the Minister for particular river basins and in 2004/05 were Goulburn-Murray Water and Grampians Wimmera-Mallee Water in northern Victoria, and Southern Rural Water, West Gippsland CMA, Melbourne Water and the Department of Sustainability and Environment in southern Victoria. Each of these resource managers reports annually to the Minister on authorities' compliance with their bulk entitlements. Not all resource manager reports for 2004/05 were available when the water accounts were prepared.

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 2004/05 was not available when this report was prepared (it is due for release later in 2006).

Table 3-3 shows the volume of water allocated under bulk entitlements, licences and private rights (farm dams) in each basin and the volume diverted from waterways in 2004/05. In each basin the volume diverted is within the entitlement volume. The total volume of bulk entitlements reported in Table 3-3 does not include bulk entitlements for the major water supply systems located in the Ovens, Loddon, Yarra, and Bunyip basins. The Yarra and Bunyip bulk entitlements are yet to be completed, and the Ovens and Loddon bulk entitlements were completed after 30 June 2004. The information on small catchment dams, which includes stock and domestic dams, shows the volume used by small catchment dams relative to bulk entitlements and private licensed diversions.

The volume of water taken under bulk entitlements is around half to two-thirds of the entitlement volume, with the exception of those basins, such as the Campaspe, Wimmera and Maribyrnong basins, where water availability was severely limited by the drought. Some bulk entitlements have an upper limit described as a five-year or 10-year rolling average. Given that the volumes taken over the previous four years have been low because of the drought, the average upper limit formula may have calculated that a very large volume could have been taken in 2004/05, even though there was not enough water to take advantage of this upper limit. However, the volume that can be extracted by a water authority is often constrained by practical matters such as;

- the capacity of the authority's diversion works (specified in the bulk entitlement order); and
- the amount of water available in the river after environmental flow obligations have been met.

3.4 Groundwater Use and Compliance

Extensive investigations were undertaken during the 1960s and 1970s to characterise Victoria's groundwater resources. However, until recently, little further effort was made to quantify the volume of available resources and to allocate usage within sustainable limits. Prior to 1995, groundwater licences were generally issued within arbitrary limits based on the proximity to other bores and waterways, but with little understanding of the long-term sustainable yields of the groundwater systems.

3.5 Groundwater Management Units Defined

Since 1995, groundwater management units – Water Supply Protection Areas (WSPAs) and Groundwater Management Areas (GMAs) – have been defined to improve the sustainable management of this important resource (Figure 3-3). These are the areas in the State where significant groundwater usage has occurred or is likely to occur. They account for over 80% of the State's useable resource.

A GMA is the geographical area for which water is drawn from an aquifer. If the aquifer has been stressed to the point where the government has stepped in to aid its management and recovery, the area is categorized as a WSPA. Areas not designated as either a GMA or a WSPA are known as unincorporated areas. These large unincorporated areas of the State also contain substantial and often unquantified resources of varying yield and quality.

Groundwater management units apply to specific aquifers and accordingly are defined by surface area and by aquifer depth. In Gippsland for instance, groundwater is drawn from many different overlapping aquifers. Aquifers (and respective GMAs and WSPAs) generally do not coincide with the overlying river basin boundaries and may underlie more than one river basin. Groundwater usage in the State Water Report is included for GMAs and WSPAs, however unincorporated areas are not included because there is limited data available for these areas.

Table 3-3 Volume allocated and taken under surface water entitlements in 2004/05

Basin	Bulk Entitlements			Unregulated River Licensed Private Diversions			Farm Dams
	Entitlement Volume(1) (ML)	Volume Taken (2) (ML)	Volume Taken (% of Entitlement Volume)	Entitlement Volume (ML)	Volume Taken (ML)	Volume Taken (% of Entitlement Volume)	Volume Taken (3) (ML)
Murray (5)	1,726,610	1,517,350	-	12,540	5,000	40%	6,500
Kiewa	1,150	580	50%	12,670	5,100	40%	3,900
Ovens (5)	3,610	16,560	-	17,180	6,900	40%	15,900
Broken	2,320	20,280	-	1,140	500	44%	15,800
Goulburn	1,961,910	1,487,750	76%	20,220	8,100	40%	47,500
Campaspe	283,390	43,980	16%	1,560	600	38%	28,800
Loddon (5)	2,240	26,330	-	15,410	6,200	40%	50,000
Avoca	280	20	7%	3,510	1,700	48%	12,700
Mallee	0	0	n/a	0	0	n/a	0
Wimmera (4) (5)	205,780	84,510	-	2,420	1,700	70%	14,400
East Gippsland	620	240	39%	720	400	56%	1,100
Snowy	2,200	870	40%	3,860	2,300	60%	3,400
Tambo	3,650	60	2%	4,080	2,500	61%	3,900
Mitchell	5,900	4,830	82%	15,400	9,000	58%	4,500
Thomson (5)	446,600	346,300	-	13,830	11,600	84%	7,000
Latrobe	256,840	137,900	54%	18,350	10,800	59%	20,500
South Gippsland	14,020	8,630	62%	11,890	7,800	66%	24,300
Bunyip (5)	0	6,410	-	12,270	5,400	44%	15,500
Yarra	0	441,010	-	35,980	27,000	75%	15,900
Maribyrnong (5)	8,700	3,840	-	2,060	1,300	63%	7,800
Werribee (5)	27,630	17,790	-	920	400	43%	9,300
Moorabool	43,100	17,680	41%	3,330	1,300	39%	22,200
Barwon	55,730	40,710	73%	5,060	3,300	65%	30,900
Corangamite	0	0	n/a	970	700	72%	12,300
Otway Coast	19,230	15,590	81%	5,440	3,900	72%	12,800
Hopkins (5)	0	340	-	9,960	5,400	54%	64,600
Portland Coast	0	0	n/a	1,220	800	66%	16,200
Glenelg (4) (6)				1,170	800	68%	55,500
Millicent Coast (5)	0	150	-	90	90	100%	0
Total	**5,071,510**	**4,239,710**		**233,250**	**130,590**	**56%**	**523,200**

Notes:

(1) Estimate of the total volume of bulk entitlement granted as at 30 June 2004. 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.

(2) Includes water taken under bulk entitlements and water taken under historical rights (progress to convert these historical rights to bulk entitlements was still underway in 2004/05).

(3) Refers to the total volume harvested by the farm dams, including the estimated water lost to evaporation.

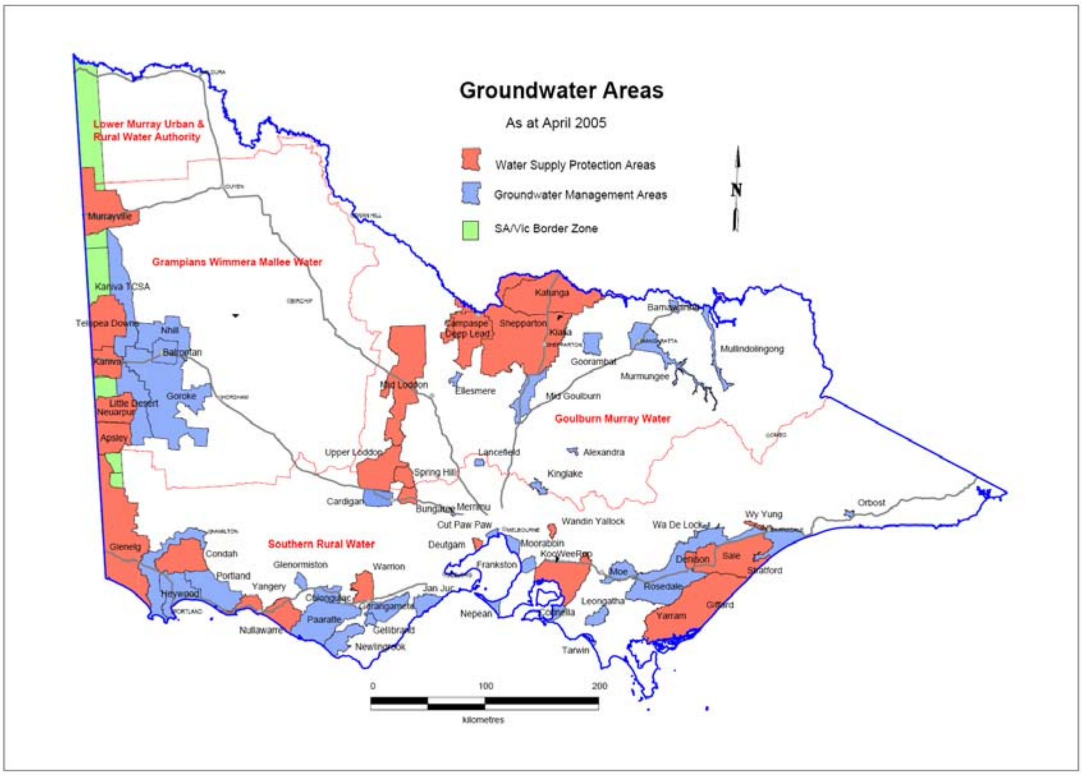
(4) Data shown over the period 1st November 2004 to 31st October 2005, in accordance with bulk entitlement specifications.

(5) Some or all of the bulk entitlements in this basin are yet to be finalised. The percentage of entitlement taken in 2004/05 is therefore not calculated for these basins.

(6) Water taken from the Glenelg basin and bulk entitlements is included under the Wimmera basin.

(7) n/a: not applicable

Figure 3-3 Groundwater management units in Victoria



Initial estimates of sustainable yields for groundwater have been made to inform decisions about granting new groundwater licences. These estimates of sustainable yield have been used to assist in the determination of the Permissible Annual Volume (PAV) that may be allocated to groundwater users in a particular GMA. The initial estimates of sustainable yields were based on limited data and there is some uncertainty associated with them. WSPAs do not have a PAV because the allocation limits are reported as the sum of the existing licensed volumes.

In response to the uncertainties and deficiencies in the hydrogeological information, an incremental and adaptive management approach (in accordance with the precautionary principle) will be used to manage groundwater sustainably as an alternative to setting allocation limits. This approach will protect the resource by defining the operating range for groundwater levels in an aquifer. Managing to groundwater levels enables the resource to be managed adaptively. As a better understanding of the sustainability of the resource is obtained, variations to water level targets can be made. Over time, target groundwater levels need to be defined for all WSPAs and a similar approach implemented for all GMAs. Thus the preferable approach for managing groundwater systems that have not been over-allocated is to:

- measure and report on groundwater usage and levels,
- set trigger water levels to manage seasonal allocations, and
- periodically review sustainable yield estimates and risks to the resource on the basis of information collected over time.

In 1997 a total of 17 groundwater areas were found to be over-allocated, or about to become over-allocated, in relation to the initial estimates of sustainable yield. These areas were given priority for the declaration as a WSPA. Since then the number of WSPAs has increased, currently there are 25 WSPAs with management plans completed or with draft management plans at various stages of development. In most cases management plans seek more reliable information on groundwater levels, sustainable yield and usage. A sound technical basis is needed to develop management responses, which may include restrictions on groundwater extractions.

3.6 Metering in Groundwater Management Units

The level of metering of groundwater resources varies throughout the State between areas. Generally metering within WSPAs is approaching 100% of the total number of licensed bores. Metering of licensed bores within GMAs was not a high priority in the past. However, the *Our Water Our Future* action plan proposes to meter all groundwater licences that are deemed to be of significant use (e.g. irrigation and/or commercial use). (See section 38.3.)

In non-metered areas, an estimate of use is provided for this report. This estimate is based on average metered use across the whole State and the ratio of metered volume to allocated volume is determined. This ratio is applied to non-metered areas. The average metered usage as a percentage of allocated volume is 35% for 2004/2005. Non-metered groundwater use is therefore estimated as 35% of the allocated volume.

3.7 Groundwater Data in 2004/05

The groundwater use data assembled in this report has varying degrees of quality. The most reliable groundwater data is on licensed groundwater usage from rural water authority customer systems. The least reliable information tends to be on stock and domestic bores.

For the purpose of this second State Water Report, groundwater details have been reported primarily under each GMA and WSPA. Compliance with licensed volumes is not assessed in this report, as much of the groundwater usage data is estimated. More detailed compliance with groundwater licence conditions in WSPAs is assessed by the relevant rural water authority, and is documented in annual WSPA reports.

The total allocated volume of groundwater in the State at 30 June 2005 was 853,000 ML (Table 3-4). Full details of water allocated and extracted from each GMA and WSPA is contained in Appendix A. The volume allocated in the 62 GMA and WSPAs varies from 0% of the PAV for Gellibrand GMA to over 200% of the PAV for the Rosedale and Wa De Lock GMAs. Stock and domestic use accounts for around 9% of the State's total estimated groundwater use.

The total estimated groundwater use across the State, including stock and domestic use, is about 401,000 ML. This represents around 47% of groundwater allocations in Victoria in 2004/05.

The groundwater allocation in the unincorporated areas is 108,000 ML (13% of the total allocated volume); estimated groundwater use in unincorporated areas is 38,000 ML (10% of the total estimated groundwater usage).

Urban water authorities using groundwater for the supply of towns accounted for 33,500 ML of allocated groundwater (4% of the total allocated volume) and 9,250 ML of metered groundwater use (3% of the total metered use).

A comparison with results from the 2003/04 State Water Accounts reveals that groundwater allocations have increased by approximately 6,000 ML (1% of total allocation) over the ensuing 12 months. In contrast, metered groundwater use has decreased by 12,000 ML (a 5% decrease). This is likely to be a conservative estimate and the actual decrease in metered use may be more significant. This is due to a number of new meters that have been installed during the year under initiatives from the *Our Water Our Future* action plan. For the purpose of this comparison, groundwater management units with metered data in 2004/05 but not in 2003/04 have not been included. The decrease in metered groundwater use reflects higher annual rainfall in the 2004/05 year.

Table 3-4 Victoria's groundwater entitlement and use

Item	Volume (ML)
Permissible Annual Volume[(1)]	858,000
Licensed allocated volume (as at 30/06/2005)	853,000
Licensed use (metered)	272,000
Licensed use (non-metered)[(2)]	91,000
Estimated Domestic and Stock use[(3)]	38,000
Total estimated use	**401,000**

Notes:

(1) Equals the sum of licensed allocations for WSPAs and the Permissible Annual Volume for GMAs.

(2) Estimate assumes usage is 35% of licensed volume

(3) Estimate assumes 2 ML/year/bore is used, with the exception of Tarwin and Nepean GMAs where 0.3 ML/year/bore is applied.

A substantial increase in licensed allocations (>1,000ML) occurred in Koo Wee Rup WSPA, Nullawarre WSPA, Wa De Lock WSPA, Murrayville WSPA, Neuarpur WSPA and Ellesmere GMA.

The apparent decrease in licensed allocations (>3,000ML) in the Glenelg WSPA, Kaniva WSPA and Telopea Downs WSPA was the result of a change in the method for accounting for groundwater allocations.

The largest increase in metered groundwater use was observed in Neaurpur WSPA and reflects groundwater trading and a greater use of existing licensed allocations in the area. The Mid Loddon WSPA, Katunga WSPA and Nagambie GMA also displayed a significant increase in metered groundwater use (>2,000ML).

The largest decrease in metered groundwater occurred in Sale WSPA (7,000ML). Large decreases were also observed in Yarram WSPA (4,000ML), Nullawarre WSPA (4,000ML) and Koo Wee Rup WSPA (2,000ML). These decreases are attributed to higher rainfall over southern Victoria in 2004/05.

3.8 Recycled Water

During 2004/05, a total of 469,000 ML of treated effluent was produced by the 178 sewage treatment plants located around Victoria. Of this, around 73,000 or 16% was recycled, as shown in Table 3-5.

Around 70% of the treated effluent generated in Victoria comes from the Melbourne metropolitan area, and most of this is at Melbourne's Eastern Treatment Plant and Western Treatment Plant.

In 2000/01, 9% of treated effluent was recycled. However, this figure did not include internal recycling at Eastern Treatment Plant (i.e. recycled water used within the treatment plant process). If this water is excluded from the 2004/05 figures, then 13% of effluent produced in 2004/05 was recycled, which was slightly lower than for the previous year.

Nearly all of the increase in water recycling since 2000/01 has occurred in the Melbourne metropolitan area, with the percentage of water recycling for regional urban water authorities declining from 32% in 1999/00 to 25% in 2004/05. Figures for 2004/05 were slightly lower than the previous year. Most of the increase in metropolitan recycling is due to a shift at the Western Treatment Plant from irrigating pasture with raw sewage (an activity which is not considered as recycling) to irrigating pasture with treated effluent (an activity which is considered as recycling).

The volume of water recycled will vary from year to year. It is dependent on the volume of effluent available, which increases in wet years due to stormwater infiltration, and on the demand for recycled water. The agricultural demand for recycled water was lower in 2004/05 than in the previous year in some areas because of the higher rainfall conditions.

Table 3-5 Volume of effluent recycled in 2004/05

Basin [1]	Total Volume of Effluent Produced[2] (ML)	Volume of Effluent Recycled (ML)	% of Effluent Recycled
Murray	12,120	5,650	47%
Kiewa	230	50	22%
Ovens	3,290	1,220	37%
Broken	690	500	72%
Goulburn	9,340	6,880	74%
Campaspe	1,340	730	54%
Loddon	9,470	1,300	14%
Avoca	340	310	91%
Mallee[3]	0	0	n/a
Wimmera	2,330	2,330	100%
East Gippsland	30	30	100%
Snowy	220	220	100%
Tambo	770	770	100%
Mitchell	1,700	1,700	100%
Thomson	550	510	93%
Latrobe	23,530	90	0%
South Gippsland	5,630	290	5%
Bunyip	165,570	17,500	11%
Yarra	9,200	210	2%
Maribyrnong	2,950	2,090	71%
Werribee	175,130	24,720	14%
Moorabool	0	0	n/a
Barwon	30,890	2,200	7%
Corangamite	2,450	560	23%
Otway Coast	1,450	470	32%
Hopkins	6,060	1,090	18%
Portland Coast	2,360	260	11%
Glenelg	1,230	1,230	100%
Millicent Coast	190	190	100%
Total	**469,060**	**73,100**	**16%**

Notes:

(1) Recycled water is reported in the river basin where the effluent is treated, for example, most of the effluent recorded for the Werribee and Bunyip river basins is sourced from areas of Melbourne in other river basins.

(2) Total volume of water available for re-use at the end of the water treatment process.

(3) Recycled water from Mallee towns on the River Murray are reported under the Murray basin.

(4) n/a: not applicable

3.9 Conclusion

Although there were differences in the way data was collected for some components of water entitlement and use between 2004/05 and 2003/04, there is a sufficient basis for comparison between the data for the two years to conclude that the level of consumptive water use in 2004/05 was very similar to 2003/04.

The drought, poor streamflows and low reservoirs, have continued to depress water use. As a result, the State has experienced low annual allocations to irrigators, rosters and bans on licensed diversions in unregulated streams, and water restrictions in cities and towns.

Use of surface water in 2004/05 was about 83% of the volume of surface water entitlements. One reason for this was the shortage of water caused by drought. For groundwater, about 46% of the entitlement volume was used.

Of the 4,900,000 ML of surface water used in Victoria in 2004/05, 89% is taken under a formal entitlement. The remaining water either did not require a formal entitlement as it is used for domestic and stock use, or is a catchment dam subject to registration (i.e. used for commercial or irrigation purposes). The State Water Report will record registrable farm dams as formal entitlements when the registration process is completed. No data is available at this stage on water taken directly from streams for domestic and stock purposes as a private right.

Of the total water use in 2004/05, about 92% was from surface water sources, 7% from groundwater and 1% was from recycled water.

4 Management of Scarce Water Resources

4.1 Prolonged Dry Conditions

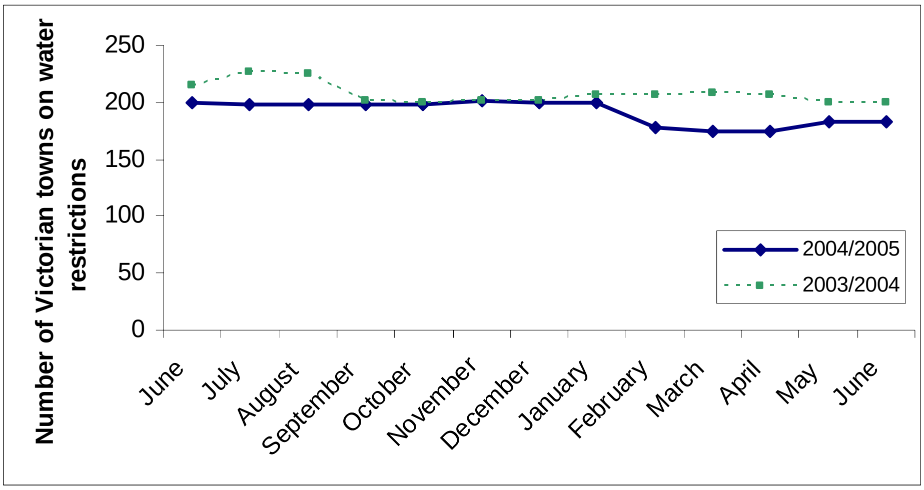
Most of Victoria experienced below average rainfall (80-100% of average rainfall) for 2004/2005, making it the ninth consecutive year of below average rainfall for much of the State. This prolonged period of low rainfall continued to place considerable stress on many urban and rural water supplies throughout 2004/2005. The effects of the prolonged dry period on Victoria's water resources include depleted levels in reservoirs (especially in the western part of the state), reduced recharge to aquifers, reduced flows in waterways, less reliable supplies from farm dams, and reductions in direct extractions from waterways. Water scarcity in irrigation systems ensured that water markets were active.

The various water restrictions and bans that resulted from these conditions are presented in this chapter. Transfers of water entitlements within the water market are increasingly used to manage water scarcity and this activity is summarised.

4.2 Urban Restrictions

At the end of June 2004, 199 towns were on water restrictions (Department of Sustainability and Environment, June 2004). This included 62 towns on severe levels of restrictions (Stages 3 and 4 of a four stage scale), 72 on moderate (Stage 2) levels, and 65 on low (Stage 1) levels. A year later at the end of June 2005, 183 towns were on water restrictions (Department of Sustainability and Environment, June 2005). This included 33 towns on severe levels of restriction, 70 on moderate levels, and 80 on low levels of restriction. These figures indicate a small improvement to the water supply situation during 2004/2005.

Figure 4-1 Changes in number of Victorian towns on water restrictions in 04/05



Source: Department of Sustainability and Environment (June 2005)

4.3 Restrictions on Water Use in Irrigation Areas

Restrictions on irrigation water use in regulated rivers are defined by the seasonal irrigation water allocation. The seasonal allocation differs from urban restrictions by allocating to each irrigator each year a share of the available resource proportional to the amount of his or her entitlement (water right or licence). Their 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), and the availability of sales water allows seasonal allocations to be greater than 100% of entitlement. They are made early in the irrigation season based on the current volume of water in storage, estimated inflows during the season and the amount of water required to provide for water in subsequent years. Allocations are reviewed by water authorities throughout the irrigation season and increased if the available water exceeds their forecasts. The initial seasonal allocations are often low because water authorities do not know for certain until late spring how much water is going to flow into their reservoirs.

The 2004/05 seasonal allocations to irrigators in Victoria's irrigation systems are shown in Table 4-1. Initial allocations were typically zero or very low. By February 2005, 100% of entitlement was available in the majority of supply systems. However, because of the average rainfall conditions and previous years of drought, the February 2005 allocations were lower than long-term median allocations for all except the Broken and Bullarook Creek systems.

End of season allocations in 2004/05 remained well below 100% in the Campaspe, Coliban, Wimmera and Maribyrnong systems. Irrigators supplied from the Wimmera, Maribyrnong and Campaspe systems were worst affected by the continuing drought. In the Campaspe basin, irrigators received only 39% of their licence volume.

In the Wimmera basin, Grampians Wimmera Mallee Water was able to offer an allocation of 7% to irrigators. This was the third season in a row that Wimmera-Mallee irrigators received a zero or very small allocation.

In the Maribyrnong basin, the volume of water stored in Rosslynne Reservoir remained low throughout the irrigation season because of below-average inflows. Consequently, irrigators on Jacksons Creek and the Maribyrnong River received no allocation for much of the season, until an allocation of 25% was announced in late February 2005.

In contrast, irrigators in the Werribee and Bacchus Marsh systems received 100% allocation (more than double that available in 2003/04), due to the supply of recycled water from Melbourne's Western Treatment Plant.

Table 4-1 Seasonal irrigation water allocations 2004/05

Irrigation System	Initial Allocation July 2004 (% of Entitlement)	Mid Season Allocation February 2005 (% of Entitlement)	Final Allocation May 2005 (% of Entitlement)	Median February Allocation (% of Entitlement)
Murray	63	100	100	200
Goulburn	5	100	100	160
Broken	55	170	170	170
Campaspe	0	39	39	220
Coliban	(1) 50	65	65	130
Loddon	0	100	100	150
Bullarook Creek	0	190	190	190
Wimmera	0	(3) 5	(5) 7	200
Thomson – Macalister	50	130	140	130
Werribee and Bacchus Marsh	(2) 5	100	100	120
Maribyrnong (SRW) (6)	0	(4) 0	(4) 25	100

Notes: (Source: Department of Primary Industries, 2005)

(1) 15 September 2004

(2) 15 August 2004

(3) Supply-by-agreement customers: 30%

(4) Jacksons Creek allocation: 25%

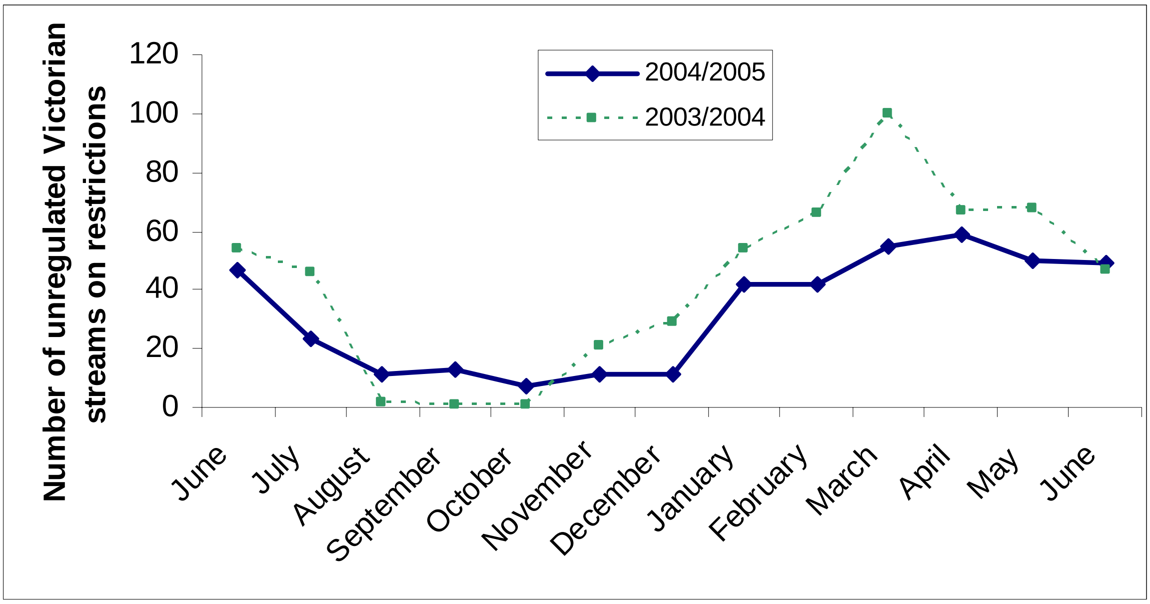
(5) Approximate only; 1 224 ML supplied for irrigation.

(6) Maribyrnong irrigators have access to unregulated high flows outside the summer period.

4.4 Restrictions on Unregulated Stream Diversions

A total of 47 unregulated streams across Victoria had some form of restriction or ban on diversion at the end of June 2004 (Department of Sustainability and Environment, June 2004). A year later, 49 unregulated streams had some form of restriction or ban on diversions (Department of Sustainability and Environment, June 2005), an increase of two over the year. The number of unregulated streams with bans or restrictions on diversions fluctuates during the year, with higher numbers of restrictions or bans generally seen in summer months.

Figure 4-2 Changes in number of unregulated Victorian streams on restrictions during 2004/05



Source: Department of Sustainability and Environment (June 2005)

4.5 Restrictions on Groundwater

Restrictions on groundwater use placed on licensees in the Werribee region located in the Deutgam WSPA in November 2003 continued until October 2004. At that time an allocation of 25% was made which continued until the end of February 2005, and then revised up to 60% until the end of June 2005. These restrictions were placed on extractions to prevent seawater from intruding into the aquifer, which has been at low levels due to climatic conditions and previous groundwater pumping.

Although not subject to restrictions on groundwater extractions, the Sale GMA levels were monitored closely throughout 2004/2005 because of the threat of seawater intrusions. A ban on transfers of licences was in place for the Sale GMA, and remained in place at the end of June 2005.

4.6 Water Entitlement Transfers

The water market is the main mechanism by which irrigators and, to a lesser extent, urban water authorities can manage their water supplies through drought. The most active trading markets are centred around the extensive Goulburn and Murray River water supply systems in northern Victoria, but small water markets exist around the Thomson/Macalister and Werribee/Bacchus Marsh irrigation districts.

The volume of surface water entitlements transferred during 2004/05 is shown in Table 4-2. Around 45,000 ML of water entitlement was permanently transferred and 380,000 ML temporarily transferred. There was also a net permanent transfer of 5,400 ML of water entitlement and a net temporary transfer of 8,200 ML from Victoria to other states.

The unaccounted difference in Table 4-2 was investigated by the Murray Darling Basin Commission during preparation of its Water Audit Monitoring Report 2004/05. The Commission had difficulties in reconciling the figures due to problems experienced by NSW with its trade and licence data system and decided to accept the figures as they are. Similar differences in the past have been due to inconsistencies in the transaction dates for interstate trades recorded by water authorities. The new water entitlements register, due to come on line in July 2007, will assign a unique date for each transaction and provide for independent audits to prevent 'unaccounted differences' occurring in future.

Table 4-2 Surface water entitlement transfers in 2004/05

Basin	Permanent Entitlement Transfer (ML)			Temporary Entitlement Transfer (ML)		
	Bought	Sold	Net Transfer to Basin	Bought	Sold	Net Transfer to Basin
Murray	38,156	25,229	12,927	188,823	178,532	10,291
Kiewa	26	32	-6	552	582	-30
Ovens	383	433	-50	567	536	31
Broken	197	197	0	1,112	1,112	0
Goulburn	1,484	15,579	-14,095	136,131	151,395	-15,264
Campaspe	416	478	-62	4,447	3,263	1,184
Loddon	767	4,783	-4,016	36,818	42,507	-5,689
Avoca	0	0	0	0	0	0
Mallee	0	0	0	0	0	0
Wimmera	0	0	0	0	0	0
East Gippsland	0	0	0	0	0	0
Snowy	0	0	0	0	0	0
Tambo	0	0	0	0	0	0
Mitchell	0	0	0	0	0	0
Thomson	87	87	0	1,951	1,951	0
Latrobe	0	0	0	1,593	1,593	0
South Gippsland	0	0	0	0	0	0
Bunyip	0	0	0	0	0	0
Yarra	0	0	0	0	0	0
Maribyrnong	0	0	0	76	76	0
Werribee	6	6	0	1,388	1,388	0
Moorabool	0	0	0	0	0	0
Barwon	0	0	0	0	0	0
Corangamite	0	0	0	0	0	0
Otway Coast	0	0	0	0	0	0
Hopkins	0	0	0	0	0	0
Portland Coast	0	0	0	0	0	0
Glenelg	0	0	0	0	0	0
Millicent Coast	0	0	0	0	0	0
Total within Victoria	41,521	46,823	-5,302	373,459	382,935	-9,476
Interstate	0	5,445	-5,445	19,298	27,451	-8,153
Unaccounted difference	n/a	n/a	143	n/a	n/a	-1,323

n/a: not applicable

Most of the trade is between irrigators but a small number of water authorities have also used the water market to augment their supplies or to mobilise their excess entitlement for the benefit of irrigators seeking to increase their seasonal allocation. Details of trades are reported for each of the bulk entitlements held by water authorities in the State Water Accounts.

Within Victoria, groundwater transfers occur on both a permanent and a temporary basis. The volume of groundwater entitlement transferred has progressively increased since groundwater trading commenced in 2002/03. Permanent transfers of groundwater entitlement in 2004/05 were 738 ML, which is roughly the same as in 2003/04 but significantly higher than 2002/03. Temporary transfers of groundwater entitlement increased in 2004/05 to 6,557 ML, which was 50% higher than the previous year. The majority of groundwater entitlement transfers occurred in southern Victoria.

Part 2
Basin Water Accounts
2004/05

Part 2 presents an account of water in each of Victoria's 29 river basins during 2004/05. The physical characteristics and management arrangements for each river basin are described, a seasonal overview presented, and environmental water, surface water, groundwater and recycled water resources are summarised.

5 Introduction and Overview

Part 2 of the State Water Report, the State Water Accounts, provides a record of water availability and use across Victoria for the 2004/05 period.

This chapter outlines how the accounts were constructed, and it presents a number of important assumptions and limitations of the data in the accounts.

The principal reporting unit for the State Water Accounts is the river basin. Information for each of the 29 basins across the State, except the Wimmera and Glenelg basins, is provided for the period from 1 July 2004 to 30 June 2005. The Wimmera and Glenelg basins' information is provided for the period from 1 November 2004 to 31 October 2005 in order to reflect the seasonal management and water accounting period for major bulk entitlements in these basins.

5.1 Data Sources

The State Water Accounts primarily draw upon information from:

- Responses to specific data requests from water authorities, catchment management authorities, the Department of Sustainability and Environment, and the Murray-Darling Basin Commission;
- Treated effluent and reuse data collected from water authorities by the Essential Services Commission;
- Hydrologic information from selected streamflow monitoring sites and stored in the Department of Sustainability and Environment's Victorian Water Resources Data Warehouse;
- Climate information generally provided by Victorian water authorities from selected rainfall and evaporation monitoring sites;
- Information on estimated relationships between water use and climate or hydrologic data which is produced by water supply system modelling; and
- Water authority annual reports.

5.2 Comparison with 2003/04

This is the second year that the water accounts have been compiled and reported. Water balance information for each basin in 2004/05 is presented alongside the values reported in 2003/04 for comparative purposes. Notes are provided where the previous method has been revised to explain large differences between 2004/05 values and those of the previous year. Where large differences occur between 2003/04 and 2004/05, they are in most cases a result of improvements in the method of estimation, whilst smaller differences are the result of climatic fluctuation between the two years.

5.3 Structure of Basin Accounts

Chapters 6 to 34 provide information on water availability and use in each of the 29 river basins across the State. This includes:

- A map showing the extent of each river basin and the location of significant water resources;

- Responsibilities for management of water resources;
- A seasonal overview of conditions in the basin that affect water resource availability and use in 2004/05;
- A summary of total water resources in the basin for:
    - Water for the environment;
    - Surface water resources;
    - Groundwater resources; and
    - Recycled water.

5.4 Key Assumptions and Limitations of Data

A number of key assumptions and limitations of the data presented should be borne in mind when viewing the accounts.

The data presented in the accounts has been collected from a number of sources. For this reason, qualifications are placed on the data and its interpretation, usually in notes below each table.

5.4.1 Apportioning of Data to River Basins

The reporting unit of the State Water Accounts is the river basin and data is reported according to river basin boundaries as designated by the Australian Water Resource Council. This unit was chosen because the majority of data is easily collected and aggregated into this reporting unit. Some data sets are, however, not aligned with river basin boundaries and this data has been treated in various ways.

5.4.1.1 Surface Water Data

Surface water data generally aligns with river basin boundaries. The only instance where this does not occur is where water is diverted from a river in one river basin and used in another. Users of surface water in Victoria are allocated a bulk entitlement based on the source of water and hence all surface water information is reported at its point of diversion. For example, Coliban Water has a bulk entitlement that allows it to divert water from Lake Eppalock, which is located in the Campaspe Basin, and then transfers that water to Bendigo, which is located in the Loddon Basin. For the purposes of the water accounts, the accounting for that water is undertaken at the point of diversion and not the point of use. Information on supply to Bendigo would therefore be located within the water accounts for the Campaspe Basin.

This similarly applies to Victoria's major cross-basin irrigation supply systems. Information on supply 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.

5.4.1.2 Groundwater Data

The management of groundwater in Victoria is based on allocating resources within three types of management unit, namely groundwater management areas (GMAs), water supply protection areas (WSPAs) and unincorporated areas. GMAs and WSPAs have been defined where there is a need for some intervention in the management of groundwater, either due to the need to control over-development or to control environmental impacts (e.g. salinity). Collectively, WSPAs and GMAs cover less than 10% of the area of the State. Unincorporated areas cover the remainder of the State and are located in areas of less intense use or poor quality water where there is a very low risk of overuse or environmental impact.

Groundwater use for the water accounts has been presented at a statewide level for each GMA and WSPA. Unincorporated areas have not been presented as this information is not readily available, however future reports may incorporate groundwater use in these areas. All other information for the water accounts has been compiled according to river basin boundaries.

The reporting of groundwater by river basin presents a number of reporting difficulties. Groundwater management units often fall across more than one river basin. Where this is the case, the total groundwater resource for the whole of the GMA or WSPA has been presented in the water accounts for each river basin only if the proportion of the GMA or WSPA within that river basin is greater than 90% by area. The concentration of bores and groundwater use varies considerably across management areas. As a result, where less than 90% of the surface area of a GMA or WSPA falls within a river basin, it is not always accurate to apportion groundwater allocations and use on the basis of area alone. Future water accounts may refine this process by allocating individual groundwater bores to river basins. GMA and WSPA boundaries are reported as at 30 June 2005.

The boundaries of the management areas for groundwater are evolving in order to include areas of increasing development, new groundwater resources and changes to groundwater extraction rates. Boundaries may be modified or new areas created, for example, to account for a groundwater recharge area which is undergoing excessive development that reduces groundwater availability in a nearby GMA. The process of modifying existing boundaries or creating new management areas is one that is undertaken collaboratively between government, water authorities, groundwater users and the community, using hydrogeological information.

Groundwater is managed not only across surface areas, but also at different aquifer depths. In the Gippsland area, for instance, groundwater is drawn from different aquifers that lie at different depths. This does not present particular reporting difficulties provided that each aquifer is reported individually, which has been done in the water accounts.

The Victorian Government's Our Water Our Future action plan recognised the implication that surface water and groundwater interaction has for the management of water resources within Victoria. In particular, it recognised the potential for double counting of surface water and groundwater resources which can currently occur under the existing management framework. National and international experience has shown this to be a major problem and processes have been initiated within the State government and water authorities to address this issue. In the determination of Permissible Annual Volumes (PAVs) for groundwater extraction throughout the State, varying degrees of consideration have been applied to groundwater-surface water interaction. The importance of this consideration has been identified in Our Water Our Future and to this end, for example, the PAV for Gellibrand is set to zero due to the concerns about groundwater pumping adversely affecting baseflow to the Gellibrand River.

5.4.1.3 Recycled Water Data

The recycled water from towns with wastewater treatment plants has been assigned to river basins according to the point of discharge from the plant to the receiving waters. If all water from a treatment plant is reused and none is discharged to rivers or lakes, the plant is reported within its river basin.

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

- Volume of effluent produced, excluding evaporation
- Volume recycled for urban and industrial uses
- Volume recycled for agricultural uses

- Volume recycled for beneficial allocations (e.g. environmental flows)
- Volume recycled within process
- Volume discharged to the environment (ocean outfalls or inland water discharges).

Due to different interpretation of these categories by water authorities in the data collected by the Essential Services Commission, similar reuse activities occurring in different basins may not necessarily be classified under the same category, e.g. the irrigation of golf courses may be classified as either agricultural reuse or urban and industrial reuse.

5.4.2 Reporting Measures

The volumes in the water accounts are generally reported in megalitres (ML); one megalitre equals one million litres. Volumes of surface water and groundwater entitlements, entitlement transfer and use from surface water entitlements have been reported to the nearest megalitre as required to assess compliance. Groundwater use and recycled water is reported to the nearest 10 megalitres. 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 megalitres to reflect the uncertainty in these values.

5.4.3 Water Management Responsibilities

The responsibilities for water management are reported in the State Water Accounts as they existed during the 2004/05 period. Changes to water management responsibilities since June 2005 will be reflected in subsequent water accounts.

5.4.4 Restrictions on Water Use

Restrictions on water use due to poor water quality or water scarcity are discussed in the seasonal overview of each chapter of this report. The restrictions applied by urban and rural water authorities at each designated stage of restriction are of different levels of severity.

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

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

For urban water authorities, water for basic household needs is always met, with restrictions largely targeting outdoor water use. Each water authority has developed restriction policies which are applied in accordance with the Drought Response Plans developed for each supply system. Almost all authorities now have a four-stage restriction policy, with only one authority having more than four restriction stages. All restrictions policies are in the process of being standardised to a uniform four-stage restriction policy in accordance with the Guidelines for Uniform Water Restrictions which have been developed for the State. There is still scope for authorities to tailor the various stages of restrictions to suit local conditions if required, but the new system will provide much greater uniformity across the State.

The new restriction policy is more detailed than existing policies, building on the recent experience of almost all water authorities with the implementation of their Drought Response Plans. However, the fundamental basis for restriction policies will not change as a result of this process. That is, progressively higher savings will be achieved at each stage of restriction by progressively limiting the hours and means available for watering and by banning specific external water uses at the higher stages of restriction. Because all authorities are now also implementing Permanent Water Saving Plans to ensure the efficient use of resources at all times, the new restriction stages are necessarily a little more severe than was the case in the past, with alternate day watering being introduced from Stage 1 and times for watering being relatively more constrained. The watering of grass is still banned from Stage 2 onwards and all outdoor water use is effectively curtailed at Stage 4.

5.4.5 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. Storages that are less than 1,000 ML are important locally, but are generally insignificant relative to total storage at a river basin and statewide level.
- The unknown term in each water balance is generally the basin inflows. Inflows have been back-calculated as the sum of basin outflows plus diversions.
- The method of calculating in-stream "losses" i.e. infiltration from streams to groundwater, flows to floodplains, and evaporation, has improved from that used in 2003/04 and is now based on the loss functions used in resource allocation models. This change significantly impacts on the water balance for a number of catchments.
- Unless otherwise reported by water authorities, stock and domestic water users were assumed to divert their full entitlement volume.
- The water accounts exclude diversions from rivers under private rights. The volume associated with these rights is small.

5.4.6 Small Catchment Dams

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

The term small catchment dams includes 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. When registration is completed, registered dams will be included as part of the unregulated licences category in future water accounts.

Small catchment dam information is presented in terms of average annual data. While the number of dams, their sizes and what they are used for is generally known, the volume of water that they actually use over the year was not readily available. Therefore it is assumed to be similar to the estimated average annual usage.

5.4.7 Groundwater Metering

The level of metering of groundwater resources varies throughout the State. Generally metering within WSPAs is approaching 100% of the total number of licensed bores. Metering of licensed bores within GMAs is the next priority and work is proceeding to install meters on bores.

In non-metered areas, an estimate of use is provided for this report. This estimate is based on average metered use across the State, where the ratio of metered volume to allocated volume is determined. The average metered use, as a percentage of allocated volume, equalled 36% in

2004/05. Non-metered groundwater use is therefore estimated as 36% of the allocated volume.

The groundwater usage data assembled in this report has varying degrees of quality. The most reliable groundwater data is on licensed groundwater usage from rural water authority customer systems. The least reliable information tends to be on stock and domestic bores.

5.4.8 Overview of Compliance with Entitlements

The State Government has a well-established system of water licensing and allocation against which compliance is assessed. The State Water Accounts provide an overview of compliance by presenting:

- The volume of surface water diverted from rivers relative to the volume in each bulk entitlement conversion order. Private licensed diversions on regulated streams are reported as part of bulk entitlements. Private licensed diversions on unregulated streams are reported as a separate line item in each basin.
- The volume of groundwater extracted relative to licensed volume for a groundwater management area or water supply protection area. This is undertaken at the scale of each aquifer and not at the individual licence holder level, which is assessed separately by water authorities.

Where a bulk entitlement was not finalised prior to 1 July 2004, compliance against that entitlement has not been assessed in the water accounts. Compliance against those entitlements will be presented in subsequent water accounts.

The water accounts do not present Victoria's compliance with the Murray-Darling Basin cap on diversions, which is assessed separately by the Murray-Darling Basin Commission's Independent Audit Group. At the time of preparing the water accounts, the Independent Audit Group had not finalised its assessment of Victoria's cap compliance.

More detailed information on compliance can be found in the resource manager's reports for each individual river basin, as well as water supply protection area reports for the 2004/05 year. This will include compliance with passing flow obligations specified within bulk entitlements. Any non-compliance with passing flows reported by water authorities has, however, been included in the water accounts where data is available.

5.4.9 Comparison of the Water Accounts with other Data Sources

The State Water Accounts 2004/05 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 cap compliance and resource manager reports. Both of these documents were not finalised at the time of preparation of the water accounts and the values presented in the water accounts may be subject to revision within those documents. The method of reporting may also be different with farm dams, for example, being reported in the water accounts but not included in diversion figures for cap reporting.

Information for individual water authorities is presented in each authority's annual report. It is important to note when comparing the water accounts with these annual reports that the water authority only reports on its area of jurisdiction. For example, Goulburn-Murray Water and Lower Murray Water only report on water trading that they have each processed, and it is only by presenting the sum of trade processed by these two authorities that an accurate picture of volumes traded can be obtained for the Murray basin.

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

6 Murray Basin (Victoria)

6.1 Location of Water Resources

The Murray basin is located within the Murray-Darling Drainage Division. For the purposes of Victoria's water accounts, the Murray basin includes:

- Victoria's share of storage in the four major regulating storages of Dartmouth Reservoir, Lake Hume, Lake Victoria and the Menindee Lakes. Although Lake Victoria and the Menindee Lakes are physically located in New South Wales, Victoria has a share of these storages under the Murray-Darling Basin Agreement.
- Victoria's share of inflows to the above four storages, its share of outflows from the Kiewa River catchment, plus outflows from other Victorian tributaries into the River Murray. Water accounts for Victorian tributaries downstream of Lake Hume are presented in their respective chapters of the water accounts.
- Water diversions in Victoria for the length of the River Murray, and water diversions from tributaries of the River Murray located upstream of Lake Hume, such as the Mitta Mitta River and Corryong Creek.

The River Murray forms the border with New South Wales and any water resources in New South Wales that are not allocated to Victoria are not included in these water accounts.

A map of the river basin is shown in Figure 6-1. The basin boundary shown upstream of Lake Hume corresponds to the Australian Water Resource Council's "Upper Murray" river basin. For the purposes of this report, the areas in Victoria supplied from the River Murray downstream of Lake Hume, such as the Murray Valley Irrigation Area, Torrumbarry Irrigation Area, and the Millewa Waterworks District, are also included.

There are no groundwater management areas (GMAs) or water supply protection areas (WSPAs) in the River Murray catchment upstream of Lake Hume. Downstream of Lake Hume, in the Murray Valley region near the outlet of the Broken and Goulburn Rivers, there are several GMAs and WSPAs adjacent to the River Murray. These include part of the Campaspe Deep Lead WSPA, Katunga WSPA, Shepparton WSPA and part of the Kialla GMA. The Border Zone for groundwater management covers groundwater management adjacent to the South Australian border, which includes the area adjacent to the River Murray. For the purposes of the water accounts, groundwater is not reported for the Murray basin, with groundwater allocation and use being reported in each relevant water account for upstream river basins.

6.2 Responsibilities for Management of Water Resources

The Murray-Darling Basin Commission is responsible for managing the water resources of the Murray system on behalf of the Victoria, New South Wales and South Australia. Goulburn-Murray Water is responsible for managing the Murray Valley, Torrumbarry, Tresco and Nyah irrigation areas, and is the licensing authority for groundwater and surface water on the Victorian side of the River Murray basin as far downstream as Nyah. Lower Murray Water (formerly Sunraysia Rural Water Authority) is responsible for managing Red Cliffs, Robinvale and Merbein Irrigation Districts, and is the licensing authority for the Sunraysia region. The First Mildura Irrigation Trust (FMIT) supplies irrigators in its district near Mildura.

Various urban water authorities manage towns supplied from the River Murray. North-East Water manages water supply to towns upstream of Lake Mulwala, including Yarrawonga. Goulburn Valley Water manages water supply to towns in the Murray Valley Irrigation Area, whilst Coliban Water supplies towns in the Torrumbarry Irrigation Area. Lower Murray Water supplies towns from Swan Hill to the South Australian border. East Gippsland Water is the provider of urban water services to the towns of Omeo and Dinner Plain.

The operation of Lake Dartmouth, Lake Hume, the Menindee Lakes and Lake Victoria is managed by River Murray Water, an internal business division of the Murray-Darling Basin Commission. Various authorities operate the water supply storages in the Murray basin on behalf of River Murray Water. Goulburn-Murray Water operates Lake Dartmouth, State Water in New South Wales operates Lake Hume and the Menindee Lakes, and the South Australian Water Corporation operates Lake Victoria. Goulburn-Murray Water also operates Yarrawonga Weir (Lake Mulwala), Torrumbarry Weir and Mildura Weir on behalf of River Murray Water.

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. Victoria shares the volume in the storages with New South Wales under the Murray-Darling Basin Agreement, which grants Victoria 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.

Snowy Hydro manages reservoirs in the upper section of the basin as part of its hydropower operations, although these storages, such as Khancoban Pondage, are located in New South Wales and are not included in the water accounts for Victoria.

Waterway management functions are divided between the North East Catchment Management Authority, the Goulburn Broken Catchment Management Authority, the North Central Catchment Management Authority and the Mallee Catchment Management Authority, with the Department of Sustainability and Environment and the Murray-Darling Basin Commission co-ordinating and integrating waterway management along the length of the River Murray.

6.3 Seasonal Overview

Rainfall conditions in the Murray basin in 2004/05 were 80-100% of the long-term average annual rainfall. The resulting streamflows were generally below the long-term average. For example, streamflows in 2004/05 in the Mitta Mitta River at Hinnomunjie (streamflow gauge number 401203) upstream of Dartmouth Dam, were 73% of the long-term average. Inflows to Dartmouth Dam were 13% higher than those estimated in 2003/04.

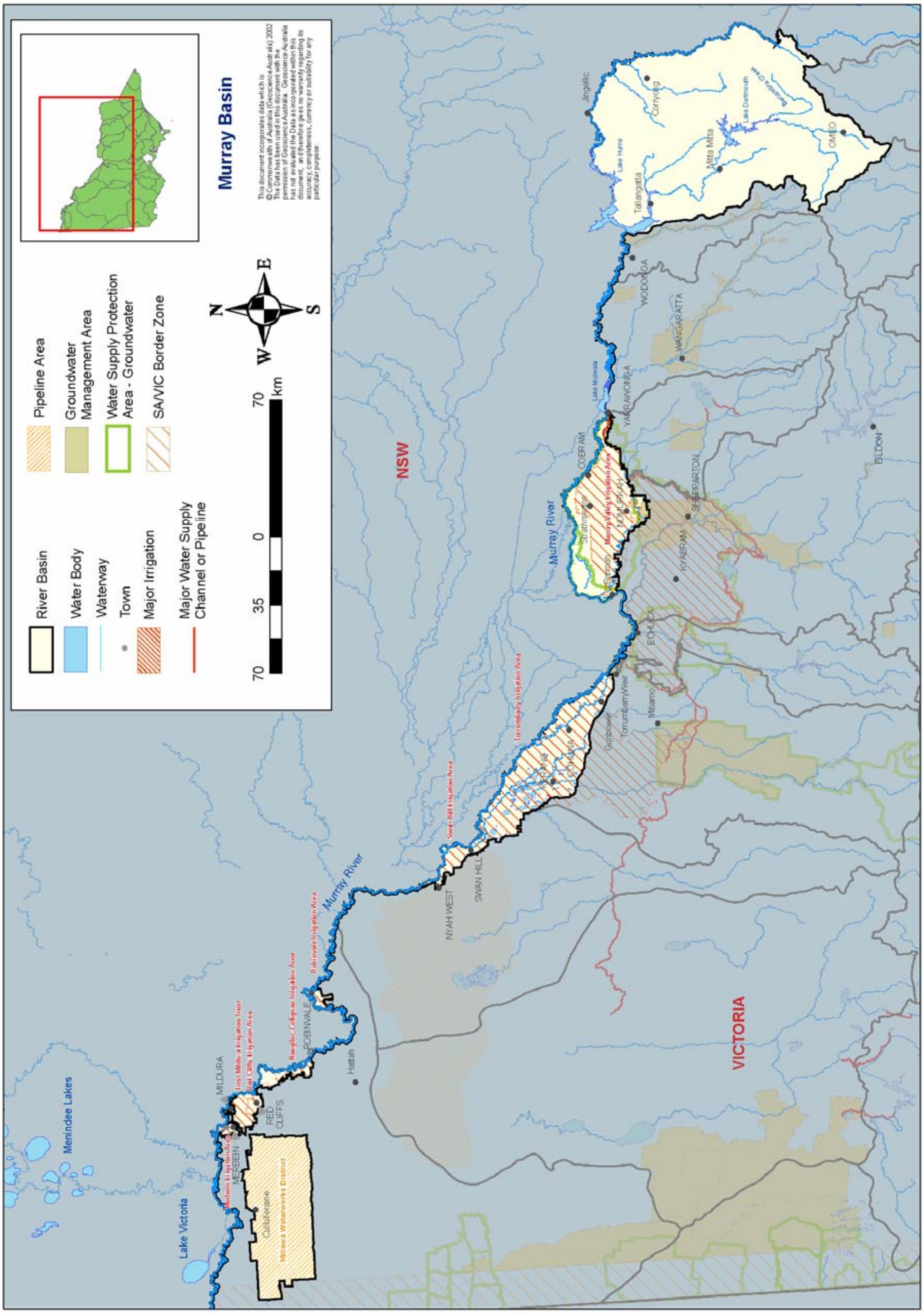
A seasonal allocation to irrigators of 100% of the entitlement volume was announced in September 2004 and the allocation remained at that level throughout the year. No urban restrictions were reported in the Murray basin in Victoria.

Restrictions were applied to some unregulated streams. In the Mitta Mitta catchment, irrigation diversions from Sandy Creek, Lockharts Creek and Waterfall Creek were subject to a ban in January 2005. This ban was lifted in the subsequent month for Sandy Creek and Lockharts Creek, whilst the irrigation diversion ban from Waterfall Creek remained in place until the end of the 2004/05 season.

Flow conditions in surplus of the regulated river requirements were declared along parts of the River Murray during the periods 13 September 2004 to 4 October 2004, and 16 to 22 November 2004. These conditions are declared when unregulated inflows (e.g. from the Kiewa or Ovens Rivers) provide sufficient flow with the forecast potential to fill Lake Victoria and cause it to spill, or to exceed the capacity of the inlet to Lake Victoria. During such periods, the surplus water is able to be used for environmental purposes in Victoria.

In 2004/05, surplus flows allowed additional diversions to enhance environmental values at McDonald Swamp and Lake Murphy located near Kerang, emergency Red Gum watering at Mulcra and Wallpolla Islands and Burra Creek in the Lower Murray, and Red Gum watering at Gunbower Forest.

Figure 6-1 Map of the Murray basin



A lack of flooding over an extended period in recent years has put the health of many River Red Gum forests and potentially Black Box woodlands in the Victorian Mallee at severe risk from water stress. Recent studies and monitoring reports have shown that these forests and woodlands may be experiencing significant population losses.

Water quality in the River Murray is a function of water quality throughout the Murray-Darling Basin, including the quality of inflows from New South Wales. During 2004/05, there were blue-green algal blooms recorded at Blampied's Lagoon, Lake Moodemere and Torgannah Lagoon. These are part of the waterway managed by the Murray Darling Basin Commission. The Gunbower Creek system of the Torrumbarry Irrigation Area was also subject to blue-green algal blooms. The areas affected by the 2003 bushfires continue to affect water quality by contributing high sediment loads to major rivers and streams in the North East, particularly during February and April 2005. This is exacerbated by the high sediment loads already in the rivers and streams from previous erosion events.

The management of water levels following high flow events along the River Murray downstream of Yarrawonga Weir is suspected of causing bank slumping and associated tree fall, particularly through the Barmah-Millewa wetlands. The Murray Darling Basin Commission is establishing a monitoring program to ascertain the cause and develop strategies to mitigate the high rate of slumping.

An assessment of the environmental health of rivers and streams in the Murray basin is available in the Index of Stream Condition: the Second Benchmark of Victorian River Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net).

Details of programs designed to improve river health through activities such as willow removal, bed stabilisation and revegetation are available from the relevant catchment management authorities.

6.4 Summary of the Total Victorian 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 6-1. The total surface water resource includes Victoria’s share of inflows to Lake Dartmouth, Lake Hume, Lake Victoria and the Menindee Lakes, Victoria's share of inflows from the Kiewa River, as well as outflows from other Victorian rivers (Ovens, Broken, Goulburn, Campaspe, Loddon) into the Murray River.

Victoria’s share of the flow in the River Murray to South Australia was 955,000 ML (955 GL) in 2004/05. A total of 1,880 GL flowed into South Australia, comprising South Australia’s entitlement flow under the Murray-Darling Basin Agreement of 1,850 GL, 15 GL surplus flow and 15 GL traded water. The flow received in 2004–05 was significantly lower than the median total annual flow of 4,800 GL, and also less than the total of 2,023 GL received in 2003–04 (Murray-Darling Basin Commission, 2005).

Table 6-1 Summary of Victoria’s share of water resources and water use in the Murray basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	4,736,300	1,528,800
Groundwater (1)	Not applicable	Not applicable
Recycled Water	12,120	5,650

Note:

(1) Groundwater allocation and use in groundwater management units that overlap the Murray basin are reported in upstream river basins.

6.5 Water for the Environment

The Minister for Environment holds an allocation of 27,600 ML a year to provide water for flora and fauna in the Murray basin. This allocation includes water for Gunbower Forest, Hird Swamp, Johnson Swamp, Lake Elizabeth, Lake Murphy, McDonald's Swamp, Cullens Lake, Round Lake, Golf Course Lake and the Cardross Basins. The use of the entitlement varies from year to year in conjunction with natural fluctuations in environmental water requirements.

During 2004/05 the emergency Red Gum watering project was continued using environmental water from the Minister's allocation (the River Murray Flora and Fauna Reserve Bulk Entitlement) and surplus flows to target trees exhibiting signs of major water stress. This is occurring at a number of anabranches and wetland sites along the Murray River including Burra Creek, Lindsay River, Chalka Creek and Potterwalkagee Creek. The project has been managed by the Department of Sustainability and Environment in partnership with Parks Victoria and the Mallee Catchment Management Authority.

Environmental water was also delivered to a number of sites for the protection of significant waterfowl habitat, aquatic vegetation communities, and native fish species – in particular, the Murray Hardyhead, a native fish species protected under the federal Environment Protection and Biodiversity Conservation Act 1999.

In 2004/05, a total of 27,590 ML of the River Murray Flora and Fauna Reserve Bulk Entitlement was used to supply water to these areas of environmental significance. The volume delivered included:

- 11,277 ML for the enhancement of River Red Gum health at Gunbower Forest, plus an additional 4,865 ML of surplus flows.
- 7,847 ML for emergency Red Gum watering in the Lower Murray region, plus an additional 207 ML of surplus flows. Sites watered were Wallpolla Island State Forest, Hattah National Park, Mulcra Island State Forest, Burra Creek, and Lindsay Island.
- 1,702 ML for the protection of native fish habitat (Murray Hardyhead) at Cardross Lakes, near Mildura.
- 591 ML, plus an additional 147 ML of surplus flows, for the protection of significant waterfowl habitat and aquatic vegetation communities at McDonald Swamp in the Kerang Lakes region.
- 3,008 ML for the protection of significant waterfowl habitat and aquatic vegetation communities at Hird Swamp in the Kerang Lakes region.
- 200 ML for the protection of significant waterfowl and fish (Murray Hardyhead) habitat at Round Lake in the Kerang Lakes region.
- 998 ML, plus an additional 570 ML of surplus flows, for the protection of significant waterfowl habitat at Lake Murphy in the Kerang Lakes region.
- 307 ML for the protection of significant fish habitat (Murray Hardyhead) at Lake Elizabeth in the Kerang Lakes region.
- 1,200 ML was pumped directly from the River Murray to Richardson's Lagoon, located north-west of Echuca, for the enhancement of significant waterfowl habitat and aquatic vegetation communities.
- An additional 460 ML of water from the River Murray Flora and Fauna Reserve Bulk Entitlement was delivered for the protection of native fish, waterfowl habitat and aquatic vegetation communities in Brays Swamp (Goulburn basin) and the Lower Campaspe River. This was managed via water trade from the Murray to the Goulburn systems.

During 2004/05, irrigators and water authorities also donated unused water entitlement to the environment. A total of seven sites benefited from approximately 1,300 ML of donated water, which was used for emergency Red Gum watering. The sites were Forest Bend/Nangiloc, Johnsons Bend, Chalka Creek South, Burra Creek, Pile Bend, Finnigans Creek and Nyah State Forest.

Each year, subject to the seasonal allocation, Victoria contributes 50,000 ML of its entitlement to the River Murray water resource to the Barmah-Millewa Forest Environmental Water Allocation for the purposes of periodically enhancing natural flood events in the forest. If the seasonal sales water allocation to Victorian Murray irrigators reaches 30% of their entitlement, the State contributes an additional 25,000 ML of sales entitlement to the Barmah-Millewa Forest Environmental Water Allocation account. New South Wales also contributes to the account. After Victoria's 2004/05 contribution, the State had accumulated a total of 175,000 ML in the account, all of which was carried over for use in 2005/06.

The River Murray basin is subject to the Murray-Darling Basin Cap, which is a limit imposed on the volume of water that can be diverted from the rivers for consumptive uses. While the cap constrains further increase in water diversions, it does not constrain new developments provided the water for them is obtained by using water more efficiently, or by purchasing water from existing developments. This cap ensures that river diversions do not keep increasing to exacerbate river health problems.

6.6 Surface Water Resources

6.6.1 Water Balance

A surface water balance for the Murray basin in Victoria is shown in Table 6-2.

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

6.6.2 Small Catchment Dams

The capacity of small catchment dams in the Murray basin is estimated to be around 10,600 ML (Table 6-3). All of these are located upstream of Lake Hume. Usage in 2004/05 is estimated to be approximately equal to the average annual usage of 6,500 ML and, after allowing for losses, the total catchment run-off that is harvested as a result of the small catchment dams is estimated to be 7,600 ML.

Table 6-2 Balance of Victorian surface water in the Murray basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
Volume in storage at start of year [1]	1,776,300	1,505,000
Volume in storage at end of year	2,208,300	1,921,100
Change in storage	**432,000**	**416,040**
Inflows		
Catchment inflow [2]	4,578,700	4,057,200
Spills from NSW share of storage	0	0
Return flow from irrigation	151,100	146,600
Treated effluent discharged back to river	6,470	6,820
Sub-total	**4,736,300**	**4,210,600**
Usage		
Urban diversions	41,630	41,560
Irrigation district diversions	1,201,200	1,112,800
Licensed private diversions from unregulated streams [3]	5,000	10,800
Licensed private diversions from regulated streams	246,100	253,500
Environmental water diversions [4]	28,408	14,900
Small catchment dams	6,500	6,500
Sub-total	**1,528,800**	**1,440,000**
Losses		
Net evaporation losses from major storages	255,300	172,500
Evaporation from small catchment dams	1,100	1,200
In-stream infiltration to groundwater, flows to floodplain and evaporation [5]	1,074,900	410,800
Sub-total	**1,331,300**	**584,500**
Water Passed at Outlet of Basin		
River Murray flow to South Australia from Victoria's allocation	955,000	1,175,000
Spills to NSW share of storages	381,900	487,800
Ceding to NSW storages per Murray-Darling Basin Agreement	107,300	107,300
Environment's Share of Total Flow in the Murray Basin	**955,000**	**1,175,000**

Notes:

(1) Start storage of current year and end storage of previous year do not match because Lake Mulwala and Torrumbarry Weir are no longer included in the storage calculation in 2004/05.

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

(3) Estimated diversions significantly declined in 2004/05 compared to 2003/04 due to the use of an improved estimation method by Goulburn-Murray Water.

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

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

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

Table 6-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	7,200	3,600	n/a
Irrigation	3,400	2,900	n/a
Total	10,600	6,500	7,600

Note:

(1) 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. Permanent interstate transfers in 2004/05 under the Pilot Interstate Water Trading Project are only permitted downstream of Nyah (near Swan Hill). Temporary interstate transfers can occur upstream of Nyah.

A summary of interstate transfer of entitlement with New South Wales and South Australia is shown in Table 6-4, whilst a summary of the transfer of entitlements within the Murray basin is shown in Table 6-5. Approximately 5,450 ML of water entitlement was permanently transferred from Victoria to interstate, whilst around 8,150 ML of water entitlement was temporarily transferred to other States. The values in Table 6-5 show a net permanent transfer of water entitlement of 12,927 ML to the Murray basin, with the net temporary transfer of 10,291 ML also to the Murray basin.

Overall in 2004/05 there was a net migration of water entitlement, both temporary and permanent, from Victoria's upstream Murray tributaries to Victoria's Murray basin, and from Victoria's Murray basin to interstate. This included a net permanent transfer of 20,800 ML to Lower Murray Water's rural customers. Much of the water entitlement transferred from upstream is sourced from the Goulburn River basin, discussed in Chapter 10 of the water accounts.

Table 6-4 Interstate transfer of entitlements in the Murray basin

Entitlement	Net Transfer to NSW (ML)	Net Transfer to SA (ML)	Net Transfer to Interstate (ML)
Permanent transfer of water right and sales	670	4,780	5,450
Temporary transfer of water right and sales	-2,610	10,760	8,150
Total transfers	**-1,940**	**15,540**	**13,600**

6.6.4 Volume Diverted

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

Licences on unregulated streams are not currently metered and water usage is an estimate provided by Goulburn-Murray Water. Compliance with individual bulk entitlement volumes is deemed to occur in Table 6-6 if water use is not more than the maximum volume allowed to be diverted in 2004/05.

6.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

The bulk entitlements in the Murray basin have various passing flow requirements. None of the water authorities drawing water from the Murray basin reported any non-compliance with environmental passing flows.

Table 6-5 Transfer of Victorian entitlements in the Murray basin

Entitlement	Permanent Entitlement Transfer (ML)			Temporary Entitlement Transfer (ML)		
	Bought	Sold	Net Transfer To Entitlement	Bought	Sold	Net Transfer To Entitlement
Goulburn Valley Water						
River Murray	0	0	0	174	0	174
North East Water						
River Murray	470	0	470	0	200	-200
Grampians Wimmera Mallee Water						
River Murray	0	0	0	0	350	-350
FMIT						
FMIT - Water Right	7	1,191	-1,184	460	5,893	-5,433
FMIT - Sales				0	0	0
Goulburn-Murray Water						
Murray Valley - Water Right	315	880	-565	51,788	31,937	19,851
Murray Valley - Sales				2,341	1,003	1,338
Kerang-Cohuna - Water Right	619	6,219	-5,601	74,692	22,798	51,894
Kerang-Cohuna - Sales				2,408	208	2,200
Swan Hill - Water Right	248	812	-564	9,422	10,715	-1,293
Swan Hill - Sales				69	0	69
Woorinen - Water Right	46	20	26	513	2,172	-1,658
Woorinen - Sales				0	0	0
Nyah - Water Right	31	157	-126	501	2,524	-2,023
Nyah - Sales				0	0	0
Tresco - Water Right	20	63	-43	332	1,306	-973
Tresco - Sales				50	0	50
Mitta Mitta - Water Right	0	385	-385	250	3,182	-2,932
Mitta Mitta - Sales				0	0	0
River Murray - Water Right	382	2,598	-2,216	5,748	18,276	-12,528
River Murray - Sales				0	0	0
Lower Murray Water						
River Murray - Lower Murray Water	2,266	0	2,266	250	8,788	-8,538
River Murray - Sunraysia Water	33,753	12,905	20,848	39,824	68,586	-28,762
Minister for Environment						
River Murray - Flora and Fauna	0	0	0	0	596	-596
Total	**38,156**	**25,229**	**12,927**	**188,823**	**178,532**	**10,291**

Table 6-6 Volume of water diverted under surface water entitlements in the Victorian Murray basin

Entitlement	Period of Bulk Entitlement (years)	Total Bulk Entitlement –30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?
East Gippsland Water						
Omeo	1	n/a	0	n/a	68	n/a
Coliban Water						
River Murray	1	6,285	0	6,285	5,202	Yes
Goulburn Valley Water						
River Murray	1	4,869	174	5,043	4,582	Yes
North East Water						
River Murray	1	12,532	-200	12,332	10,394	Yes
Grampians Wimmera Mallee Water						
River Murray	1	3,592	-350	3,242	3,182	Yes
FMIT						
River Murray	1	82,097	-5,433	76,664	49,521	Yes
Goulburn-Murray Water						
River Murray	1	1,204,433	53,996	1,258,429	1,112,216	Yes
Lower Murray Water						
River Murray - Lower Murray Water	1	30,235	-8,538	21,697	21,381	Yes
River Murray - Sunraysia Water	1	354,971	-28,762	326,209	283,738	Yes
Minister for Environment						
River Murray - Flora and Fauna	1	27,600	-596[1]	27,004	27,130[1]	Yes[1]
River Murray – Snowy Environmental Reserve	1	n/a	0	n/a	0	n/a
Total Annual Volume of Bulk Entitlements		**1,726,614**	**10,291**	**1,736,905**	**1,517,345**	
Licensed Diversions from Unregulated Streams		12,542	0	12,542	5,000	

Notes:

(1) There is a discrepancy between the amount traded to the Goulburn system (596 ML) and the amount used (460 ML), which was unable to be confirmed by Goulburn-Murray Water. Assuming the amount used in the Goulburn system of 460 ML is correct (refer to Table 10-5), then the amount used on the Murray (27,130 ML) is within the maximum allowable diversion.

(2) n/a: bulk entitlement conversion order was not finalised at the beginning of 2004/05.

6.6.6 Compliance with Streamflow Management Plans

There are currently no streamflow management plans in place or being developed for streams in the Murray basin.

6.7 Groundwater Resources

As stated previously, the allocation and use of groundwater in the Murray basin is reported in upstream tributaries. In an unincorporated area in the upper part of the basin on the Great Dividing Range, East Gippsland Water holds a licence for 60 ML a year and uses groundwater to supply the town of Dinner Plain. In 2004/05 extractions of 61 ML were recorded, a volume much greater than the recorded consumption of 36 ML. The unaccounted water at Dinner

Plain is currently being reviewed by East Gippsland Water, but is expected to be due to poor meter performance during sub-zero temperatures.

Table 6-7 Compliance with licensed groundwater volumes, Murray basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Kialla (1+2) GMA (8%)	>25	4,770	2,332	0	816	816	Not Available (6)
Katunga WSPA (81%)	>25	59,770	44,080	26,200	20	26,220	Not Available (6)
Shepparton WSPA (32%)	0-25	203,619	203,619	64,820	15,000	79,820	Not Available (6)

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

A summary of the licensed entitlements and use for groundwater management units that overlap the Murray basin, excluding stock and domestic use, is presented in Table 6-7. An estimate of stock and domestic groundwater use is provided in Table 6-8. In addition to Dinner Plain, in the Murray basin groundwater is used as an urban water supply for the townships of Katunga, Strathmerton, and Barnawartha. The licensed entitlements and metered use for these groundwater supplies is provided in Table 6-9.

The Murray basin contains part of the Katunga WSPA, Shepparton WSPA and Kialla GMA. The volumes described in Table 6-7 and Table 6-8 are totals for the management units and include the area that falls outside the Murray basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 6-8 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Kialla (1+2) GMA	23	46
Katunga WSPA	593	1,186
Shepparton WSPA	415	830

Note:

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

Table 6-9 Urban groundwater usage

Town Supplied	Licensed Allocation ML	Metered Use
Katunga	60	47
Strathmerton	213	130
Barnawartha	293	83
Dinner Plain [1]	60	61

Note:

(1) Refer to text in Section 6.7 above.

6.8 Recycled Water

Around 47% of the volume of effluent passed through treatment plants in the basin was recycled for consumptive use (Table 6-10), mostly for agricultural purposes.

Table 6-10 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Bellbridge	24	24	0	24	0	0	0	0
Bundalong	20	0	0	0	0	0	0	20
Cobram	495	495	0	495	0	0	0	0
Cohuna	223	0	0	0	0	0	0	223
Corryong	108	108	0	108	0	0	0	0
Dartmouth	22	0	0	0	0	0	22	0
Echuca	1,596	595	0	595	0	0	0	1,001
Koondrook	43	0	0	0	0	0	0	43
Koorlong	1,168	1,168	0	1,168	0	0	0	0
Merbein	11	11	0	11	0	0	0	0
Mildura	1,770	1,770	0	1,770	0	0	0	0
Nathalia	127	127	0	127	0	0	0	0
Numurkah	241	241	0	241	0	0	0	0
Nyah	42	0	0	0	0	0	0	42
Omeo	28	28	0	28	0	0	0	0
Red Cliffs	148	148	118	30	0	0	0	0
Robinvale	191	191	0	191	0	0	0	0
Swan Hill	1,250	0	0	0	0	0	0	1,250
Tallangatta	98	98	0	98	0	0	0	0
Wodonga	4,204	335	335	0	0	0	3,869	0
Yarrawonga	310	310	0	310	0	0	0	0
Total	**12,119**	**5,649**	**453**	**5,196**	**0**	**0**	**3,891**	**2,579**

Notes:

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

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

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

7 Kiewa Basin

7.1 Location of Water Resources

The Kiewa basin is located within the Murray-Darling Drainage Division. It includes the Kiewa River plus a number of small tributaries such as Running Creek and Yackandandah Creek. The Kiewa basin discharges to the River Murray at Wodonga. A map of the river basin is shown in Figure 7-1. Groundwater management areas (GMAs) within the Kiewa basin include part of the Mullindolingong GMA.

7.2 Responsibilities for Management of Water Resources

Goulburn-Murray Water is the licensing authority responsible for managing groundwater pumping and private diversions from the Kiewa basin. North-East Water is responsible for urban water supply in the Kiewa basin. Southern Hydro manages several reservoirs in the upper parts of the basin as part of its hydropower operations. The North-East Catchment Management Authority is responsible for waterway management in the Kiewa basin.

7.3 Seasonal Overview

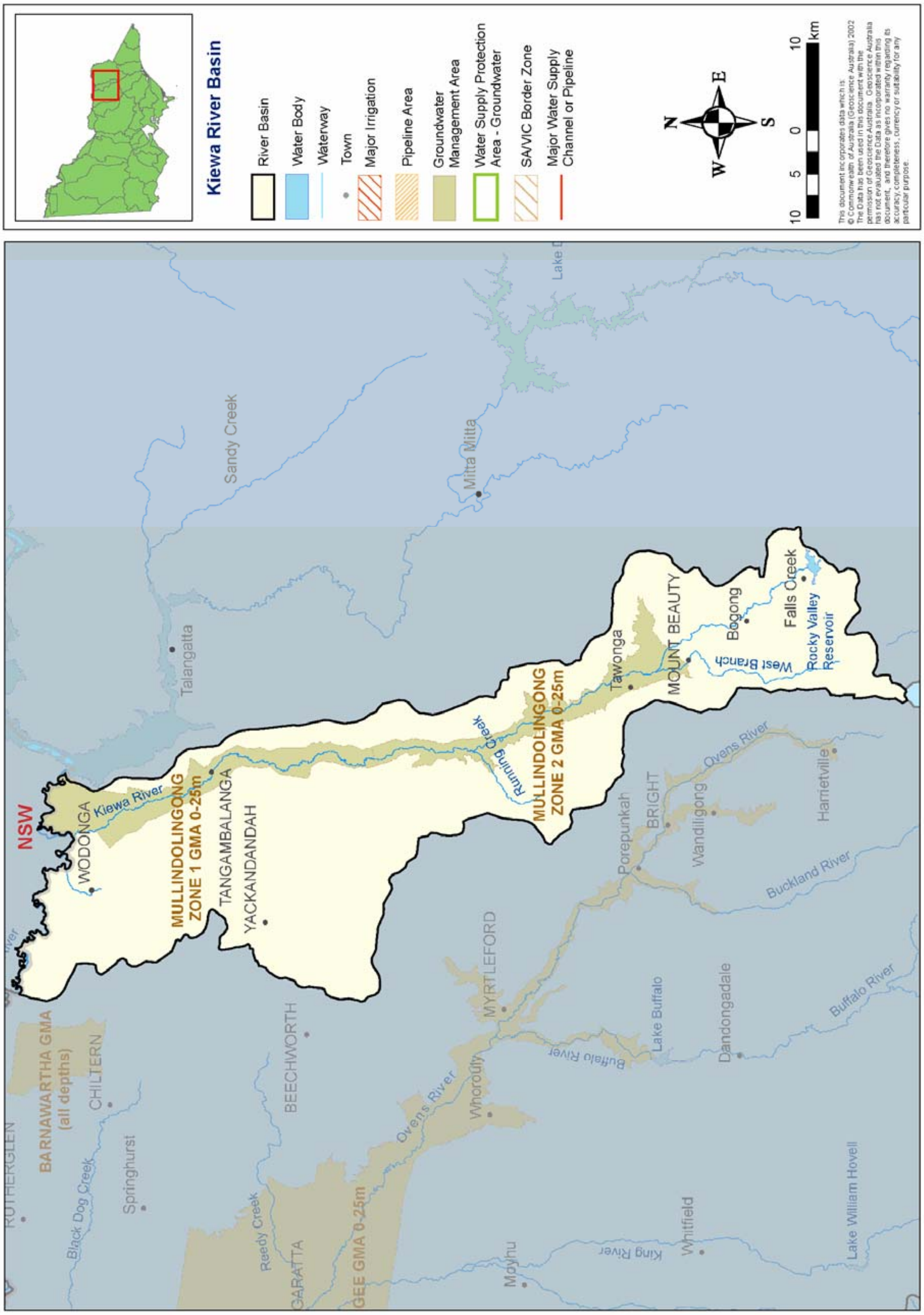
Rainfall conditions in the Kiewa basin in 2004/05 were close to average at 80-100% of long-term average rainfall. The resulting streamflow from the basin was below average, for example Bandiana (streamflow gauge number 402205) recorded approximately 66% of the long-term average streamflow. Annual streamflow totals in 2004/05 were almost identical to those in 2003/04.

Irrigation bans were imposed on Middle Creek in January 2005, and from January 2005 until May 2005 in the following creeks: Bay, Cherry Tree, Glen, Hellhole, Sheepwash and Basin Creek. No urban restrictions occurred during the season.

During 2004/05, no blue-green algal blooms were reported by Goulburn-Murray Water. The areas affected by the 2003 bushfires continue to have an influence on water quality by contributing high sediment loads to the North East's major rivers and streams. These effects were particularly noticeable during February and April 2005. The effect on water quality is exacerbated by the high sediment loads already in the rivers and streams from previous erosion events.

An assessment of the environmental health of rivers and streams in the Kiewa basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net). Details of works undertaken to improve the basin's long-term water quality and river health during 2004/05 are available from the relevant catchment management authority.

Figure 7-1 Map of the Kiewa basin



7.4 Summary of the 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 7-1. Only a small proportion of the surface and groundwater resources in the Kiewa basin was extracted for consumptive use within the basin.

Table 7-1 Summary of total water resource and water use in the Kiewa basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water [1]	324,400	9,600
Groundwater [2]	7,000	500
Recycled Water	230	50

Notes:

(1) Value shown is Victoria's share (50%) of total inflows under the Murray Darling Basin Agreement.

(2) Approximately 80% of the Kiewa basin is an unincorporated area that contains a significant groundwater resource not represented in these totals.

7.5 Water for the Environment

There was no formal environmental water reserve established in the Kiewa basin in 2004/05. However, the Murray-Darling Basin cap, which is a limit imposed on the volume of water that can be diverted from the rivers for consumptive uses, applies in the Kiewa basin. The cap on the Kiewa basin is accounted under the Murray/Kiewa/Ovens river valley system. While the cap restrains increased water diversions, it does not constrain new developments provided the water for them is obtained by water efficiency savings or by purchasing water from existing developments.

Water for the environment in the Kiewa basin was also provided under passing flow obligations in consumptive bulk entitlements for water authorities. The environment's share of total flow at the basin outlet was 635,300 ML (includes Victoria's and NSW's shares), which is approximately 98% of total inflows (Table 7-2). The 635,300 ML includes environmental flows required under bulk entitlements, and all other water flowing from the basin which was not taken out of waterways for consumptive uses.

Although water quantity was largely unaffected in 2004/05 in the Kiewa basin, the timing of diversions within the basin can affect the flow regime at a smaller catchment scale. In the upper Kiewa, private diversions during the irrigation season can also have a significant impact on the flow regime, resulting in negative effects on aquatic habitats and populations. A streamflow management plan is being developed to devise water sharing rules that minimise the impacts of such diversions and ensure the water resources of the area are managed equitably and sustainably.

When the environment's share of total flow in the Kiewa River passes out of the basin into the River Murray, it becomes a resource available to the Murray basin, along with other River Murray inflows. Once it has reached the River Murray, water from the Kiewa River is considered a shared resource under the Murray-Darling Basin Agreement and may be used to meet the River Murray's environmental flow requirements and/or be diverted for consumptive use.

7.6 Surface Water Resources

7.6.1 Water Balance

A surface water balance for the Kiewa basin is shown in Table 7-2. It can be seen from the water balance that diversions in the Kiewa Basin are small relative to the total available resource.

Note that only those storages greater than 1,000 ML capacity have been included in the water balance. In the Kiewa basin this includes Rocky Valley Reservoir and Lake Guy. Although hydropower utilises a significant volume of surface water in the Kiewa basin, this use is non-consumptive. Non-consumptive uses are not incorporated in the surface water balance.

Urban water consumption declined in 2004/05 compared to the previous year partly due to the connection of the townships of Kiewa and Tangambalanga to the Wodonga system (supplied via the River Murray).

Table 7-2 Balance of surface water in the Kiewa basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
Volume in storage at start of year	9,100	26,100
Volume in storage at end of year	7,700	9,100
Change in storage	-1,400	-17,000
Inflows		
Catchment inflow - Victoria's share (1)	324,300	647,500
Catchment inflow - NSW share (1)	324,300	
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	180	170
Sub-total	**648,800**	**647,700**
Usage		
Urban diversions	580	770
Licensed private diversions from unregulated streams (2)	5,100	8,200
Small catchment dams	3,900	3,900
Sub-total	**9,600**	**12,900**
Losses		
Net evaporation losses from major storages	0	30
Losses from small catchment dams	1,100	1,100
In-stream infiltration to groundwater and evaporation (3)	4,208	0
Sub-total	**5,308**	**1,100**
Water Passed at Outlet of Basin		
Kiewa Basin outflow to River Murray	635,300	650,600
Environment's Share of Total Flow in the Kiewa Basin	**635,300**	**650,600**

Notes:

(1) Inflows have been back-calculated from outflows plus diversions. Inflows are equally shared between Victoria and NSW.

(2) Estimated diversions significantly declined in 2004/05 compared to 2003/04 due to the use of an improved estimation method by Goulburn-Murray Water.

(3) Losses estimated using loss functions from the Kiewa River REALM. The volume of estimated losses increased from the previous year due to an improvement of the calculation method.

The method of calculating in-stream losses was updated in 2004/05 to be sourced from the loss functions in the Kiewa River REALM model. This is an improvement on the previous year's water accounts, in which losses were assumed to be zero because data was not readily available.

7.6.2 Small Catchment Dams

The capacity of small catchment dams in the Kiewa basin is estimated to be around 6,300 ML (Table 7-3). Usage from the dams is estimated to be approximately equal to the average annual usage of 3,900 ML. After allowing for losses the total catchment run-off that is harvested by the dams is estimated to be 5,000 ML.

Table 7-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	4,000	2,000	n/a
Irrigation	2,300	1,900	n/a
Total	6,300	3,900	5,000

Note:
(1) n/a: information not available

7.6.3 Water Entitlement Transfers

Transfers of water entitlements in the Kiewa basin are listed in Table 7-4. As shown, both permanent and temporary transfers occurred in 2004/05.

Table 7-4 Water entitlement transfers in the Kiewa basin

Bulk Entitlement	Permanent Entitlement Transfer (ML)			Temporary Entitlement Transfer (ML)		
	Bought	Sold	Net Transfer To Entitlement	Bought	Sold	Net Transfer To Entitlement
North East Water						
Kiewa - Tangambalanga	0	0	0	0	30	-30
Yackandandah	24	0	24	0	0	0
Goulburn-Murray Water						
Kiewa	2	32	-30	552	552	0
Total	**26**	**32**	**-6**	**552**	**582**	**-30**

7.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 7-5.

Compliance with individual bulk entitlement volumes is deemed to occur in Table 7-5 if water use is not more than the maximum volume allowed to be diverted in 2004/05. Full details of compliance with bulk entitlements will be provided in the resource manager's 2004/05 report for the Kiewa basin (Goulburn-Murray Water, in press).

Licences on unregulated streams are not currently metered and water usage is an estimate provided by Goulburn-Murray Water. The total private diversion in 2004/05 from the Kiewa basin of 5,100 ML is considerably less than the licensed entitlement of 12,637 ML held by licensed diverters. The reasons for this are unclear.

The bulk entitlement held by Southern Hydro for its Kiewa operations is a non-consumptive entitlement for hydropower.

Table 7-5 Volume of water diverted under surface water entitlements in the Kiewa basin

Entitlement	Period of Bulk Entitlement (years)	Total Bulk Entitlement –30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?
North East Water						
Kiewa – Tangambalanga	1	179	-30	149	0	Yes
Mount Beauty - Tawonga	1	719	0	719	403	Yes
Yackandandah	1	202	0	202	150	Yes
Southern Hydro Ltd						
Bogong Village	1	50	0	50	25	Yes
Kiewa - Southern Hydro Ltd	1	0	0	0	0	Yes
Total Annual Volume of Bulk Entitlements		**1,150**	**-30**	**1,120**	**578**	
Licensed diversions from unregulated streams		12,667	-30	12,637	5,100	

7.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

The bulk entitlements for North-East Water and Southern Hydro have various passing flow requirements. Goulburn-Murray Water, as resource manager for the Kiewa basin, had not completed its compliance report at the time of publication of the water accounts and thus detailed information on authorities' compliance with their environmental flow obligations was unavailable. Neither North-East Water nor Southern Hydro reported any non-compliance with passing flow conditions specified in their bulk entitlements.

7.6.6 Compliance with Streamflow Management Plans

The Kiewa River was identified in the *Our Water Our Future* action plan as a priority unregulated river. A streamflow management plan (SFMP) is currently being developed in the Kiewa basin to enhance the environmental water reserve and to develop a plan for minimising the impact of river diversions on the environment. This SFMP was not in operation in 2004/05.

7.7 Groundwater Resources

Licensed groundwater entitlements and use for the Mullindolingong GMA in the Kiewa basin, excluding stock and domestic use, are shown in Table 7-7. This table illustrates that licensed entitlements represent less than 20% of the allocation limit. An estimate of stock and domestic groundwater use is provided in Table 7-6.

The Kiewa basin contains 97% of the Mullindolingong GMA by surface area. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 7-6 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Mullindolingong GMA	385	770

Note:

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

Table 7-7 Compliance with licensed groundwater volumes, Kiewa basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Mullindolingong GMA (97%)	0-25	6,980	1,285	0	450	450	6,980

Notes:

1. The percentage of the GMA/WSPA by surface area within the river basin is given in the parentheses.
2. This column indicates the aquifer depth limits for which the GMA/WSPA applies.
3. The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not includegroundwater resources from unincorporated areas within the basin.
4. Includes domestic and stock usage in those cases where this forms part of a licensed allocation.
5. For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

7.8 Recycled Water

All sewage treatment plants in the Kiewa basin are operated by North-East Water. Around 23% of the volume of effluent passed through treatment plants in the basin was recycled for consumptive use (Table 7-8).

Table 7-8 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reuse (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Mount Beauty	165	4	0	4	0	0	162	0
Yackandandah	68	50	0	50	0	0	18	0
Total	233	53	0	53	0	0	180	0

Notes:

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

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

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

8 Ovens Basin

8.1 Location of Water Resources

The Ovens basin is located within the Murray-Darling Drainage Division. It includes the Ovens River, the King River and various smaller tributaries such as Fifteen Mile Creek and Reedy Creek. The Ovens River discharges to the River Murray upstream of Lake Mulwala. A map of the river basin is shown in Figure 8-1. Groundwater management areas (GMAs) within the Ovens basin include the Murmungee GMA and the Barnawartha GMA.

8.2 Responsibilities for Management of Water Resources

Goulburn-Murray Water is the licensing authority responsible for managing groundwater and surface water licensed diversions from the Ovens basin. Goulburn-Murray Water also operates the major reservoirs Lake Buffalo and Lake William Hovell. North-East Water is responsible for urban water supply in the Ovens basin, including the towns of Bright, Myrtleford, Beechworth and Chiltern. The North-East Catchment Management Authority is responsible for waterway management.

8.3 Seasonal Overview

Rainfall in the Ovens basin was close to average in 2004/05 at around 80-100% of long-term average rainfall. Streamflows in 2004/05 were 89% of the long-term average, and were slightly less than those estimated in the previous season. For example the streamflow recorded in Ovens River at Myrtleford (gauge number 403210) was 78% of the long-term average.

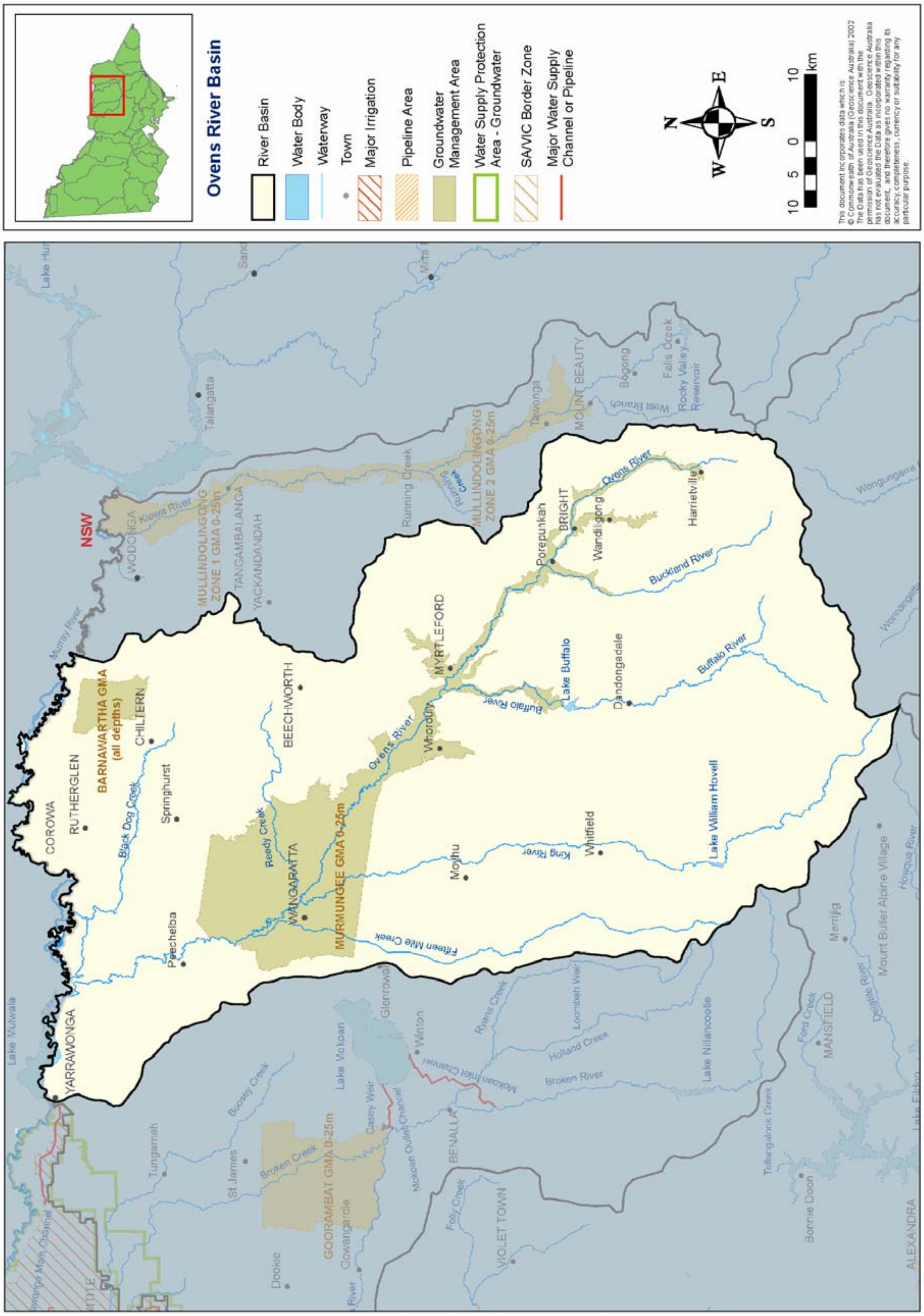
There were no urban or rural restrictions on water use over the season.

The areas affected by the 2003 bushfires continue to have an influence on water quality by contributing high sediment loads to the North East's major rivers and streams. These effects were particularly noticeable during February and April 2005. The effect on water quality is exacerbated by the high sediment loads already in the rivers and streams from previous erosion events.

There were no major negative water quantity events reported in 2004/2005.

An assessment of the environmental health of rivers and streams in the Ovens basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net) Details of works undertaken to improve the basin's long-term water quality and river health during 2004/05 are available from the North-East Catchment Management Authority.

Figure 8-1 Map of the Ovens basin



8.4 Summary of the 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 8-1.

Table 8-1 Summary of total water resource and use in the Ovens Basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	1,512,500	39,300
Groundwater (1)	18,800	6,000
Recycled Water	3,290	1,220

Note:

(1) Approximately 80% of the Ovens basin is an unincorporated area that contains a significant groundwater resource not represented in these totals.

8.5 Water for the Environment

In 2004/05 there was no formal environmental water reserve established in the Ovens basin, however the Murray-Darling Basin Cap was in place to limit growth in total consumptive water use, leaving the remaining water for the environmental water reserve. Water for the environment was also provided under passing flow obligations in consumptive bulk entitlements for water authorities in the basin.

The environment's share of total flow within the Ovens basin was 1,452,900 ML in 2004/05, which is approximately 96% of the total inflows (Table 8-2).

Although water quantity was largely unaffected in 2004/05, diversions from unregulated sections of the basin impact on the environmental water reserve at a catchment scale. On the upper Ovens River, private diversions during the irrigation season can have a significant impact on the flow regime, resulting in negative effects on aquatic habitats and populations. A streamflow management plan is being developed to devise water sharing rules that minimise the impacts of such diversions and ensure the water resources of the area are managed equitably and sustainably.

When the water remaining to benefit the environment in the Ovens River passes out of the basin into the River Murray, it becomes a resource available to the Murray basin along with other River Murray inflows. Once reaching the River Murray, water from the Ovens River is accounted as a Victorian State tributary input to the River Murray (rather than a shared resource between New South Wales and Victoria).

8.6 Surface Water Resources

8.6.1 Water Balance

A surface water balance for the Ovens basin is shown in Table 8-2. Note that only those storages greater than 1,000 ML capacity have been included in the water balance. In the Ovens basin this includes Lake Buffalo and Lake William Hovell.

Inflows to the basin were 89% of the long-term average of 1,692,000 ML a year (National Land and Water Audit, 2001). The largest diversion of water from the basin was via small catchment dams.

Table 8-2 Balance of surface water in the Ovens basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
Volume in storage at start of year	25,100	28,500
Volume in storage at end of year	28,000	25,100
Change in storage	2,900	-3,400
Inflows		
Catchment inflow (1)	1,510,400	1,609,800
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	2,070	1,950
Sub-total	**1,512,500**	**1,611,800**
Usage		
Urban diversions (2)	6,740	2,980
Licensed private diversions from regulated streams	9,800	11,800
Licensed private diversions from unregulated streams (3)	6,900	7,200
Small catchment dams	15,900	15,900
Sub-total	**39,300**	**37,800**
Losses		
Net evaporation losses from major storages	3,500	3,200
Losses from small catchment dams	4,500	4,500
In-stream infiltration to groundwater, flows to floodplain and evaporation (4)	9,400	9,400
Sub-total	**17,400**	**17,100**
Water Passed at Outlet of Basin		
Ovens Basin outflow to River Murray	1,452,900	1,560,200
Environment's Share of Total Flow in the Ovens Basin	**1,452,900**	**1,560,200**

Notes:

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

(2) The Ovens River System Bulk Entitlement, managed by North East Water, was incorrectly omitted in the 2003/04 water balance.

(3) Estimated diversions significantly declined in 2004/05 compared to 2003/04 due to the use of an improved estimation method by Goulburn-Murray Water.

(4) This figure is the average annual loss from the Ovens River REALM model because insufficient data is available to readily calculate losses specific to 2004/05.

8.6.2 Small Catchment Dams

The capacity of small catchment dams in the Ovens basin is estimated to be around 24,800 ML (Table 8-3). Usage from the dams is estimated to be approximately equal to the average annual usage of 15,900 ML and, after allowing for losses, the total catchment run-off that is harvested by the dams is estimated to be 20,400 ML.

Table 8-3 Small catchment dam information in the Ovens basin 2004/05

Type of Small Catchment Dam	Capacity (ML)	Volume Used (ML)	Total Water Harvested (ML)
Stock and domestic	14,700	7,400	n/a
Irrigation	10,100	8,500	n/a
Total	**24,800**	**15,900**	**20,400**

Note:
(1) n/a: information not available

8.6.3 Water Entitlement Transfers

Transfers of water entitlements within the Ovens basin are listed in Table 8-4. North East Water made a number of temporary water entitlement transfers to manage within its bulk entitlements.

Table 8-4 Water entitlement transfers in the Ovens basin 2004/05

Entitlement	Permanent Entitlement Transfer (ML)			Temporary Entitlement Transfer (ML)		
	Bought	Sold	Net Transfer To Entitlement	Bought	Sold	Net Transfer To Entitlement
North East Water						
Chiltern	0	0	0	30	0	30
Glenrowan	0	0	0	1	0	1
Myrtleford	0	0	0	0	4	-4
Porepunkah	0	0	0	4	0	4
Whitfield	0	0	0	2	0	2
Ovens River System	0	0	0	0	2	-2
Goulburn-Murray Water						
Ovens River System	383	433	-50	530	530	0
Total	**383**	**433**	**-50**	**567**	**536**	**31**

8.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 8-5.

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 2004/05.

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

Table 8-5 Volume of water diverted under surface water entitlements in the Ovens basin

Entitlement	Period of Bulk Entitle-ment (years)	Total Bulk Entitlement – 30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?	Volume Diverted in 2004/05 (ML)
North East Water							
Beechworth	1	1,100	0	1,100	604	Yes	604
Bright	1	704	0	704	680	Yes	680
Chiltern	1	180	30	210	210	Yes	210
Glenrowan	1	90	1	91	91	Yes	91
Harrietville	1	91	0	91	72	Yes	72
Porepunkah	1	166	4	170	170	Yes	170
Springhurst	1	36	0	36	30	Yes	30
Whitfield	1	34	2	36	35	Yes	35
Ovens River System	1	n/a	-2	n/a	4,217	n/a	4,217
Myrtleford	2	2,424	-4	2,420	1,493	Yes	628
Goulburn-Murray Water							
Ovens River System	1	n/a	0	n/a	14,631	n/a	9,817
Total Annual Volume of Bulk Entitlements		**3,613**	**31**	**3,646**	**21,488**		**16,555**
Licensed Diversions from Unregulated Streams		17,180	0	17,180	6,900		6,900

Notes:

(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2004, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2004-05 period. The *actual* maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

(2) n/a: bulk entitlement conversion order was not finalised at the beginning of 2004/05.

8.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

The bulk entitlements for North-East Water have various passing flow requirements. Detailed information on compliance with these reporting requirements is not provided in this report, however there were no significant non-compliances reported for 2004/05.

One bulk entitlement conversion order in the Ovens basin, to be managed by Goulburn-Murray Water, was not yet finalised in 2004/05. This forthcoming bulk entitlement will specify minimum environmental passing flows at designated points in the Ovens basin. Compliance with these obligations will be included in future reports once the bulk entitlement is finalised and information becomes available.

8.6.6 Compliance with Streamflow Management Plans

A streamflow management plan (SFMP) is currently being developed for the Upper Ovens basin. This SFMP was not in operation in 2004/05.

A draft plan was made available for comment in 2003/04 and a consultation process was undertaken. Responses will be considered by the Consultative Committee for review of the draft plan prior to being submitted for approval to the Minister for Water. During 2004/05 further investigative work was carried out that considered the feasibility of implementation options.

8.7 Groundwater Resources

Licensed groundwater entitlements and use for the Barnawartha and Murmungee GMA in the Ovens basin, excluding stock and domestic use, are shown in Table 8-6. An estimate of stock and domestic groundwater use is provided in Table 8-7.

Groundwater is used within the Ovens basin as an back-up urban water supply for the townships of Myrtleford and Springhurst and the rural city of Wangaratta. The licensed entitlements and metered use for these groundwater supplies is provided in Table 8-8. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts. The Ovens basin contains all of the Barnawartha GMA and the Murmungee GMA.

Table 8-6 Compliance with licensed groundwater volumes, Ovens basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Barnawartha GMA (100%)	ALL	2,100	485	0	170	170	2,100
Murmungee GMA (100%)	0-25	16,710	11,792	0	4,127	4,127	16,710

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

Table 8-7 Number of stock and domestic bores and estimated use, Ovens basin 2004/05

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Barnawartha GMA	28	56
Murmungee GMA	1,285	2,570

Note:

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

Table 8-8 Urban groundwater usage, Ovens basin 2004/05

Town Supplied	Licensed Allocation ML	Metered Use
Myrtleford	75	0
Springhurst	20	0
Wangaratta	150	0

8.8 Recycled Water

All sewage treatment plants in the Ovens basin are operated by North-East Water. Approximately 37% of the volume of effluent that passed through treatment plants in the basin was recycled (Table 8-9).

Table 8-9 Volume of recycled water, Ovens basin 2004/05

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Barnawartha	43	43	0	43	0	0	0	0
Beechworth	374	82	0	82	0	0	291	1
Bright / Porepunkah	259	17	17	0	0	0	241	0
Chiltern	90	90	0	90	0	0	0	0
Myrtleford	338	0	0	0	0	0	338	0
Rutherglen / Wahgunyah	294	294	89	205	0	0	0	0
Wangaratta	1,893	694	9	685	0	0	1,200	0
Total	**3,291**	**1,221**	**115**	**1,105**	**0**	**0**	**2,070**	**1**

Notes:

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

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

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

9 Broken Basin

9.1 Location of Water Resources

The Broken basin is located within the Murray-Darling Drainage Division. It includes the Broken River, which flows into the Goulburn River at Shepparton, and Broken Creek, which flows into the River Murray at Barmah. A map of the river basin is shown in Figure 9-1. For the purposes of the water accounts, the Broken basin excludes the Murray Valley Irrigation Area. This area is primarily supplied from the River Murray and is included in the Murray Basin water accounts. Similarly, accounting for environmental water use in the Barmah Forest is included in the Murray basin water accounts.

Water supply protection areas (WSPAs) within the Broken basin include part of the Katunga WSPA and the Shepparton WSPA. Groundwater management areas within the Broken Basin include the Goorambat GMA.

9.2 Responsibilities for Management of Water Resources

Goulburn-Murray Water is responsible for managing groundwater and surface water licensed diversions in the Broken basin. Goulburn-Murray Water also operates the major reservoirs Lake Mokoan and Lake Nillahcootie. North-East Water is responsible for urban water supply across most of the Broken Basin, with Goulburn Valley Water supplying towns in the west of the basin. The Goulburn-Broken Catchment Management Authority is responsible for waterway management and river health.

9.3 Seasonal Overview

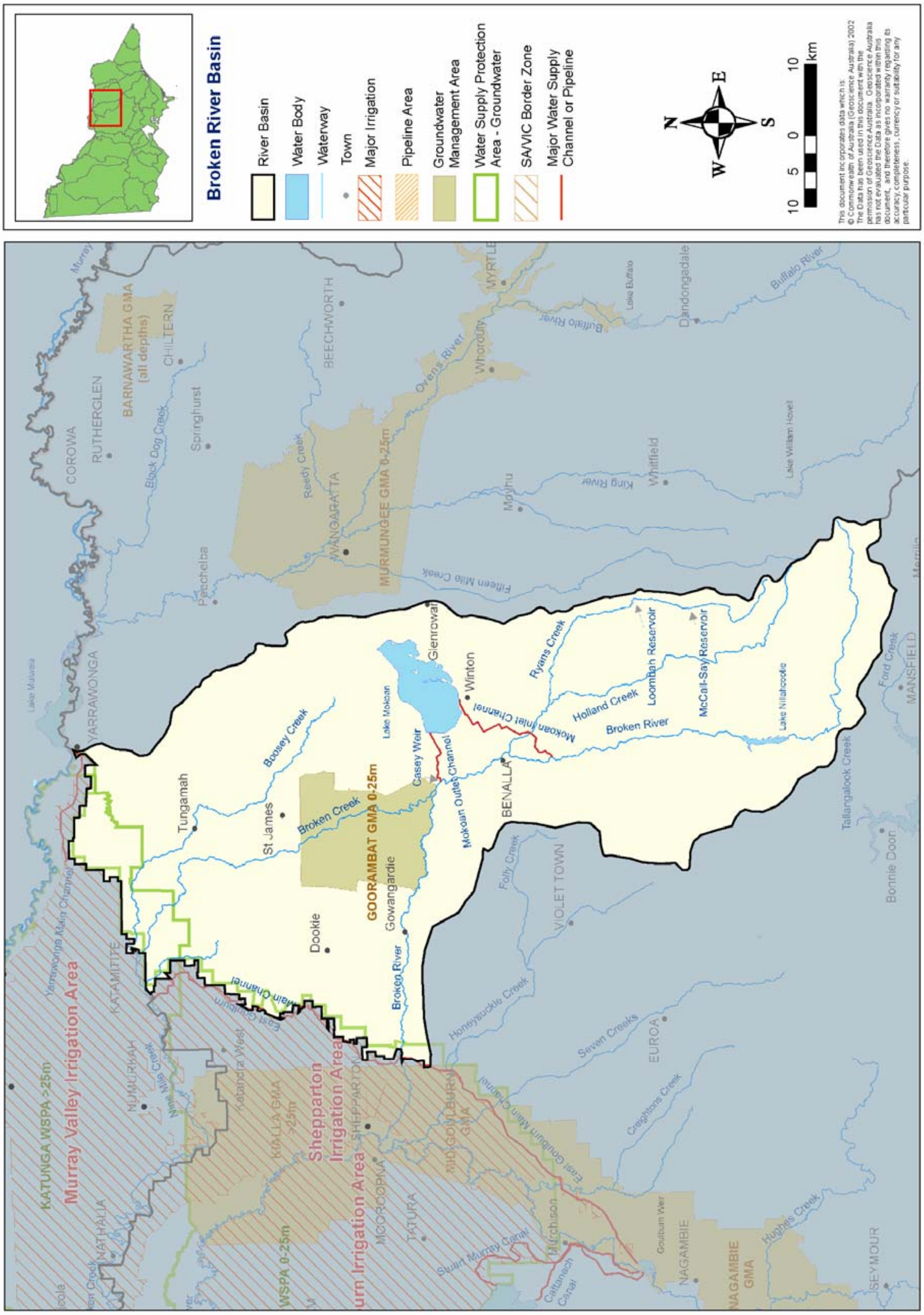
Rainfall conditions in the Broken basin in 2004/05 were close to or slightly below the long-term average across most of the basin. The year's streamflows were slightly lower than expected, with both the Moonee Creek at Lima (streamflow gauge 404208) in the upper part of the catchment and the Broken River at Gowangardie (streamflow gauge number 404224) further downstream, for example, exhibiting streamflows of just over 50% of the long-term average. Total streamflows in the basin were very similar to those estimated in 2003/04.

The seasonal irrigation water allocation in the regulated parts of the Broken River system was well above the licensed volume because a sales component equal to 70% of water right was announced in September 2004. The final allocation of 170% was the same as in 2003/04. In a repeat of 2003/04 conditions, an irrigation ban was imposed on diversions from Boosey Creek for the whole of 2004/05. There were no restrictions on urban usage in 2004/05.

The Broken Creek system has in recent years been experiencing severe *Azolla* blooms (a tiny water fern associated with blue-green algae) and low dissolved oxygen conditions due to drought and low flows. Strategic water management activities in 2004-05 were directed towards mitigating *Azolla* accumulation and improving dissolved oxygen concentrations to levels required by fish. This was achieved via routing greater passing flows through the waterway and strategically operating in-stream weir gates to pulse downstream flows. No blue-green algal blooms or fish kills were recorded in 2004/05, which is attributed to the success of this management strategy.

An assessment of the environmental health of rivers and streams in the Broken basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net).

Figure 9-1 Map of the Broken basin



9.4 Summary of the 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 9-1.

Table 9-1 Summary of total water resource and water use in the Broken basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	251,500	36,600
Groundwater [(1)]	Not available	Not available
Recycled Water	690	500

Note:
(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90% of their surface area within the river basin boundary.

9.5 Water for the Environment

There was no formal environmental water reserve established in the Broken basin in 2004/05. However, the Murray-Darling Basin Cap, which is a limit imposed on the volume of water that can be diverted from the rivers for consumptive use, applies in the Broken basin. Water for the environment was also provided through passing flow obligations for water authorities in the basin.

The environment's share of total flow was 113,400 ML at the basin outlet, which is around 45% of the total amount of surface water in the basin (Table 9-2).

In addition to the passing flow requirements, additional water was provided to maintain water quality and environmental health of the lower Broken Creek during the low flow period. This additional water was provided by redirecting irrigation water from the River Murray into Broken Creek (via the Mulwala Canal) and returning the water to the River Murray via Rice's Weir. Whilst this addition was not a specific environmental entitlement, it highlights the potential for water authorities to use irrigation releases for environmental benefits in some circumstances.

When the environment's share of total flow in the Broken River passes out of the basin into the River Murray, it becomes a resource available to the Murray basin, along with other River Murray inflows. Once it has reached the River Murray, the water from the Broken River is controlled by the Murray-Darling Basin Commission and may be used to meet the River Murray's environmental flow requirements and/or be diverted for consumptive use.

The water available to benefit the environment in the Barmah Forest, located at the outlet of Broken Creek, is discussed in the water account for the Murray basin.

9.6 Surface Water Resources

9.6.1 Water Balance

A surface water balance for the Broken basin is shown in Table 9-2. 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 9-2 Balance of surface water in the Broken basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
Volume in storage at start of year	110,700	90,500
Volume in storage at end of year	123,200	110,700
Change in storage	12,500	20,200
Inflows		
Catchment inflow (1)	251,300	270,800
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	190	270
Sub-total	**251,500**	**271,000**
Usage		
Urban diversions	1,790	2,020
Licensed private diversions from regulated streams (2)	18,500	17,500
Licensed private diversions from unregulated streams	500	1,500
Small catchment dams	15,800	15,700
Sub-total	**36,600**	**36,700**
Losses		
Net evaporation losses from major storages	66,400	81,300
Losses from small catchment dams	7,100	7,100
In-stream infiltration to groundwater, flows to floodplain and evaporation (3)	15,500	0
Sub-total	**89,000**	**88,500**
Water Passed at Outlet of Basin		
Broken River at Gowangardie to Goulburn Basin	94,900	114,300
Boosey Creek at Tungamah to Murray Basin	14,900	9,000
Broken Creek at Katamatite to Murray Basin	3,600	2,300
Environment's Share of Total Flow in the Broken Basin	**113,400**	**125,700**

Notes:

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

(2) Includes Tungamah stock and domestic system.

(3) Losses estimated up to April 2005. The volume of estimated losses increased from the previous year due to an improvement of the calculation method. Losses in 2004/05 were sourced from the Broken River and Broken Creek Loss Reduction concept study.

Evaporative losses from Lake Mokoan represent over 90% of the total evaporative loss from major storages in the Broken Basin. This high evaporative loss has been a major factor in the decision to decommission the lake.

9.6.2 Small Catchment Dams

The capacity of small catchment dams in the Broken basin is estimated to be around 25,000 ML (Table 9-3). Usage from the dams is estimated to be approximately equal to the average annual usage of 15,800 ML and, after allowing for losses, the total catchment run-off that is harvested by the dams is estimated to be 22,900 ML.

Table 9-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	15,400	7,700	n/a
Irrigation	9,600	8,100	n/a
Total	**25,000**	**15,800**	**22,900**

Note:

(1) n/a: information not available

9.6.3 Water Entitlement Transfers

Transfers of water entitlements within the Broken basin are listed in Table 9-4. Only intra-basin transfers occurred during the 2004/05 period.

Table 9-4 Water entitlement transfers in the Broken basin

Entitlement	Permanent Entitlement Transfer (ML)			Temporary Entitlement Transfer (ML)		
	Bought	Sold	Net Transfer To Entitlement	Bought	Sold	Net Transfer To Entitlement
Goulburn-Murray Water						
Broken River System	197	197	0	1,112	1,112	0
Total	**197**	**197**	**0**	**1,112**	**1,112**	**0**

9.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 9-5. 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 2004/05.

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

Table 9-5 Volume of water diverted under surface water entitlements in the Broken basin

Entitlement	Period of Bulk Entitlement (years)	Total Bulk Entitlement –30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?
North East Water						
Loombah-McCall Say	1	2,324	0	2,324	1,674	Yes
Tungamah, Devenish and St. James	1	n/a	0	n/a	118	n/a
Goulburn-Murray Water						
Broken River System	1	n/a	0	n/a	15,422	n/a
Broken River System – Tungamah D&S, Urban Supplies	1	n/a	0	n/a	3,071	n/a
Total Annual Volume of Bulk Entitlements		**2,324**	**0**	**2,324**	**20,284**	
Licensed Diversions from Unregulated Streams		1,137	0	1,137	500	

Note:

(1) n/a: bulk entitlement conversion order was not finalised at the beginning of 2004/05.

9.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

The bulk entitlements for North-East Water have various passing flow requirements. No non-compliance issues with passing flow obligations were reported by North-East Water in 2004/05.

9.6.6 Compliance with Streamflow Management Plans

There is no streamflow management plan in operation in the Broken basin.

9.7 Groundwater Resources

Licensed groundwater entitlements and use for the Goorambat GMA and Katunga WSPA in the Broken Basin, excluding stock and domestic use, is shown in Table 9-6. An estimate of stock and domestic groundwater use is provided in Table 9-7.

Groundwater is used as an urban water supply for the township of Goorambat. The licensed entitlement and metered use for this groundwater supply is provided in Table 9-8.

The Broken basin contains all of the Goorambat GMA and 8%of the Katunga WSPA by surface area. The volumes described in Table 9-6 and Table 9-7 are totals for the management areas and include the area that falls outside the Broken basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 9-6 Compliance with licensed groundwater volumes, Broken basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Goorambat GMA (100%)	0-25	4,888	1,543	0	540	540	4,888
Katunga WSPA (8%)	>25	59,770	44,080	26,200	20	26,220	Not Available (6)

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 9-7 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Goorambat GMA	17	34
Katunga WSPA	593	1,186

Note:

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

Table 9-8 Urban groundwater usage

Town Supplied	Licensed Allocation ML	Metered Use
Goorambat	24	24

9.8 Recycled Water

Around 73% of the volume of effluent passed through the treatment plant in the basin was recycled for consumptive use (Table 9-9).

Table 9-9 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Benalla	690	503	0	503	0	0	187	0
Total	690	503	0	503	0	0	187	0

Notes:

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

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

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

10 Goulburn Basin

10.1 Location of Water Resources

The Goulburn basin is located within the Murray-Darling Drainage Division. It includes the Goulburn, Delatite, Howqua and Big Rivers upstream of Eildon and the Acheron River, Yea River, King Parrot Creek, Creightons Creek, Seven Creeks and Hughes Creek downstream of Lake Eildon. The Broken River flows into the Goulburn River at Shepparton. The Goulburn River discharges to the River Murray east of Echuca.

A map of the river basin is shown in Figure 10-1.

The Goulburn basin water account includes all irrigation areas and towns that are supplied from the Goulburn water supply system. This includes the Shepparton and Central Goulburn Irrigation Areas, as well as those areas located outside of the basin such as the Pyramid-Boort Irrigation Area, and Normanville and West Loddon Waterworks Districts supplied via the Waranga Western Channel, and part of the Wimmera-Mallee domestic and stock system.

Groundwater water supply protection areas (WSPAs) within the Goulburn basin include part of the Campaspe Deep Lead WSPA, Katunga WSPA and Shepparton WSPA. Groundwater management areas (GMAs) include the whole of the Nagambie GMA and Alexandra GMA, and part of the Kialla GMA and Kinglake GMA.

10.2 Responsibilities for Management of Water Resources

Goulburn-Murray Water manages the Goulburn water supply system which includes Lakes Eildon and Nagambie, and the Waranga Basin. It is also the licensing authority responsible for managing private groundwater pumping and surface water diversions in the Goulburn basin.

Goulburn Valley Water is responsible for urban water supply for towns located within the Goulburn basin. Coliban Water also supplies numerous towns located in the North Central region, as well as the townships of Lockington and Rochester, from water sourced from the Goulburn via the Waranga Western Channel. (Rochester is also supplied via the Campaspe system when the Waranga Western Channel is closed for maintenance).

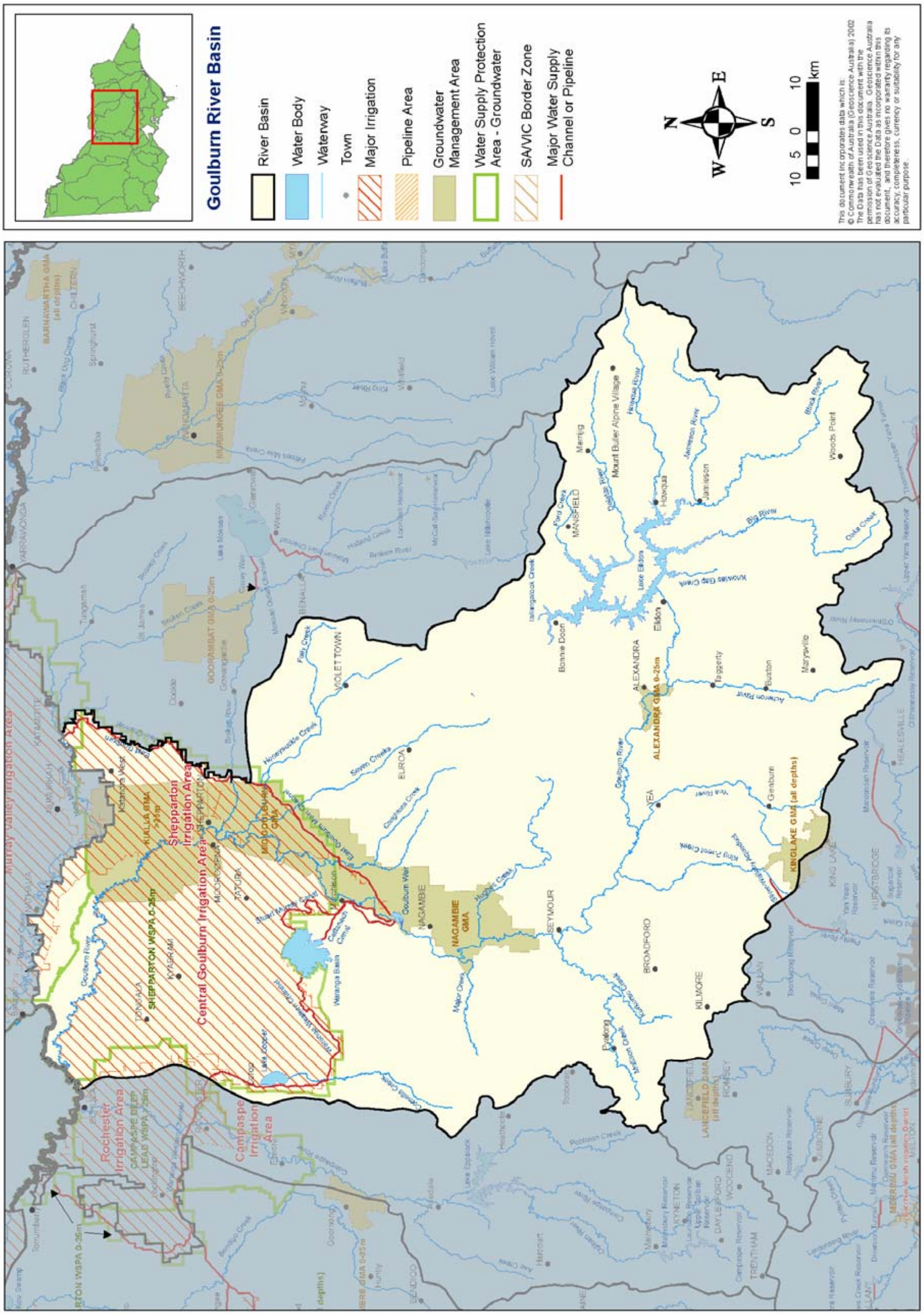
The Goulburn Broken Catchment Management Authority is responsible for waterway management.

10.3 Seasonal Overview

Rainfall conditions in the Goulburn basin in 2004/05 were close to the long-term average across most of the basin at 80-100% of the long-term average rainfall. Streamflows were, however, below average across much of the catchment. For example, the year's streamflows in the Delatite River at Tonga Bridge (streamflow gauge 405214) upstream of Lake Eildon were 63% of the long-term average streamflow. Streamflows in 2004/05 were 69% of the long-term average, and were less than those estimated in 2003/04 (84% of the estimated long-term average).

An initial seasonal irrigation water allocation of 5% was made in July 2003. This had increased to 100% of entitlement by the end of November 2004 and remained at this level until the end of the irrigation season. The 100% allocation is the same as the final allocation announcement of the previous season. The median long-term February allocation in this system is 160% of entitlement, hence irrigators in the Goulburn system again had to make do with less than their usual seasonal allocation.

Figure 10-1 Map of the Goulburn basin



For unregulated streams, an irrigation ban was in place for licensed diversions from Sunday Creek throughout the 2004/05 season until June 2005 when it was finally lifted. No other bans or restrictions were imposed. This is in contrast to the previous year when 10 unregulated streams were subject to some form of restriction during 2003/04.

At the start of the 2004/05 season, Stage 3 restrictions (of a four stage policy) continued for Broadford, Clonbinane, Waterford Park, Kilmore, Wallan, and Wandong/Heathcote Junction. These restrictions had been in place since December 2003. The restrictions were eased to Stage 2 from December 2004, then lifted in mid-February 2005. Stage 1 restrictions were reimposed on urban demans from the Sunday Creek system from June 2005. In May 2005, voluntary restrictions were announced for Tatura, and remained in place in the following month. The townships supplied by the Goulburn system managed by Coliban Water (including the townships of Boort, Dingee, Lockington, Macorna, Mitiamo, Mysia, Pyramid Hill and Rochester) were subject to Stage 1 restrictions throughout 2004/05.

A blue-green algal bloom occurred in Lake Eildon in November and December 2004 (microcystis, maximum alert level 3).

An assessment of the environmental health of rivers and streams in the Goulburn basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005).

10.4 Summary of the 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 10-1.

Table 10-1 Summary of total water resource and water use in the Goulburn basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	2,464,000	1,552,700
Groundwater [1]	Not available	Not available
Recycled Water	9,340	6,880

Note:

(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90% of their surface area within the river basin boundary.

10.5 Water for the Environment

Two environmental entitlements to return water to the Snowy River have been established in the Goulburn basin. An entitlement of 3,600 ML a year was granted in June 2004 and a second entitlement was granted in January 2005 for 10,762 ML a year. While these were not part of the Goulburn supply system operation in 2004/05, they form part of the water that is going towards achieving Victoria’s target of returning 141,000 ML to the Snowy River by 2012. These two entitlements are held by the Minister for Environment and were achieved by saving water through the improved metering of small volume supplies in irrigation districts. Water savings for the Snowy River also occurred in the Murray basin (refer Section 6.5). An environmental flow study was completed for the Goulburn River in 2003. This study will inform any decisions in relation to water recovery as part of the Living Murray Initiative.

In 2004/05 there was no formal environmental water reserve (as defined by legislation) established in the Goulburn basin. However, the Murray-Darling Basin Cap, which is a limit imposed on the volume of water that can be diverted from the rivers for consumptive use, applies in the Goulburn basin. Water for the environment was also provided under passing flow obligations in consumptive bulk entitlements for water authorities in the basin. The environment's share of total flow was 449,700 ML at the basin outlet, which is around 19% of the total amount of surface water in the basin (Table 10-3).

The timing of diversions in the unregulated sections of the basin, particularly in the Yea River and King Parrot Creek, can impact on the environmental water reserve. Licensed diversions during the irrigation season can have a significant impact on the flow regime resulting in negative effects on aquatic habitats and populations. Streamflow management plans are developing water sharing rules that will minimise the impacts of such diversions.

In 2004/05, an environmental water allocation of 266 ML was provided to Brays Swamp. Brays Swamp is a privately owned freshwater marsh, located near Merrigum in northern Victoria, and has been identified as a regional high value site. The environmental water allocation consisted of 112 ML of water entitlement for Stockyard Plain and 24 ML of water entitlement for Gaynors Swamp, and 460 ML from the River Murray Flora and Fauna Reserve Bulk Entitlement held by the Minister for Environment. (The use of part of the River Murray Flora and Fauna Reserve Bulk Entitlement in the Goulburn system was achieved via temporary water trading between the two systems.) When the environment's share of total flow in the Goulburn River passes out of the basin into the River Murray, it becomes a resource available to the Murray basin, along with other River Murray inflows. Once it has reached the River Murray, the Goulburn River water is controlled by the Murray-Darling Basin Commission and may be used to meet the River Murray's environmental flow requirements and/or be diverted for consumptive use.

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. In the Goulburn basin, this includes Lake Eildon, Lake Nagambie (Goulburn Weir) and Sunday Creek Reservoir.

10.6.2 Small Catchment Dams

The capacity of small catchment dams in the Goulburn basin is estimated to be around 71,100 ML (Table 10-2). Usage from the dams is estimated to be approximately equal to the average annual usage of 47,500 ML and, after allowing for losses, the total catchment run-off that is harvested by the dams is estimated to be 57,200 ML.

Table 10-2 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	35,900	17,900	n/a
Irrigation	35,200	29,600	n/a
Total	71,100	47,500	57,200

Note:

(1) n/a: information not available

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

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
Volume in storage at start of year (6)	695,500	476,100
Volume in storage at end of year	963,100	859,600
Change in storage	267,600	383,500
Inflows		
Catchment inflow (1)	2,366,600	2,813,300
Inflow from Broken River at Gowangardie	94,900	114,300
Return flow from irrigation (2)	0	0
Treated effluent discharged back to river	2,460	3,150
Sub-total	**2,464,000**	**2,930,800**
Usage		
Urban diversions	27,890	25,550
Irrigation district diversions	1,434,000	1,476,300
Licensed private diversions from regulated streams	25,400	24,800
Licensed private diversions from unregulated streams	8,100	13,700
Silver and Wallaby Creeks to Yarra Basin	9,300	3,000
Environmental water diversions	500	0
Small catchment dams	47,500	47,500
Sub-total	**1,552,700**	**1,590,900**
Losses		
Net evaporation losses from major storages (3)	66,400	119,800
Losses from small catchment dams	9,700	9,700
In-stream infiltration to groundwater, flows to floodplain and evaporation (4)	115,200	293,800
Sub-total	**191,300**	**423,300**
Water Passed at Outlet of Basin		
Goulburn River to Campaspe River via Waranga Western Channel (5)	2,700	0
Goulburn River outflow to River Murray	411,300	494,300
Goulburn River outflow to River Murray via Broken Creek	38,400	38,900
Environment's Share of Total Flow in the Goulburn Basin	**449,700**	**533,200**

Notes:

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

(2) Assumed to be zero as Goulburn-Murray Water was unable to readily separate return flows by basin in 2004/05.

(3) 2003/04 erroneously included evaporation from the off-stream storage of Waranga Basin.

(4) Losses estimated using loss functions from the Goulburn Simulation Model (REALM). The volume of estimated losses decreased from the previous year due to an improvement of the calculation method.

(5) Value omitted in 2003/04.

(6) Start storage of current year and end storage of previous year do not match because the off-stream storages of Waranga Basin and Greens Lake are no longer included in the storage calculation in 2004/05.

10.6.3 Water Entitlement Transfers

Transfers of water entitlements within the Goulburn basin are listed in Table 10-4. It can be seen from this table that there was a net export of water entitlement from the basin, with 14,095 ML being permanently traded and 15,264 ML being temporarily traded to other basins. Goulburn Valley Water was a significant seller of entitlement to the water market.

Table 10-4 Water entitlement transfers in the Goulburn basin

Entitlement	Permanent Entitlement Transfer (ML)			Temporary Entitlement Transfer (ML)		
	Bought	Sold	Net Transfer To Entitlement	Bought	Sold	Net Transfer To Entitlement
Coliban Water						
Rochester	0	0	0	100	50	50
Boort	0	0	0	0	10	-10
Pyramid Hill	0	0	0	0	10	-10
Goulburn Valley Water						
Alexandra	0	0	0	0	520	-520
Bonnie Doon	0	0	0	30	65	-35
Colbinabbin	0	0	0	0	45	-45
Corop	0	0	0	0	30	-30
Dookie	0	0	0	0	50	-50
Eildon	0	0	0	0	312	-312
Gigarre	0	0	0	0	46	-46
Katandra West	0	0	0	0	15	-15
Kyabram	0	0	0	0	560	-560
Mooroopna	0	0	0	0	213	-213
Murchison	0	0	0	15	124	-109
Nagambie	0	0	0	0	290	-290
Rushworth	0	0	0	0	120	-120
Seymour	0	0	0	0	3,095	-3,095
Shepparton	0	0	0	0	4,578	-4,578
Stanhope	0	0	0	15	109	-94
Tatura	0	0	0	0	500	-500
Tongala	0	0	0	0	90	-90
Goulburn-Murray Water						
Goulburn River - Water right	245	331	-86	5,400	16,512	-11,112
Goulburn River - Sales				0	0	0
Central Goulburn - Water right	355	8,036	-7,681	65,448	57,451	7,997
Central Goulburn - Sales				65	0	65
Rochester - Water right	598	4,288	-3,690	42,837	29,669	13,168
Rochester - Sales				306	22	284
Shepparton Irrigation District - Water right	286	2,924	-2,638	21,299	36,909	-15,609
Shepparton Irrigation District - Sales				20	0	20
Minister for Environment						
River Murray - Flora and Fauna	0	0	0	596	0	596
Total	1,484	15,579	-14,095	136,131	151,395	-15,264

10.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 10-5. Compliance with individual bulk entitlement volumes is deemed to occur in Table 10-5 if water use is not more than the maximum volume allowed to be diverted in 2004/05. Full details of compliance with bulk entitlements will be provided in the resource manager's 2004/05 report for the Goulburn basin (Goulburn-Murray Water, in press).

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

Table 10-5 Volume of water diverted under surface water entitlements in the Goulburn basin

Entitlement	Period of Bulk Entitle-ment (years)	Total Bulk Entitlement – 30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?	Volume Diverted in 2004/05 (ML)
Coliban Water							
Rochester	1	1,400	50	1,450	1,400	Yes	1,400
Lockington	1	130	0	130	57	Yes	57
Boort	1	425	-10	415	227	Yes	227
Dingee	1	50	0	50	6	Yes	6
Macorna	1	40	0	40	6	Yes	6
Mitiamo	1	60	0	60	28	Yes	28
Mysia	1	15	0	15	6	Yes	6
Pyramid Hill	1	300	-10	290	283	Yes	283
Goulburn Valley Water							
Alexandra	1	916	-520	396	380	Yes	380
Bonnie Doon	1	112	-35	77	69	Yes	69
Buxton [(2)]	1	110	0	110	0	Yes	0
Colbinabbin	1	89	-45	44	33	Yes	33
Corop	1	44	-30	14	10	Yes	10
Dookie	1	160	-50	110	110	Yes	110
Eildon	1	480	-312	168	163	Yes	163
Euroa System	1	1,990	0	1,990	751	Yes	751
Girgarre	1	100	-46	54	43	Yes	43
Katandra West	1	64	-15	49	41	Yes	41
Kyabram	1	2,000	-560	1,440	1,352	Yes	1,352
Longwood	1	120	0	120	69	Yes	69
Mansfield	1	1,300	0	1,300	685	Yes	685
Marysville	1	462	0	462	390	Yes	390
Merrigum [(3)]	1	0	0	0	0	Yes	0
Mooroopna	1	500	-213	287	187	Yes	187
Murchison	1	350	-109	241	235	Yes	235
Nagambie	1	825	-290	535	508	Yes	508
Pyalong	1	75	0	75	46	Yes	46
Rushworth	1	530	-120	410	378	Yes	378
Seymour	1	5,340	-3,095	2,245	1,691	Yes	1,691
Shepparton	1	18,320	-4,578	13,743	13,145	Yes	13,145
Stanhope	1	200	-94	106	93	Yes	93
Sunday Creek	1	2,875	0	2,875	1,875	Yes	1,875
Tatura	1	2,600	-500	2,100	1,985	Yes	1,985
Thornton	1	120	0	120	53	Yes	53
Tongala	1	1,404	-90	1,314	1,232	Yes	1,232
Toolamba [(4)]	1	0	0	0	0	Yes	0
Upper Delatite	1	235	0	235	98	Yes	98
Violet Town [(5)]	1	270	0	270	0	Yes	0
Woods Point	1	21	0	21	17	Yes	17
Yea	1	438	0	438	238	Yes	238

Table 10-5 (cont'd)

Entitlement	Period of Bulk Entitle-ment (years)	Total Bulk Entitlement – 30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?	Volume Diverted in 2004/05 (ML)
Minister for Environment							
Snowy Environ-mental Reserve	1	18,000	0	18,000	0	Yes	0
River Murray - Flora and Fauna	1	0	596	596	460	Yes	460
Goulburn-Murray Water							
Eildon-Goulburn Weir	10	18,994,445	-5,189	18,989,257	1,425,940	Yes	1,459,398
Total Annual Volume of Bulk Entitlements		**1,961,915**	**-15,314**	**1,946,651**	**1,570,945**		**1,487,749**
Licensed Diversions from Unregulated Streams		20,221	0	20,221	8,100		8,100

Notes:

(1) For multiyear entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2004, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2004-05 period. The *actual* maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

(2) Buxton supply was connected to the Marysville system in 2001/02 to increase the security of supply.

(3) Merrigum is now supplied from Kyabram, and the entitlement for Merrigum has been transferred to Kyabram.

(4) Toolamba is now supplied from Shepparton.

(5) Violet Town is now supplied from Euroa.

10.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

The bulk entitlements for Goulburn-Murray Water and Goulburn Valley Water have various passing flow requirements.

Goulburn-Murray Water reported that the average weekly flow at Murchison was 0.6 ML under the minimum weekly average required for one day.

10.6.6 Compliance with Streamflow Management Plans

Several streamflow management plans (SFMPs) are currently being developed in the Upper Goulburn basin. There are three priority unregulated rivers in the basin: King Parrot Creek and Yea River in the upper Goulburn and Seven Creeks in the mid-Goulburn. Draft SFMPs were developed for the King Parrot Creek and Yea River. These plans will be revised in 2005/06 in light of the new Ministerial guidelines for development of SFMPs. Background scientific investigation to support the development of the Seven Creeks SFMP will commence in 2004/05.

10.7 Groundwater Resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Goulburn basin, excluding stock and domestic use, is presented in Table 10-6. An estimate of stock and domestic groundwater use is provided in Table 10-7.

The Goulburn basin contains the whole Nagambie GMA and Alexandra GMA as well as part of the Campaspe Deep Lead WSPA, Shepparton WSPA, Katunga WSPA, Kialla GMA and Kinglake GMA. The volumes described in Table 10-6 and Table 10-7 are totals for the management areas and include the area that falls outside the Goulburn basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 10-6 Compliance with licensed groundwater volumes, Goulburn basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Alexandra GMA (100%)	0-25	900	1,714	0	600	600	900
Kialla (1+2) GMA (92%)	>25	4,770	2,332	0	816	816	4,770
Kinglake GMA (78%)	ALL	3,830	1,840	0	644	644	Not Available (6)
Campaspe Deep Lead WSPA (10%)	>25	46,039	46,039	25,270	443	25,713	Not Available (6)
Katunga WSPA (10%)	>25	59,770	44,080	26,200	20	26,220	Not Available (6)
Nagambie GMA (100%)	ALL	5,650	6,648	3,410	1,000	4,410	5,650
Shepparton WSPA (53%)	0-25	203,619	203,619	64,820	15,000	79,820	Not Available (6)

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 10-7 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Alexandra GMA	52	104
Kialla (1+2) GMA	23	46
Kinglake GMA	342	684
Campaspe Deep Lead WSPA	188	376
Katunga WSPA	593	1,186
Nagambie GMA	70	140
Shepparton WSPA	415	830

Note:

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

10.8 Recycled Water

All sewage treatment plants in the Goulburn Basin are operated by Goulburn Valley Region Water Authority. Around 74% of the volume of effluent passed through treatment plants in the basin was recycled for consumptive use (Table 10-8).

Table 10-8 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Alexandra	286	127	0	127	0	0	159	0
Avenel	0	0	0	0	0	0	0	0
Bonnie Doon	15	15	0	15	0	0	0	0
Broadford	96	96	0	96	0	0	0	0
Eildon	172	83	0	83	0	0	89	0
Euroa	240	240	0	240	0	0	0	0
Girgarre	0	0	0	0	0	0	0	0
Kilmore	164	164	0	164	0	0	0	0
Kyabram	314	314	0	314	0	0	0	0
Mansfield	205	205	39	166	0	0	0	0
Marysville	79	79	0	79	0	0	0	0
Mooroopna	702	702	0	702	0	0	0	0
Murchison	0	0	0	0	0	0	0	0
Nagambie	111	111	0	111	0	0	0	0
Seymour	606	606	86	520	0	0	0	0
Shepparton	4,781	2,687	0	2,687	0	0	2,093	0
Stanhope / Rushworth	0	0	0	0	0	0	0	0
Tatura	811	811	0	811	0	0	0	0
Tongala	337	337	0	337	0	0	0	0
Upper Delatite	26	26	0	26	0	0	0	0
Violet Town	0	0	0	0	0	0	0	0
Wallan	298	182	0	182	0	0	116	0
Yea	97	97	15	82	0	0	0	0
Total	**9,339**	**6,882**	**140**	**6,742**	**0**	**0**	**2,457**	**0**

Notes:

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

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

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

11 Campaspe Basin

11.1 Location of Water Resources

The Campaspe basin is located within the Murray-Darling Drainage Division. It includes the Campaspe River, the Coliban River and various smaller tributaries such as Axe Creek and Mount Pleasant Creek. The Campaspe River discharges to the River Murray at Echuca. A map of the river basin is shown in Figure 11-1.

Water supply protection areas (WSPAs) within the Campaspe basin include part of the Campaspe Deep Lead WSPA. Groundwater management areas (GMAs) within the Campaspe basin include part of the Ellesmere GMA.

11.2 Responsibilities for Management of Water Resources

Goulburn-Murray Water is the licensing authority responsible for managing groundwater pumping and private diversions from the river basin.

Coliban Water operates the Upper Coliban, Lauriston and Malmsbury Reservoirs in the upper reaches of the river basin, whilst Goulburn-Murray Water operates Lake Eppalock. Coliban Water is responsible for the majority of urban water supply in the Campaspe basin, with Western Water supplying Woodend at the southern end of the basin. Coliban Water supplies rural customers via the Coliban Main Channel.

The North-Central Catchment Management Authority is responsible for waterway management in the Campaspe basin.

11.3 Seasonal Overview

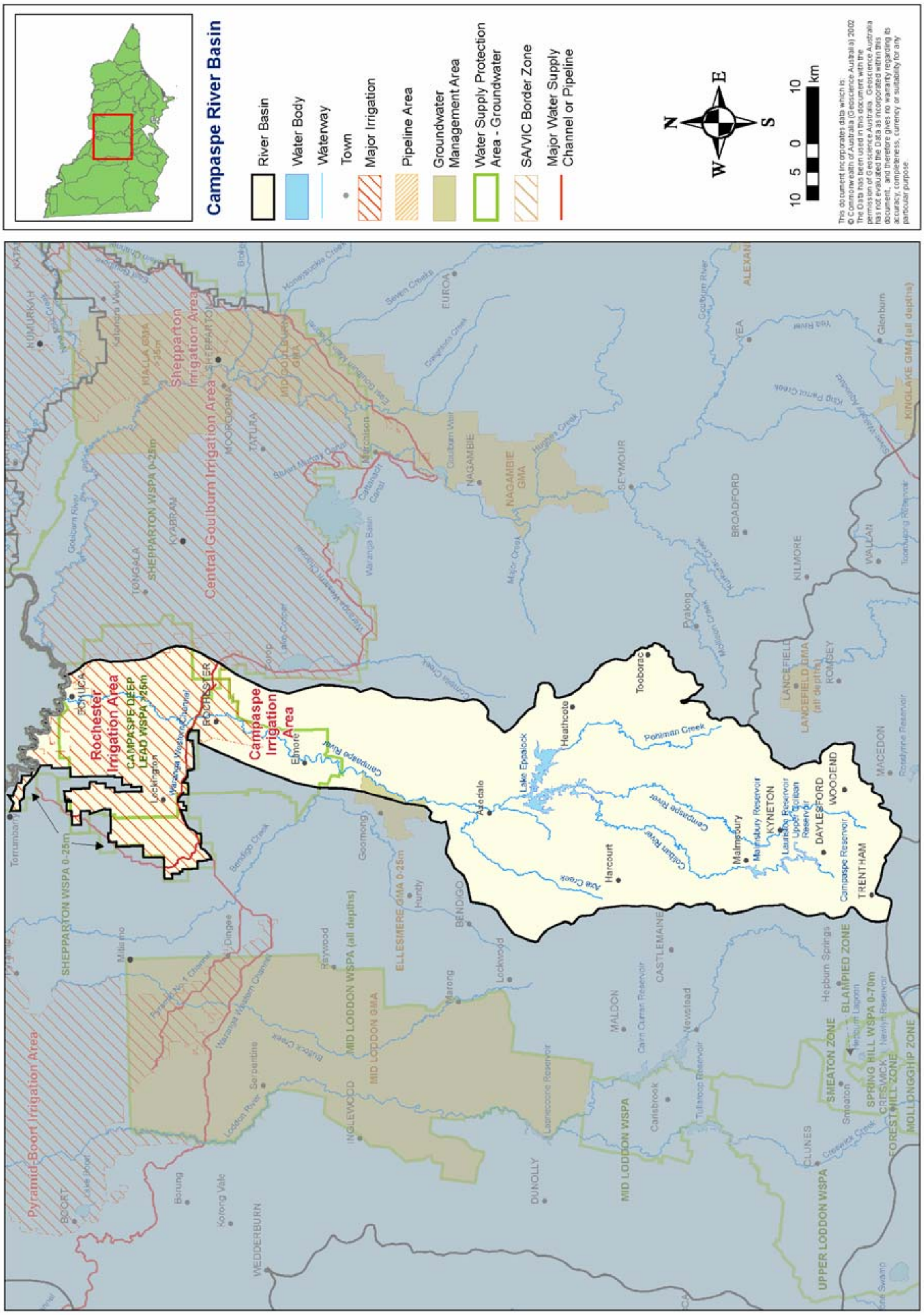
Rainfall conditions in the Campaspe basin in 2004/05 were approximately equal to the long-term average across the basin. Streamflows were, however, below average across much of the catchment, possibly due to the prolonged effects of previous dry years. Streamflows in 2004/05 in Axe Creek at Longlea (streamflow gauge number 406214) were 7% of the long-term average streamflow, whilst outflows from the Campaspe River at Rochester were 6% of the long-term average streamflow (but marginally higher than 2003/04 outflows).

The seasonal water allocation for the Campaspe Irrigation District was initially zero, and rose to 39% of water right by the end of February. This allocation was the lowest of the Northern Victorian irrigation areas during the season and was considerably lower than the previous year's February allocation (92%) and the long-term median February allocation (220%). The seasonal irrigation water allocation for Coliban Channel diverters in 2004/05 was initially 50% and rose to 65% of entitlement by the end of the February. This was much lower than the long-term median February allocation of 130% of entitlement.

Irrigation bans were imposed on licensed diverters on the Lower Campaspe River between the Waranga Western Channel and the River Murray from September 2004 until the end of the 2004/05 period. Irrigation bans were also in place from January 2005 to May 2005 along the Campaspe River and tributaries above Eppalock, including the Coliban River.

The severe urban restrictions in place at the start of the year eased slightly, but urban usage still remained restricted in this river basin throughout the year. Stage 4 (of four stages) for towns supplied from the Coliban system (including Bendigo) and Tooborac continued from June 2004. Restrictions were increased from Stage 2 to Stage 4 for towns supplied from the Campaspe system (Axedale and Goornong). All Stage 4 restrictions were eased to modified

Figure 11-1 Map of the Campaspe basin



Stage 4 restrictions in October 2004, then Stage 3 in November 2004. Stage 3 restrictions remained in place for the remainder of the 2004/05 period. Stage 1 restrictions (in place since late 2003) continued throughout 2004/05 for Trentham and Elmore, which are both supplied by groundwater.

Details of works undertaken to improve the basin's long-term water quality and river health during 2004/05 are available from the North Central Catchment Management Authority.

An assessment of the environmental health of rivers and streams in the Campaspe basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net).

11.4 Summary of the 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 11-1. The total surface water resource for the Campaspe basin includes 2,700 ML which was transferred into the Campaspe River from the Waranga Western Channel.

Table 11-1 Summary of total water resource and water use in the Campaspe basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	122,200	73,400
Groundwater (1)	Not available	Not available
Recycled Water	1,340	730

Note:

(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90% of their surface area within the river basin boundary.

11.5 Water for the Environment

There was no formal environmental water reserve established in the Campaspe basin in 2004/05. However, the Murray-Darling Basin Cap, which is a limit imposed on the volume of water that can be diverted from rivers for consumptive use, applies in the Campaspe basin.

The environment's share of total flow at the Campaspe basin outlet was 9,900 ML, which is approximately 8% of total inflows (Table 11-2). This 9,900 ML represents all water flowing from the basin that was not taken out of waterways for consumptive uses.

When the environment's share of total flow in the Campaspe River passes out of the basin into the River Murray, it becomes a resource available to the Murray basin, along with other River Murray inflows. Once it has reached the River Murray, water from the Campaspe River is under the control of the Murray-Darling Basin Commission and may be used to meet the River Murray's environmental flow requirements and/or be diverted for consumptive use.

The ongoing drought continues to impact significantly on flows within all streams in the Campaspe basin. In the summer of 2004/05, 2700 ML of water was diverted from the Goulburn system through the Waranga Western Channel into the Campaspe River downstream of the Campaspe siphon. This transfer of water was undertaken to protect the environmental values of the river and improve water quality. Approximately 330 ML of the water released from the Goulburn was counted as an in-stream loss in the Campaspe River that did not reach the River Murray. This loss was accounted for as a consumptive use under the River Murray Flora and Fauna Bulk Entitlement.

11.6 Surface Water Resources

11.6.1 Water Balance

A surface water balance for the Campaspe basin is shown in Table 11-2. Note that only those on-stream storages greater than 1,000 ML capacity have been included in the water balance. In the Campaspe basin, on-stream storages greater than 1,000 ML capacity include the Upper Coliban, Lauriston and Malmsbury Reservoirs, as well as Lake Eppalock.

Table 11-2 Balance of surface water in the Campaspe basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
Volume in storage at start of year [(1)]	30,300	36,900
Volume in storage at end of year [(1)]	41,600	32,900
Change in storage	11,300	-4,100
Inflows		
Catchment inflow [(2)]	119,200	158,800
Return flow from irrigation [(3)]	0	0
Waranga Western Channel to Campaspe River	2,700	1,400
Treated effluent discharged back to river	340	600
Sub-total	**122,200**	**160,700**
Usage		
Urban diversions	12,580	29,500
Coliban Channel rural diversions	13,600	
Campaspe Irrigation District diversions	13,500	23,900
Licensed private diversions from regulated streams [(4)]	4,300	10,900
Licensed private diversions from unregulated streams	600	1,200
Small catchment dams	28,800	28,800
Campaspe River to Waranga Western Channel	0	1,300
Sub-total	**73,400**	**95,500**
Losses		
Net evaporation losses from major storages	11,400	12,300
Losses from small catchment dams	14,700	14,700
In-stream infiltration to groundwater, flows to floodplain and evaporation [(5)]	1,500	34,000
Sub-total	**27,600**	**61,100**
Water Passed at Outlet of Basin		
Campaspe River outflow to River Murray	9,900	8,200
Environment's Share of Total Flow in the Campaspe Basin	**9,900**	**8,200**

Notes:

(1) Campaspe Weir, which has a capacity of over 1,000 ML, was included in the total storage volume in 2003/04. Goulburn-Murray Water only maintains the volume in the weir pool to be able to supply irrigation channels by gravity and hence does not consider it to be a harvestable storage. For this reason, it has not been included in the 2004/05 water balance.

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

(3) Assumed to be zero as Goulburn-Murray Water was unable to separate return flows by basin.

(4) The volume of estimated diversions decreased from the previous year due to an improvement of the calculation method by Goulburn-Murray Water.

(1) Losses estimated using loss functions from the Goulburn Simulation Model (REALM). The volume of estimated losses decreased from the previous year due to an improvement of the calculation method.

As shown in the balance, irrigation district diversions declined in 2004/05 compared to the previous season. This is due to the abnormally low allocations in 2004/05 (39%). In-stream losses are also considerably different, due to an improvement in the calculation method. In last year's water accounts, losses were back-calculated, whereas in the current year's water accounts, losses were extracted from the REALM model covering the river basin.

11.6.2 Small Catchment Dams

The capacity of small catchment dams in the Campaspe basin is estimated to be around 40,300 ML (Table 11-3). Usage in 2004/05 is estimated to be approximately equal to the average annual usage of 28,800 ML and, after allowing for losses, the total catchment run-off that is harvested as a result of the small catchment dams is estimated to be 43,500 ML.

Table 11-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	15,000	7,500	n/a
Irrigation	25,300	21,300	n/a
Total	**40,300**	**28,800**	**43,500**

Note:

(1) n/a: information not available

11.6.3 Water Entitlement Transfers

Transfers of water entitlements within the Campaspe basin are listed in Table 11-4. It can be seen from this table that there was a net import of water entitlement to the basin, with 62 ML being permanently traded out of the basin and 1,184 ML being temporarily traded into the basin.

Table 11-4 Water entitlement transfers in the Campaspe basin

Entitlement	Permanent Entitlement Transfer (ML)			Temporary Entitlement Transfer (ML)		
	Bought	Sold	Net Transfer To Entitlement	Bought	Sold	Net Transfer To Entitlement
Coliban Water						
Axedale, Goornong & Part Rochester (1)	0	0	0	50	0	50
Campaspe System	0	0	0	0	135	-135
Goulburn-Murray Water						
Campaspe District - Water right	0	478	-478	3,381	1,409	1,972
Campaspe District - Sales				0	0	0
Campaspe River - Water right	416	0	416	1,016	1,719	-703
Campaspe River - Sales				0	0	0
Total	**416**	**478**	**-62**	**4,447**	**3,263**	**1,184**

Notes:

(1) Coliban Water also purchased 918 ML of water right within the Campaspe Irrigation District in 2004/05, for use from 2005/06 onwards. This purchase will be accounted for under the Campaspe District water entitlement managed by Goulburn-Murray Water.

11.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 11-5. Compliance with individual bulk entitlement volumes is deemed to occur in Table

11-5 if water use is not more than the maximum volume allowed to be diverted in 2004/05. Full details of compliance with bulk entitlements are expected to be provided in the resource manager's 2004/05 report for the Campaspe basin.

It is evident in the irrigation diversion figures in Table 11-5 that the Goulburn-Murray Water entitlement is under-utilised, with only 22% of the entitlement volume being diverted over the 10 year period of assessment. This is primarily due to a recent history of lower than average allocations over the extended drought period.

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

Table 11-5 Volume of water diverted under bulk entitlements in the Campaspe basin

Entitlement	Period of Bulk Entitle-ment (years)	Total Bulk Entitlement – 30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?	Volume Diverted in 2004/05 (ML)
Coliban Water							
Axedale, Goornong & Part Rochester (2)	1	349	50	399	252	Yes	252
Coliban System	3	150,780	-135	150,645	88,427	Yes	25,721
Western Water							
Woodend	1	n/a	0	n/a	193	n/a	193
Goulburn-Murray Water							
Campaspe System	10	2,327,760	1,269	2,325,539	523,633	Yes	17,815
Total Annual Volume of Bulk Entitlements		**283,385**	**1,184**	**384,740**	**82,284**		**43,981**
Licensed Diversions from Unregulated Streams		1,559	0	1,559	600		600

Notes:

(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2004, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2004-05 period. The *actual* maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

(2) Temporary transfer to bulk entitlement occurred to cover usage above allocation. Allocation in 2004/05 for Axedale and Goornong (215 ML entitlement volume, remainder to Part Rochester) was 50% to urban customers, or a total of 107.5 ML excluding temporary trade, whilst usage in 2004/05 was 117 ML.

(3) n/a: bulk entitlement conversion order was not finalised at the beginning of 2004/05

11.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

The bulk entitlements in the Campaspe system have various passing flow requirements. Goulburn-Murray Water, as resource manager for the Campaspe basin, had not completed its compliance report at the time of publication of the water accounts.

No instances of non-compliance with passing flows were reported in 2004/05 by Coliban Water. Goulburn-Murray Water reported compliance failures with passing flow requirements following difficulty in determining minimum passing flow requirements under low flow conditions, due to measurement problems and inconsistency in travel time. Compliance failures also occurred due to errors in remotely accessed data.

11.6.6 Compliance with Streamflow Management Plans

No streamflow management plans are currently in operation in the Campaspe basin.

11.7 Groundwater Resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Campaspe basin, excluding stock and domestic use, is presented in Table 11-6. An estimate of stock and domestic groundwater use is provided in Table 11-7.

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 11-6.

The Campaspe basin contains part of the Campaspe Deep Lead WSPA, the Shepparton WSPA and the Ellesmere GMA. The volumes described in Table 11-6 and Table 11-7 are totals for the management areas and include the area that falls outside the Campaspe basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 11-6 Compliance with licensed groundwater volumes, Campaspe basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Ellesmere GMA (28%)	0-25	1,900	2,280	0	798	798	Not Available (6)
Campaspe Deep Lead WSPA (76%)	>25	46,039	46,039	25,270	443	25,713	Not Available (6)
Shepparton WSPA (12%)	0-25	203,619	203,619	64,820	15,000	79,820	Not Available (6)

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 11-7 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Ellesmere GMA	16	32
Campaspe Deep Lead WSPA	188	376
Shepparton WSPA	415	830

Note:

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

Table 11-8 Urban groundwater usage

Town Supplied	Licensed Allocation ML	Metered Use
Elmore	284	174
Trentham	48	16

11.8 Recycled Water

All sewage treatment plants in the Campaspe basin are operated by Coliban Water apart from Woodend, which is operated by Western Water. Around 54% of the volume of effluent passed through treatment plants in the basin was recycled for consumptive use (Table 11-9).

Table 11-9 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Elmore	40	0	0	0	0	0	0	40
Heathcote	119	94	0	94	0	0	0	25
Kyneton	646	328	0	328	0	0	318	0
Lockington	25	0	0	0	0	0	0	25
Rochester	299	113	0	113	0	0	0	186
Woodend	215	190	75	115	0	0	25	0
Total	**1,344**	**725**	**75**	**650**	**0**	**0**	**343**	**276**

Notes:

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

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

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

12 Loddon Basin

12.1 Location of Water Resources

The Loddon basin is located within the Murray-Darling Drainage Division. It includes the Loddon River and various smaller tributaries such as Bet Bet Creek and Bendigo Creek. The basin is crossed by the Waranga Western Channel, which provides water to users in the Loddon basin from the Goulburn Basin. For the purposes of the water accounts, the Loddon River catchment excludes the Torrumbarry Irrigation Area, which is mostly supplied from the River Murray. The Loddon River discharges to the River Murray and the Kerang Lakes, which both form part of the Murray basin in the water accounts. A map of the Loddon basin is shown in Figure 12-1.

Water supply protection areas (WSPA) within the Loddon basin include the whole of the Mid Loddon WSPA and Spring Hill WSPA, and parts of the Campaspe Deep Lead WSPA. Groundwater management areas (GMAs) within the Loddon basin include part of the Ellesmere GMA.

12.2 Responsibilities for Management of Water Resources

Goulburn-Murray Water manages the Pyramid-Boort Irrigation Area and the major reservoirs in the basin including Cairn Curran, Laanecoorie and Tullaroop Reservoirs, and is also the licensing authority responsible for groundwater and surface water licensed diversions.

Central Highlands Water and Coliban Water are responsible for urban water supply in the Loddon Basin, whilst the North Central Catchment Management Authority is responsible for waterway management.

12.3 Seasonal Overview

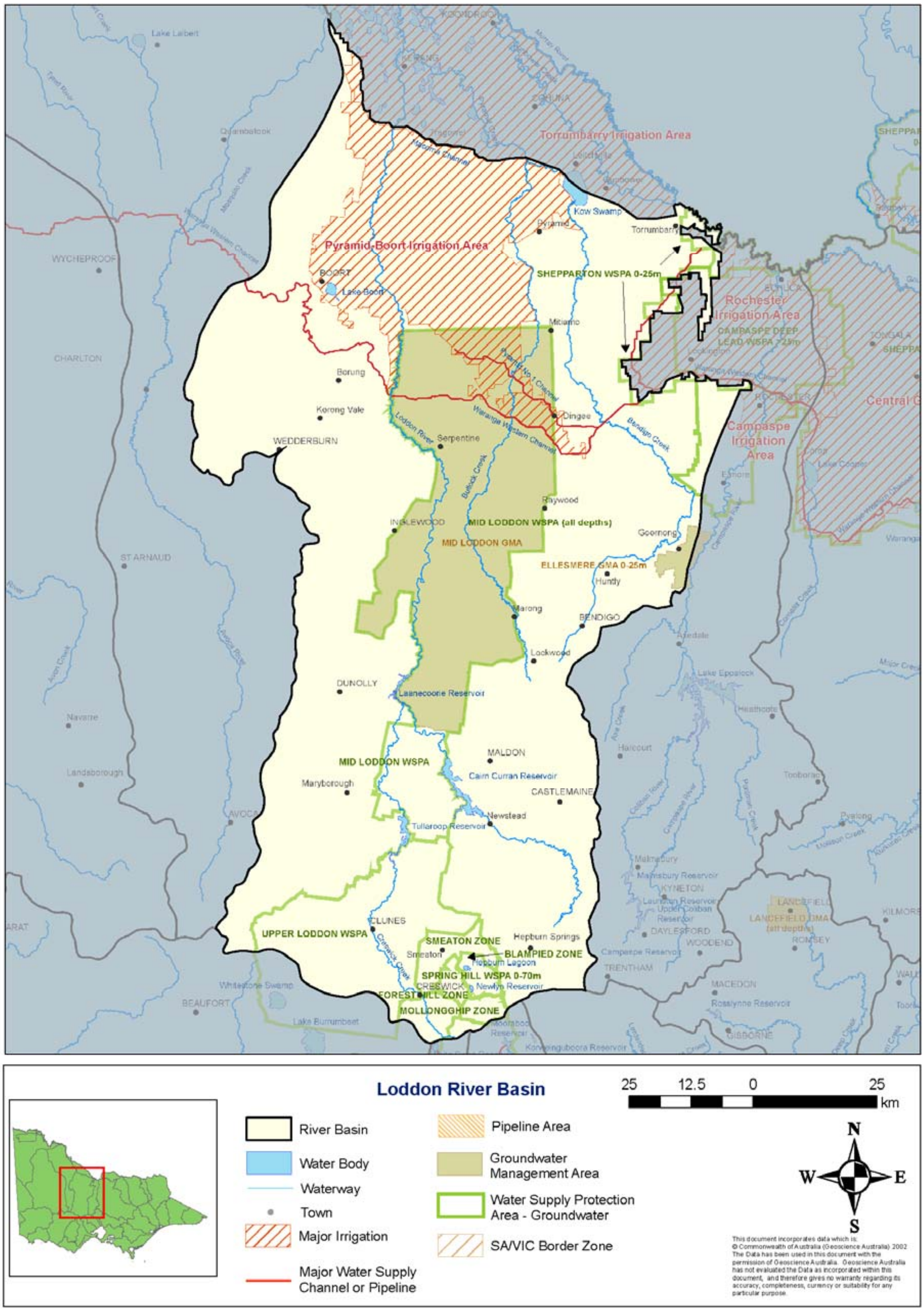
Rainfall conditions across most of the Loddon basin in 2004/05 were approximately equal to the long-term average. Streamflows were, however, very much below average. The year's streamflow from the basin recorded at Appin South (streamflow gauge number 407205) was around 6% of the long-term average. Further upstream on the Loddon River at Newstead (streamflow gauge number 407215), the streamflow was around 30% of the long-term average.

The low inflows in the Loddon basin in 2004/05, which were similar to 2003/04, resulted in restrictions and bans on water use throughout the year. Irrigation districts in the Loddon basin had an initial seasonal irrigation water allocation of 0% of entitlement, rising to 100% by the end of November 2004 and for the remainder of the season. This was well below the long-term median allocation of 150%. The low seasonal allocation in the Loddon basin was the result of low water availability in both the Goulburn and Loddon basins.

Bans and restrictions on licensed diversions from unregulated streams were put in place in several tributaries in the Loddon basin at various times throughout 2004/05. Irrigation bans were in place for Lake Meran and Lower Loddon River (below Fernihurst Weir) for the whole year. Irrigation diversions were banned along Bullock Creek (upper) between January and May 2005, whilst bans on irrigation diversions also occurred late in the season along the Upper Loddon River above Cairn Curran, Campbells Creek and Barkers Creek.

Urban water restrictions affected towns across the basin throughout the year. Throughout the year, Stage 1 restrictions (of four stages) were in place in Daylesford, and Stage 2 restrictions occurred in Maryborough and Talbot. Lexton was also on voluntary restrictions throughout 2004/05. The Loddon system managed by Coliban Water, which includes the townships of Bealiba, Bridgewater, Dunolly, Inglewood, Jarklin, Laanecoorie, Serpentine and Tarnagulla, was subject to Stage 4 restrictions (of four stage policy) from August 2004. This was eased to Stage 1 restrictions by mid-November 2004 and for the rest of 2004/05.

Figure 12-1 Map of the Loddon basin



Blue-green algal blooms were reported by Goulburn-Murray Water in Tullaroop Reservoir, from August to October 2004 and again from March 2005 onwards, and Hepburns Lagoon, from March 2005 onwards. Details of works undertaken to improve the basin's long-term water quality and river health during 2004/05 are available from the North Central Catchment Management Authority.

A statewide assessment of stream condition found that only 3% of streams in the Loddon basin are in good condition. The full report on the environmental health of rivers and streams in the Loddon basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005).

12.4 Summary of the 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 12-1.

Table 12-1 Summary of total water resource and water use in the Loddon basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	188,100	82,500
Groundwater [(1)]	Not available	Not available
Recycled Water	9,470	1,300

Notes:

(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90% of their surface area within the river basin boundary.

12.5 Water for the Environment

In 2004/05 there was no formal environmental water reserve established in the Loddon basin, however the Murray-Darling Basin Cap, which is a limit imposed on the volume of water that can be diverted from the rivers for consumptive use, applies in the Loddon basin. Water for the environment was also provided under passing flow obligations in consumptive bulk entitlements for water authorities in the basin.

A bulk entitlement conversion process was in progress in 2004/05 to convert water authorities' existing rights to water to a clearly defined entitlement. As part of this process, a separate entitlement for the environment has been proposed. This entitlement is likely to be finalised in 2005/06 and will provide a range of environmental flows to the Loddon basin. The North Central Catchment Management Authority completed the Upper Loddon Environmental Flow Study in 2004/05, which will be used to inform the Upper Loddon bulk entitlement process.

The ongoing drought continues to impact significantly on flows within all streams in the Loddon basin. The environment's share of total flow at the basin outlet was 8,100 ML, representing only approximately 5% of total inflows (Table 12-2).

When the environment's share of total flow in the Loddon River passes out of the basin into the River Murray, it becomes a resource available to the Murray basin, along with other River Murray inflows. Once it has reached the River Murray, the Loddon River water is under the control of the Murray-Darling Basin Commission and may be used to meet the River Murray's environmental flow requirements and/or be diverted for consumptive use.

12.6 Surface Water Resources

12.6.1 Water Balance

A surface water balance for the Loddon basin is shown in Table 12-2.

Note that 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 the major rural water storages of Laanecoorie, Cairn Curran and Tullaroop Reservoirs plus some of the smaller urban storages, such as Newlyn Reservoir, Hepburn Lagoon, and Evansford Reservoir.

Table 12-2 Balance of surface water in the Loddon basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
Volume in storage at start of year (1)	18,000	23,400
Volume in storage at end of year (1)	40,000	20,600
Change in storage	22,000	2,800
Inflows		
Catchment inflow (2)	161,000	168,500
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	6,750	7,790
Sub-total	**167,800**	**176,300**
Usage		
Urban diversions	2,910	2,850
Licensed private diversions from regulated streams (3)	23,400	8,000
Licensed private diversions from unregulated streams (3)	6,200	5,700
Small catchment dams	50,000	50,300
Sub-total	**82,500**	**66,600**
Losses		
Net evaporation losses from major storages	14,600	12,600
Losses from small catchment dams	29,600	29,500
In-stream infiltration to groundwater, flows to floodplain and evaporation (4)	10,900	52,700
Sub-total	**55,100**	**94,900**
Water Passed at Outlet of Basin		
Loddon River outflow to River Murray (Appin Sth)	4,100	5,500
Wandella Creek at Fairlea	n/a	n/a
Mount Hope Creek at Mitiamo	4,000	6,500
Bullock Creek, Calivil and Nine Mile Creek	n/a	n/a
Environment's Share of Total Flow in the Loddon Basin	**8,100**	**12,000**

Notes:

(1) 2003/04 storage volume included Spring Gully and Sandhurst Reservoirs. Both reservoirs are utilisedused as off-stream storages and so have been excluded in the 2004/05 water balance.

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

(3) The volume increased from the previous year due to an improvement of the calculation method.

(4) 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). The volume of estimated losses decreased from the previous year due to an improvement of the calculation method.

There is a degree of uncertainty in the water balance for the Loddon basin because of the interaction of the Waranga Western Channel with streams across the basin, most notably at Serpentine Creek and Loddon Weir. The estimate of inflows does not include any transfers from the Waranga Western Channel to the Loddon River downstream of Loddon Weir, as an assessment of this transfer was unavailable at the time of preparation of the State Water Accounts. As such it was assumed that there was no net transfer from the Waranga Western Channel to the Loddon basin.

Private diversions in 2004/05 were significantly higher relative to the previous year because of greater water availability in the basin. In-stream losses were significantly lower because of an improvement in the method of calculation from the previous year. In-stream losses in 2004/05 were sourced from the Goulburn Simulation REALM model.

12.6.2 Small Catchment Dams

The capacity of small catchment dams in the Loddon basin is estimated to be around 72,300 ML (Table 12-3). Usage in 2004/05 is estimated to be approximately equal to the average annual usage of 50,000 ML and, after allowing for losses, the total catchment run-off that is harvested as a result of the small catchment dams is estimated to be 79,600 ML.

Table 12-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	31,600	15,800	n/a
Irrigation	40,700	34,200	n/a
Total	**72,300**	**50,000**	**79,600**

Note:

(1) n/a: information not available

12.6.3 Water Entitlement Transfers

Transfers of water entitlements within the Loddon basin are listed in Table 12-4. It can be seen from this table that there was a net export of water entitlement from the basin, with 4,016 ML being permanently traded out of the basin and 5,689 ML being temporarily traded out of the basin.

Table 12-4 Water entitlement transfers in the Loddon basin

<table>
<tr><th rowspan="2">Entitlement</th><th colspan="3">Permanent Entitlement Transfer (ML)</th><th colspan="3">Temporary Entitlement Transfer (ML)</th></tr>
<tr><th>Bought</th><th>Sold</th><th>Net Transfer To Entitlement</th><th>Bought</th><th>Sold</th><th>Net Transfer To Entitlement</th></tr>
<tr><td colspan="7">Central Highlands Water</td></tr>
<tr><td>Maryborough</td><td>0</td><td>0</td><td>0</td><td>10</td><td>0</td><td>10</td></tr>
<tr><td colspan="7">Goulburn-Murray Water</td></tr>
<tr><td>Loddon River - Water right</td><td rowspan="2">245</td><td rowspan="2">245</td><td rowspan="2">0</td><td>1,680</td><td>5,550</td><td>-3,870</td></tr>
<tr><td>Loddon River – Sales</td><td>4</td><td>0</td><td>4</td></tr>
<tr><td>Pyramid-Boort - Water right</td><td rowspan="2">522</td><td rowspan="2">4538</td><td rowspan="2">-4016</td><td>34,685</td><td>36,957</td><td>-2,273</td></tr>
<tr><td>Pyramid-Boort - Sales</td><td>440</td><td>0</td><td>440</td></tr>
<tr><td>Total</td><td>767</td><td>4,783</td><td>-4,016</td><td>36,818</td><td>42,507</td><td>-5,689</td></tr>
</table>

12.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 12-5. Compliance with individual bulk entitlement volumes is deemed to occur in Table 12-5 if water use is not more than the maximum volume allowed to be diverted in 2004/05. It should be noted that many of the bulk entitlements for the Loddon basin were not completed by the start of 2004/05 and values are not reported against those bulk entitlements. A number of these bulk entitlement conversion orders were completed during 2004/05 and will be reported against in subsequent water accounts.

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

Table 12-5 Volume of water diverted under surface water entitlements in the Loddon basin

Entitlement	Period of Bulk Entitlement (years)	Total Bulk Entitlement –30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?
Central Highlands Water						
Creswick	1	500	0	500	0	Yes
Daylesford	1	916	0	916	630	Yes
Lexton	1	n/a	0	n/a	27	n/a
Maryborough	1	n/a	10	n/a	1,000	n/a
Talbot	1	n/a	0	n/a	539	n/a
Coliban Water						
Loddon System	1	820	0	820	710	Yes
Goulburn-Murray Water						
Bullarook	1	n/a	0	n/a	6,484	n/a
Loddon	1	n/a	-5,699	n/a	16,944	n/a
Total Annual Volume of Bulk Entitlements		**2,236**	**-5,689**	**2,236**	**26,334**	
Licensed Diversions from Unregulated Streams		15,411	0	15,411	6,200	

Note:
(1) n/a: bulk entitlement conversion order was not finalised at the beginning of 2004/05

12.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

The bulk entitlements in the Loddon basin have various passing flow requirements. Detailed compliance with these passing flows has not been assessed as part of this report.

12.6.6 Compliance with Streamflow Management Plans

A streamflow management plan (SFMP) is currently being developed in the Upper Loddon basin. This SFMP was not in operation in 2004/05.

12.7 Groundwater Resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Loddon basin, excluding stock and domestic use, is presented in Table 12-6. An estimate of stock and domestic groundwater use is provided in Table 12-7. In the Loddon basin groundwater is used as an urban 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 12-8.

The Loddon basin contains all of the Mid Loddon WSPA and Spring Hill WSPA as well as part of the Upper Loddon WSPA, Bungaree WSPA, Campaspe Deep Lead WSPA and Ellesmere GMA. The volumes described in Table 12-6 and Table 12-7 are totals for the management areas and include the area that falls outside the Loddon basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 12-6 Compliance with licensed groundwater volumes, Loddon basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Ellesmere GMA (72%)	0-25	1,900	2,280	0	798	798	Not Available (6)
Bungaree WSPA (9%)	> 60	5,356	5,356	2,610	0	2,610	Not Available (6)
Campaspe Deep Lead WSPA (15%)	>25	46,039	46,039	25,270	443	25,713	Not Available (6)
Mid Loddon WSPA (100%)	ALL	34,046	34,046	15,580	2,000	17,580	34,046
Spring Hill WSPA (100%)	<70	4,909	4,909	1,300	70	1,370	4,909
Upper Loddon WSPA (75%)		13,036	13,036	2,210	4,000	6,210	Not Available (6)

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not includegroundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 12-7 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Ellesmere GMA	16	32
Bungaree WSPA	252	504
Campaspe Deep Lead WSPA	188	376
Mid Loddon WSPA	235	470
Spring Hill WSPA	136	272
Upper Loddon WSPA	306	612

Note:

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

Table 12-8 Urban Groundwater usage in the Loddon basin

Town Supplied	Licensed Allocation ML	Metered Use
Forest Hill	350	229
Dean	30	21
Waubra	100	44
Learmonth	100	59
Clunes	350	185

12.8 Recycled Water

The sewage treatment plants in the Loddon basin are operated by the Coliban and Central Highlands Water Authorities. Around 14% of the volume of effluent passed through treatment plants in the basin was recycled for consumptive use (Table 12-9).

Table 12-9 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Bendigo	6,296	750	0	750	0	0	4,825	721
Bridgewater, Inglewood	80	0	0	0	0	0	0	80
Castlemaine	1,029	0	0	0	0	0	1,029	0
Clunes	48	0	0	0	0	0	0	48
Creswick	236	5	0	5	0	0	231	0
Daylesford	486	279	25	254	0	0	47	160
Kerang	466	0	0	0	0	0	466	0
Maryborough	801	261	130	131	0	0	154	386
Pyramid Hill	25	0	0	0	0	0	0	25
Total	**9,467**	**1,295**	**155**	**1,140**	**0**	**0**	**6,752**	**1,420**

Notes:

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

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

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

13 Avoca Basin

13.1 Location of Water Resources

The Avoca basin is located within the Murray-Darling Drainage Division. It includes the Avoca River plus a number of small tributaries such as Strathfillan Creek and Cherry Tree Creek. The Avoca River spills into the Kerang Lakes at Lake Bael Bael, as well as a number of distributaries that flood wetlands to the north-east and north-west of the river during high flow periods. A map of the river basin is shown in Figure 13-1.

There are no groundwater management areas or water supply protection areas located within the Avoca basin.

13.2 Responsibilities for Management of Water Resources

Central Highlands Water is responsible for urban water supply for towns in the southern part of the Avoca basin. Grampians Wimmera Mallee Water, formed by the recent amalgamation of Grampians Water and Wimmera Mallee Water, supplies towns in the northern part of the basin via water sourced from outside the basin.

Grampians Wimmera Mallee Water is also responsible for the delivery of rural water supplies to farms via the Wimmera-Mallee Channel system, the Northern Mallee Pipeline, the western end of the Waranga Western Channel, and diversions from rivers. Grampians Wimmera Mallee Water is the surface water and groundwater licensing authority across the basin.

The North-Central Catchment Management Authority is responsible for waterway management in the Avoca basin.

13.3 Seasonal Overview

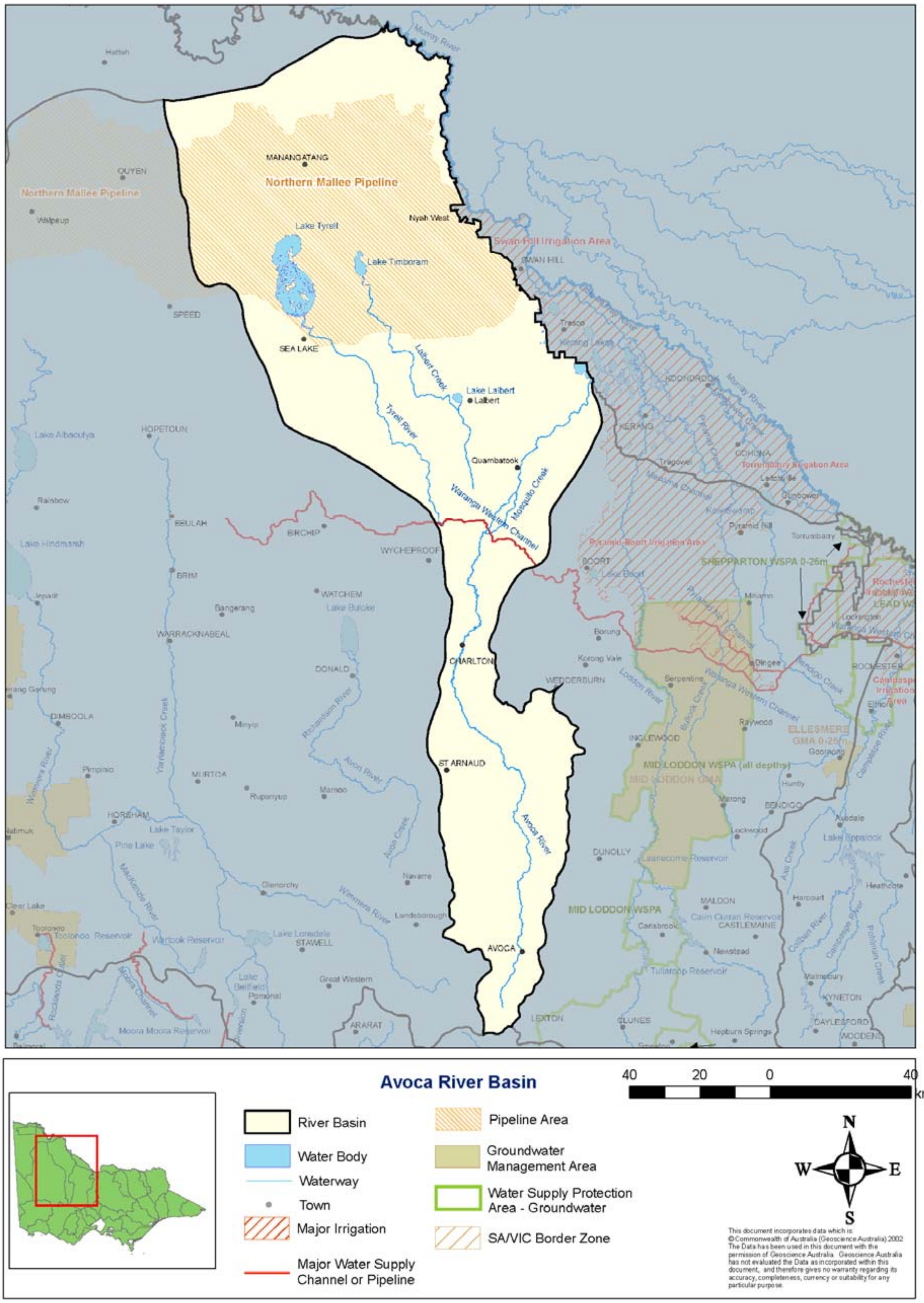
Rainfall conditions in the Avoca basin in 2004/05 were approximately equal to the long-term average across the basin. However, due to previously prolonged dry conditions this was not reflected in the basin's streamflows. For example, the streamflow recorded at Quambatook (streamflow gauge number 408203) for 2004/05 was less than 1% of the long-term average, whilst streamflows further upstream at Coonooer Bridge (streamflow gauge number 408200) were approximately 3% of long-term average flows at this location. The Avoca River flows into a terminal lake system, Lake Bael Bael and The Marshes that can overflow into the Murray system in wet years.

Similar to the previous season, Stage 3 (of eight stages) restrictions were in place at Redbank, and voluntary restrictions applied in Ampitheatre and Avoca throughout 2004/05. No restrictions on water use by licensed diverters were reported in the Avoca basin.

A statewide assessment of stream condition found that 35% of streams in the Avoca basin are in poor condition. The full report is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005).

Details of works undertaken to improve the basin's long-term water quality and river health during 2004/05 are available from the North Central Catchment Management Authority.

Figure 13-1 Map of the Avoca basin



13.4 Summary of the 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 13-1.

Table 13-1 Summary of total water resource and water use in Avoca basin 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	25,200	14,400
Groundwater (1)	Not available	Not available
Recycled Water	340	310

Note:

(1) There are no GMAs or WSPAs in this river basin. Groundwater use from unincorporated areas is not known.

13.5 Water for the Environment

There was no formal environmental water reserve established in the Avoca basin in 2004/05. However, the Murray-Darling Basin Cap, which is a limit imposed on the volume of water that can be diverted from the rivers for consumptive use, applies in the Avoca basin. The cap on the Avoca is accounted for as part of the Wimmera-Mallee river valley system. Whilst the cap restrains further increase in water diversions, it does not constrain new developments provided the water for them is obtained by using water more efficiently, or by purchasing water from existing developments.

The Avoca River is one of the few rivers in Northern Victoria which does not have a major reservoir or diversion weir in its upper reaches. Because of this, it has a flow pattern which is very close to natural.

The ongoing drought continues to impact significantly on flows within all streams in the Avoca basin. No flow was recorded in 2004/05 at the basin outlet to the Kerang Lakes, which outflow to the River Murray during wet years. The main use of water for the environment in the Avoca basin is the periodic flooding of wetlands coinciding with major flood events. No such events occurred in 2004/05. In its lower reaches, the Avoca River is a perched river that loses substantial volumes to groundwater, particularly during bank overflow events when water spreads across the floodplain.

No significant natural or environmental flows were recorded in the Tyrrell or Lalbert Creeks, apart from some channelled flows from the existing Wimmera Mallee stock and domestic system.

13.6 Surface Water Resources

13.6.1 Water Balance

A surface water balance for the Avoca basin is shown in Table 13-2.

It can be seen from the water balance that small catchment dams are the main source of water supply in the catchment.

Urban use of surface water resources decreased significantly in 2004/05 as the water supply for the township of Avoca was switched to groundwater. In-stream losses to groundwater, the floodplain and evaporation losses also decreased significantly in 2004/05 due to reduced streamflows in comparison to the previous year.

The estimate of in-stream losses to groundwater and evaporation is the volume of water that is unaccounted for after separately estimating inflows, outflows, change in storage and consumptive use.

Table 13-2 Balance of surface water in the Avoca basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume (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	25,200	33,900
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	20	30
Sub-total	**25,200**	**33,900**
Usage		
Urban diversions (2)	20	170
Licensed private diversions from unregulated streams	1,700	1,600
Small catchment dams	12,700	12,700
Sub-total	**14,400**	**14,400**
Losses		
Net evaporation losses from major storages	0	0
Losses from small catchment dams	9,700	9,700
In-stream infiltration to groundwater, flows to floodplain and evaporation (3)	1,100	9,800
Sub-total	**10,800**	**19,500**
Water Passed at Outlet of Basin		
Avoca River outflow to Kerang Lakes	0	0
Environment's Share of Total Flow in the Avoca Basin	**1,100**	**9,800**

Notes:

(1) Excludes wetlands in the Avoca basin.

(2) Urban water supply for the township of Avoca was sourced from groundwater in 2004/05.

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

13.6.2 Small Catchment Dams

The capacity of small catchment dams in the Avoca basin is estimated to be around 19,400 ML (Table 13-3). Usage in 2004/05 is estimated to be approximately equal to the average annual usage of 12,700 ML and, after allowing for losses, the total catchment run-off that is harvested as a result of the small catchment dams is estimated to be 22,400 ML.

Table 13-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	10,500	5,300	n/a
Irrigation	8,900	7,400	n/a
Total	**19,400**	**12,700**	**22,400**

Note:

(1) n/a: information not available

13.6.3 Water Entitlement Transfers

There were no records of water entitlement transfers to or from the Avoca basin in 2004/05.

13.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk water entitlement is shown in Table 13-4. 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 2004/05.

Licences on unregulated streams are not currently metered and hence compliance has not been assessed. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 13-4 Volume of water diverted under surface water entitlements in the Avoca basin

Entitlement	Period of Bulk Entitlement (years)	Total Bulk Entitlement –30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?
Central Highlands Water						
Amphitheatre	1	25	0	25	12	Yes
Avoca [(1)]	1	233	0	233	0	Yes
Redbank	1	20	0	20	5	Yes
Total Annual Volume of Bulk Entitlements		**278**	**0**	**278**	**17**	
Licensed Diversions from Unregulated Streams		3,512	0	3,512	1,700	

Note:

(1) Urban water supply for the township of Avoca was sourced from groundwater in 2004/05.

13.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

The bulk entitlements in the Avoca basin have various passing flow requirements. No instances of non-compliance with passing flows were reported in 2004/05 by Central Highlands Water.

13.6.6 Compliance with Streamflow Management Plans

No streamflow management plans (SFMPs) are currently being developed in the Avoca basin. None were in operation in the Avoca basin in 2004/05.

13.7 Groundwater Resources

There are no groundwater management areas or water supply protection areas located within the Avoca basin. However, groundwater is 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 13-5. The bore used to supplement the urban water supply of Redbank has no licensed allocation because it is a shire drought relief bore. Like stock and domestic bores, drought relief bores generally do not have an allocation associated with them. Central Highlands Water has an agreement with the shire for the temporary use of this bore.

Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 13-5 Urban groundwater usage

Town Supplied	Licensed Allocation ML	Metered Use
Avoca	200	175
Redbank	0	5

13.8 Recycled Water

Around 93% of the volume of effluent passed through treatment plants in the basin was recycled for consumptive use (Table 13-6).

The Avoca treatment plant is designed to recycle all wastewater received. During 2004/05, a new irrigation system was installed at the site. Whilst some wastewater was recycled during the commissioning of the new system, the remainder was stored in a winter storage lagoon for use during 2005/06.

Table 13-6 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Avoca	32	8	0	8	0	0	0	24
Charlton	37	37	0	37	0	0	0	0
Sea Lake	55	55	0	55	0	0	0	0
St. Arnaud	171	171	1	170	0	0	0	0
Wycheproof	41	41	0	41	0	0	0	0
Total	**336**	**312**	**1**	**311**	**0**	**0**	**0**	**24**

Notes:

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

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

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

14 Mallee Basin

14.1 Location of Water Resources

The Mallee basin is located within the Murray-Darling Drainage Division. There are no major surface water resources generated within the Mallee basin, however water is transferred to the region from the Murray basin via the Northern Mallee Pipeline, from the Wimmera and Glenelg Basins via the Wimmera-Mallee channel system, and from the Goulburn and Loddon Basins via the Waranga Western Channel.

Groundwater is a significant source of water supply in the region. Water supply protection areas (WSPAs) within the Mallee basin include all of the Murrayville WSPA. Groundwater management areas (GMAs) within the Mallee include part of both the Telopea Downs GMA and the Kaniva GMA. The Mallee basin also contains the border groundwater management zones 9B, 10B and 11B, in addition to part of Zone 8B. A map of the river basin is shown in Figure 14-1.

14.2 Responsibilities for Management of Water Resources

Grampians Wimmera Mallee Water is responsible for supplying water to farms and towns in the north of the basin via the Northern Mallee Pipeline from the River Murray, and in the south of the basin from the Wimmera-Mallee channel system.

Grampians Wimmera Mallee Water, via an agreement with Lower Murray Water, is also the licensing authority for the Murrayville WSPA and all other groundwater bores in the Mallee.

The Mallee Catchment Management Authority is responsible for waterway management.

14.3 Seasonal Overview

Rainfall conditions in the Mallee basin in 2004/05 were approximately equal to the long-term average across the basin.

Seasonal restrictions on water use are reported under the relevant river basin from where supplies are sourced, i.e. Murray and Wimmera basins.

The Mallee basin generally doesn't have any defined streams other than the Murray River, which runs along the entire northern edge of the basin, and has only a few small tributaries at various points close to the Murray. An assessment of the environmental health of rivers and streams in the Mallee basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net).

14.4 Summary of the Total Water Resources in the Basin

The total volumes of water available and supplied from water resources in the Mallee basin are shown in Table 14-1.

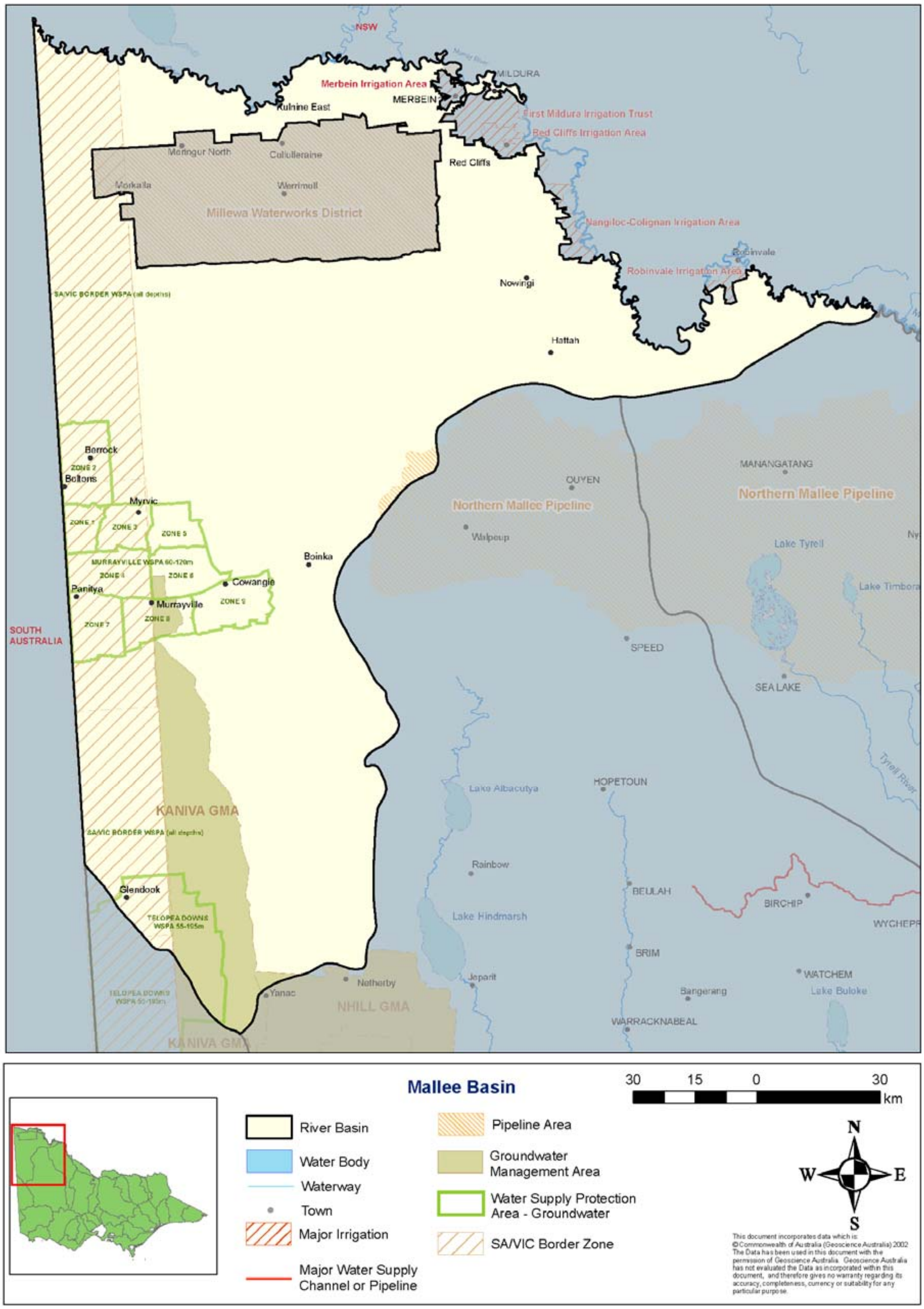
Table 14-1 Summary of total water resource and water use in the Mallee basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	0	0
Groundwater [(1)]	Not available	Not available
Recycled Water	0	0

Note:

(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90% of their surface area within the river basin boundary.

Figure 14-1 Map of the Mallee basin



14.5 Water for the Environment

In 2004/05 there was no formal environmental water reserve established in the Mallee basin. However, the Murray-Darling Basin Cap, which is a limit imposed on the volume of water that can be diverted from the rivers for consumptive use, applies in the Mallee basin. The cap on the Mallee basin is accounted for as part of the Wimmera-Mallee river valley system. While the cap restrains further increase in water diversions, it does not constrain new developments provided the water for them is obtained by using water more efficiently, or by purchasing water from existing developments.

Refer to Chapter 6, Murray basin, for environmental water provided to Red Gums along the River Murray floodplain that borders that Mallee basin.

14.6 Surface Water Resources

14.6.1 Water Balance

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

14.6.2 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 farm dams is assumed to be zero.

14.6.3 Water Entitlement Transfers

There were no transfers of water entitlement in the Mallee basin.

14.6.4 Volume Diverted

There are no bulk entitlements supplied from surface water sourced from within the Mallee basin. The volume diverted under bulk entitlements for water supplied to the Mallee basin is presented in the water accounts for the adjacent river basins.

14.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

Surface water resources are imported from other basins and hence there are no formal passing flow obligations within the Mallee basin itself. Compliance with passing flows at the source of water diverted is reported in the water accounts for adjacent river basins.

14.6.6 Compliance with Streamflow Management Plans

No streamflow management plans exist or are being developed in the Mallee basin.

14.7 Groundwater Resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Mallee basin, excluding stock and domestic use, is presented in Table 14-2. An estimate of stock and domestic groundwater use is provided in Table 14-3. 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 14-4.

The Mallee basin contains all of the Murrayville WSPA as well as part of the Telopea Downs WSPA and Kaniva GMA. The volumes described in Table 14-2 and Table 14-3 are totals for the management areas and include the area that falls outside the Mallee basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 14-2 Compliance with licensed groundwater volumes, Mallee basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Kaniva GMA (80%)	Tertiary Confined Sand Aquifer	1,100	0	0	0	0	Not Available (6)
Murrayville WSPA (100%)	60-120	9,633	9,633	4,700	0	4,700	9633
Telopea Downs WSPA (38%)	55-195	7,482	7,482	3,830	0	3,830	Not Available (6)

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 14-3 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Kaniva GMA	0	0
Murrayville WSPA	250	500
Telopea Downs WSPA	73	146

Note:

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

Table 14-4 Urban groundwater usage

Town Supplied	Licensed Allocation ML	Metered Use
Tutye (Cowangie)	40	10
Murrayville	475	175

14.8 Recycled Water

There are no sewage treatment plants within the Mallee basin.

15 Wimmera Basin

15.1 Location of Water Resources

The Wimmera basin is located within the Murray-Darling basin. A map of the river basin is shown in Figure 15-1.

The Wimmera River is the longest land-locked river in Victoria. It flows from the north side of the Great Dividing Range near Elmhurst (the Mt Cole and Pyrenees Ranges), and from the Grampians Ranges to Lake Hindmarsh. During exceptionally wet periods, Lake Hindmarsh overflows through Outlet Creek, into Lake Albacutya and onto a series of smaller lakes and the Wirrengren Plain in the Mallee. The system is essentially a series of pools which must fill before water spills downstream into the next. When filled, Lake Hindmarsh is the largest natural freshwater body in Victoria. Both Lake Hindmarsh and Lake Albacutya support significant bird life including some species listed under the Japan-Australia Migratory Birds Agreement and the China-Australia Migratory Birds Agreement. Lake Albacutya is a Ramsar-listed wetland of international significance.

The Avon and Richardson Rivers, which are also included in the water accounts for the Wimmera basin, flow into and terminate in Lake Buloke.

Groundwater management areas (GMAs) within the Wimmera basin include the whole Balrootan GMA and Nhill GMA, and part of the Goroke GMA.

15.2 Responsibilities for Management of Water Resources

The former organisations of Wimmera Mallee Water and Grampians Water merged to become Grampians Wimmera Mallee Water in July 2004.

Grampians Wimmera Mallee Water is the licensing authority for groundwater and surface water resources in the Wimmera basin, and is responsible for the Wimmera-Mallee water supply system which delivers water to urban centres and farms in a large part of the Wimmera, Mallee and Avoca basins.

Central Highlands Water supplies the towns of Landsborough and Navarre.

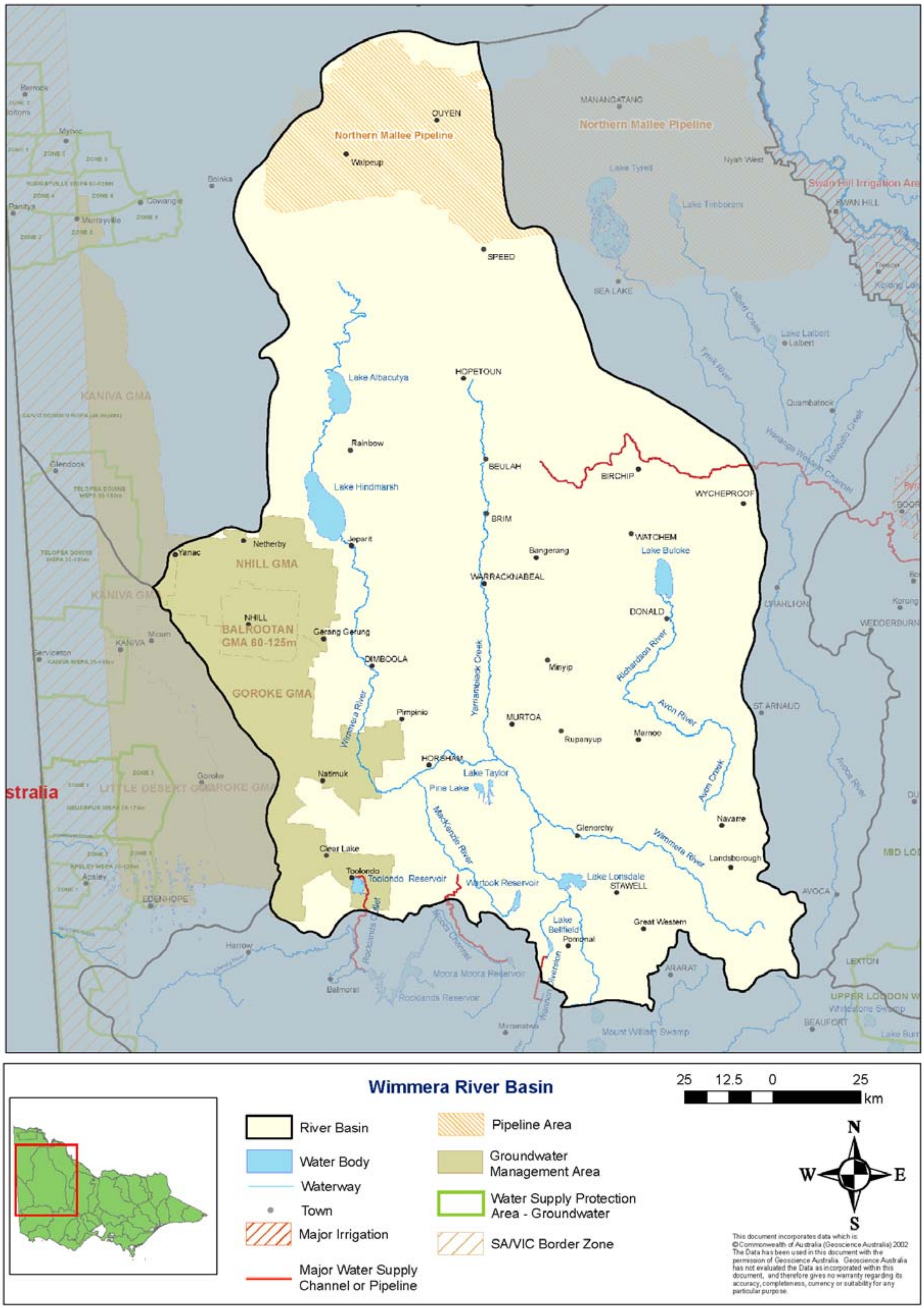
The Wimmera Catchment Management Authority is responsible for waterway management in the Wimmera River catchment, and the North Central Catchment Management Authority is responsible for waterway management in the Avon and Richardson River catchments.

15.3 Seasonal Overview

Conditions in the Wimmera basin are reported over the period 1 November 2004 to 31 October 2005, to concur with the specifications of major bulk entitlements in the basin.

Conditions in the Wimmera basin remained extremely dry in 2004/05. In October 2005, the storages in the Wimmera Mallee domestic and stock system were only 9% full, with many large storages such as Lake Lonsdale and Toolondo Reservoir empty. Rainfall conditions in the Wimmera basin in 2004/05 were slightly drier than the long-term average across the whole of the basin. Streamflows were typically well below average. The year's flows in the Wimmera River over Glenorchy Weir (streamflow gauge no. 415201) were 14% of the long-term average, flows in the Wimmera River at Glynwylln were 10% of the long-term average, whilst flows at Lochiel (streamflow gauge no. 415246) were only 2% of the long-term average. Outflows from the Richardson River at Donald (streamflow gauge no. 415257) were close to zero.

Figure 15-1 Map of the Wimmera basin



Following the extreme dry conditions in 2003/04 that required severe restrictions, the 2004/05 summer domestic and stock channel run was limited to the filling of one dam per 250 ha, while the 2005 winter channel run filled only one dam for every 400 ha. Supply-by-agreement customers' allocation for 2004/05 was also low at 40%, while the seasonal allocation to irrigators in the Wimmera basin was approximately 8% of entitlement. There was no irrigation allocation available in the previous two seasons.

Urban restrictions across the Wimmera basin were extensive, and are listed below:

- Stage 3 (of five stage) restrictions continued (from November 2002) at Berriwillock, Beulah, Charlton, Culgoa, Dooen, Hopetoun, Marnoo, Nullawil, Rainbow, Tarranyurk, Warracknabeal, Watchem, and Wycheproof, and (from February 2003) at Ararat, Birchip, Donald, Glenorchy, Great Western, Halls Gap, Horsham, Jeparit, Minyip, Murtoa, Noradjuha, Pimpinio, Pomonal, St Arnaud, Stawell, Reids (Taits) Lane, and (from November 2003) at Antwerp, Brim, Lascelles, Rupanyup, Woomelang, and Yaapeet.
- Restrictions were increased to Stage 4 (of five) at Natimuk, Clear Lake, Jung and Dimboola in October 2005.
- Stage 3 restrictions (of a five stage restriction policy) were lifted at Lalbert in January 2005 as a result of the source for the town water supply being changed to the Murray River via the Cannie Ridge pipeline system.

The ongoing drought continues to impact significantly on flows within all streams in the Wimmera River and the Avon Richardson basins. The extended dry period and lack of flows resulted in salinity levels in the lower Wimmera reaching over 50,000 EC in late spring 2004 (prior to environmental flow releases). Some small algal blooms were observed in the lower Wimmera River in later spring and early summer.

Details of works undertaken to improve the basin's long-term water quality and river health during 2004/05 are available from the relevant catchment management authorities.

An assessment of the environmental health of rivers and streams in the Wimmera basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net).

15.4 Summary of the 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 15-1.

Table 15-1 Summary of total water resource and water use in the Wimmera basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	106,400	93,100
Groundwater (1)	Not available	400
Recycled Water	2,330	2,330

Note:

(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90% of their surface area within the river basin boundary.

15.5 Water for the Environment

In May 2004, a bulk entitlement of 32,240 ML was granted to the Minister for Environment for the Wimmera and Glenelg rivers. This is the environment's share of water savings from the Northern Mallee Pipeline Scheme which was completed in 2003. While annual allocations to the environment were made as the pipelining progressed, the first formal allocations under the bulk entitlement came into force on 1 November 2004.

The Murray-Darling Basin Cap, which is a limit imposed on the volume of water that can be diverted from the rivers for consumptive use, applies in the Wimmera basin. The Cap on the Wimmera is accounted for under the Wimmera-Mallee river valley system. While the Cap restrains further increase in water diversions, it does not constrain new development provided the water is obtained by water efficiency savings, or by purchasing water from existing entitlement holders.

Consistent with the bulk entitlement conversion orders, a total of 11,987 ML was allocated to the Glenelg and Wimmera Rivers during the 2004/05 flow season (1 November 2004 – 30th October 2005). In addition, 3,300 ML was allocated to the Glenelg River as a compensation flow to contribute in achieving environmental objectives. The Inter Catchment Advisory Group (ICAG) met to determine the split of environmental allocation between catchments. As a result of these negotiations, the Wimmera River received 5,954 ML in 2004/05, whilst 4,433 ML was carried over in storage for future use.

Nearly 5,000 ML of environmental water releases were provided to the lower Wimmera River (downstream of the Yarriambiack Creek confluence to Jeparit) between November 2004 and March 2005. The flow regime implemented was based on ecological recommendations and was made up of a late spring fresh, baseflow, and a summer fresh followed by a second baseflow. The summer fresh was augmented by a significant rainfall event in February 2005. The aim of the flows was to provide a flushing flow from Taylors Lake outlet that would travel as far down the river as Jeparit Weir, replenish pools and improve water quality and provide a continuing baseflow to maintain water quality. Flows substantially reduced surface water salinities in the lower Wimmera (from Tarranyurk to Jeparit) with reductions of around 35,000 EC units observed at several sites on the lower Wimmera. The key benefits of the environmental water releases were:

- the spring fresh initially filled pools and resulted in a connection between pools;
- the summer fresh enabled water quality to be substantially improved along most of the river;
- timing of the summer fresh meant that flow was sustained well past the environmental flow ceasing in early March, keeping salinity lower for a longer period of time; and
- lower air temperatures during passage of summer fresh meant downstream losses were substantially reduced.

Almost 500 ML of environmental water releases were provided to the mid-reach of the MacKenzie River (between the Dad and Dave Weir and Distribution Heads) between December 2004 and May 2005. The aim of the flows was to provide short ‘cease-to-flow’ periods, maintain water quality and habitat quantity in permanent pools with baseflows, and to wet low-lying habitats during high flows. The flow regime implemented was based on the recommendation of the Stressed Rivers report (Department of Natural Resources and Environment and Wimmera Catchment Management Authority, 2002) and consisted of a series of summer freshes, cease-to-flow periods and baseflows. This regime maintained both pool habitat and water quality along the reach.

No significant natural or environmental flows were recorded in the northern section of the Yarriambiack or Outlet Creeks in the Mallee Catchment Management Authority region.

The Wimmera-Mallee pipeline project aims to pipe the domestic and stock water supply system, covering an area of approximately 2.3 million hectares, to reduce losses that occur via seepage and evaporation from the existing channels. Approximately 83,000 ML of annual savings will be available for other uses such as additional environmental flows in the Wimmera and Glenelg Rivers. Water savings from the pipeline will enhance the health of the Wimmera River and significant terminal lakes in the region. The project is currently in the design phase.

15.6 Surface Water Resources

15.6.1 Water Balance

A surface water balance for the Wimmera basin is shown in Table 15-2. In November 2004 the major storages in the Wimmera basin held only 15% of their capacity. During the year the catchment inflows were 73,900 ML, approximately 23% of the long-term average of 316,400 ML (National Land and Water Audit, 2001). By October 2005, the volume in storage had decreased to 9% of capacity.

Table 15-2 Balance of surface water in the Wimmera basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
Volume in storage at start of year (1)	65,700	43,300
Volume in storage at end of year	47,900	61,600
Change in storage	-17,800	18,300
Inflows		
Catchment inflow (2)	73,900	107,300
Inflows from the Glenelg Basin	32,500	34,900
Return flow from irrigation	0	0
Treated effluent discharged back to river	0	120
Sub-total	**106,400**	**142,300**
Usage		
Urban diversions	9,680	9,460
Irrigation and S & D diversions	67,300	32,400
Licensed private diversions from unregulated streams	1,700	1,900
Small catchment dams	14,400	14,300
Sub-total	**93,100**	**58,100**
Losses (3)		
Net evaporation losses from major storages	14,200	22,100
Losses from small catchment dams	8,500	8,600
In-stream infiltration to groundwater, flows to floodplain and evaporation (4 & 5)	7,200	33,300
Sub-total	**29,900**	**63,900**
Water Passed at Outlet of Basin		
River outflows to Lake Hindmarsh (measured at Lochiel) (5)	1,200	2,000
River outflows to Lake Buloke	40	0
Environment's Share of Total Flow in the Wimmera Basin		
Environmental releases to Rivers from storage	6,000	3,900
River outflows to terminal lakes	1,240	2,000

Notes:

(1) For the Wimmera basin, the beginning of the year is October 2004, and the end of the year is October 2005 .

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

(3) The losses accounted for in the water balance do not include any of the considerable losses that occur while water is being transferred from storages to the point of use.

(4) Losses estimated using loss functions from the Grampians Wimmera Mallee Resource Allocation Model (REALM). The volume of estimated losses decreased from the previous year due to an improvement of the calculation method.

(5) Includes environmental water diversion of 7,600 ML in 2004/05.

The largest diversions from the basin were for irrigation and stock and domestic use of 67,300 ML. Losses from the system (not including losses from the stock and domestic supply system) were estimated to be 29,900 ML. The evaporation from storages alone was 20% of the catchment inflows. The losses accounted for in the water balance do not include any of the considerable losses that occur while water is being transferred from storages to the point of use.

Grampians Wimmera Mallee Water received 4,500 ML of inflows from the Waranga Western Channel. This transfer is from diversions made in the Goulburn basin and is not shown in the surface water balance for the Wimmera River.

Grampians Wimmera Mallee Water supplied 1,130 ML to the Avoca basin via the Wimmera-Mallee domestic and stock water supply system, and 1,160 ML to the Hopkins basin to supply urban centres including Ararat, Willaura and Lake Bolac. Irrigation and stock and domestic water are supplied to the Avoca basin via the Wimmera channel system.

15.6.2 Small Catchment Dams

The capacity of small catchment dams in the Wimmera basin is estimated to be around 22,300 ML (Table 15-3). Usage in 2004/05 is estimated to be approximately equal to the average annual usage of 14,400 ML and, after allowing for losses, the total catchment run-off that is harvested as a result of the small catchment dams is estimated to be 22,900 ML.

Table 15-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	12,900	6,500	n/a
Irrigation	9,400	7,900	n/a
Total	22,300	14,400	22,900

Note:
(1) n/a: information not available

15.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water entitlements within the basin in 2004/05.

15.6.4 Volume Diverted

Bulk entitlements were granted to Grampians Wimmera Mallee Water and the Minister for Environment for the Wimmera and Glenelg Rivers in 2004.

The volume of water diverted under each water authority's bulk entitlement is shown in Table 15-4. 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 2004/05.

Licences on unregulated streams are not currently metered and hence compliance has not been assessed. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 15-4 Volume of water diverted under surface water entitlements in the Wimmera basin

Entitlement	Period of Bulk Entitle-ment (years)	Total Bulk Entitlement – 30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?	Volume Diverted in 2004/05 (ML)
Central Highlands Water							
Landsborough - Navarre	1	60	0	60	0	Yes	0
Grampians Wimmera Mallee Water							
Elmhurst	1	n/a	0	n/a	17	n/a	17
Halls Gap	1	n/a	0	n/a	16	n/a	16
Willaura, Moyston, Lake Bolac and Wickliffe	1	n/a	0	n/a	176	n/a	176
Wimmera and Glenelg Rivers - Grampians Water	5	65,300	0	65,300	n/a	n/a	9,468
Wimmera and Glenelg Rivers - Wimmera Mallee Water	5	802,100	0	802,100	n/a	n/a	67,276
Minister for Environment							
Wimmera and Glenelg Rivers	5	161,200	0	161,200	n/a	n/a	7,554
Total Annual Volume of Bulk Entitlements		**205,780**	**0**	**205,780**			**84,507**
Licensed Diversions from Unregulated Streams		2,421	0	2,421	1,700		1,700

Notes:

(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2004, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2004-05 period. The *actual* maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

(2) n/a: bulk entitlement conversion order was either not finalised at the beginning of 2004/05 or, in the case of multi-year bulk entitlements, 2004/05 was the first season of operation of bulk entitlements and diversions prior to 2004/05 are not applicable.

15.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

Central Highlands Water complied with all passing flow obligations specified in their bulk entitlement.

No non-compliances with passing flow obligations were reported by Grampians Wimmera Mallee Water.

15.6.6 Compliance with Streamflow Management Plans

There is no streamflow management plan (SFMP) currently in operation in the Wimmera basin. A SFMP is being prepared for the Upper Wimmera River.

15.7 Groundwater Resources

A summary of the licensed entitlements and use for groundwater management areas that overlap the Wimmera basin, excluding stock and domestic use, is presented in Table 15-5. An estimate of stock and domestic groundwater use is provided in Table 15-6. Groundwater is used as an urban water supply for the townships of Landsborough, Nhill, Boroka and Kiata. The licensed entitlements and metered use for these groundwater supplies is provided in Table 15-7.

The Wimmera basin contains all of the Balrootan (Nhill) GMA, and parts of the Nhill GMA and Goroke GMA. The volumes described in Table 15-5 and Table 15-6 are totals for the management areas and include the area that falls outside the Wimmera basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 15-5 Compliance with licensed groundwater volumes, Wimmera basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Balrootan (Nhill) GMA (100%)	60-125	980	1,522	370	0	370	980
Goroke GMA (63%)	Tertiary Confined Sand Aquifer	2,200	0	0	0	0	Not Available (6)
Nhill GMA (98%)	Tertiary Confined Sand Aquifer	1,200	0	0	0	0	1,200

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 15-6 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Balrootan (Nhill) GMA	38	76
Goroke GMA	0	0
Nhill GMA	0	0

Note:

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

Table 15-7 Urban groundwater usage

Town Supplied	Licensed Allocation ML	Metered Use
Landsborough	0	28
Nhill	1,000	335
Boroka	30	0
Kiata	40	4

15.8 Recycled Water

Grampians Wimmera Mallee Water operates 12 sewage treatment plants in the Wimmera basin, and reuses 100% of the effluent at eight of these plants. Approximately 83% of the treated effluent was reused during 2004/05, for irrigation of pasture, horticulture and vineyards, and watering of recreational facilities and parks (Table 15-8).

Table 15-8 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Birchip	52	52	0	52	0	0	0	0
Dimboola	89	89	0	89	0	0	0	0
Donald	113	113	0	113	0	0	0	0
Halls Gap	137	137	2	135	0	0	0	0
Horsham	1,130	1,130	143	988	0	0	0	0
Jeparit	0	0	0	0	0	0	0	0
Murtoa	88	88	0	88	0	0	0	0
Natimuk	0	0	0	0	0	0	0	0
Nhill	165	165	0	165	0	0	0	0
Rainbow	0	0	0	0	0	0	0	0
Stawell	444	444	149	295	0	0	0	0
Warracknabael	109	109	109	0	0	0	0	0
Total	**2,327**	**2,327**	**403**	**1,924**	**0**	**0**	**0**	**0**

Notes:

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

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

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

16 East Gippsland Basin

16.1 Location of Water Resources

The most eastern river basin within Victoria, the East Gippsland basin, is located within the South East Coast Drainage Division. The basin includes the Genoa River, the most eastern river in Victoria, which has its headwaters in New South Wales and flows south-east through Victoria before reaching the ocean near Mallacoota.

Other rivers within the basin include the Betka River, Wingan River, Thurra River, Cann River and the Bemm River. The Bemm River is a heritage listed river which flows into the Sydenham Inlet, a significant wetland. A map of the river basin is shown in Figure 16-1.

There are no groundwater management areas or water supply protection areas located within the East Gippsland basin.

16.2 Responsibilities for Management of Water Resources

Southern Rural Water is the licensing authority in this basin and manages licensed diversions from groundwater and surface water sources. East Gippsland Water is responsible for urban water supply in the basin, which includes the towns of Mallacoota, Cann River and Bemm River. The East Gippsland Catchment Management Authority is responsible for waterway management in the basin.

16.3 Seasonal Overview

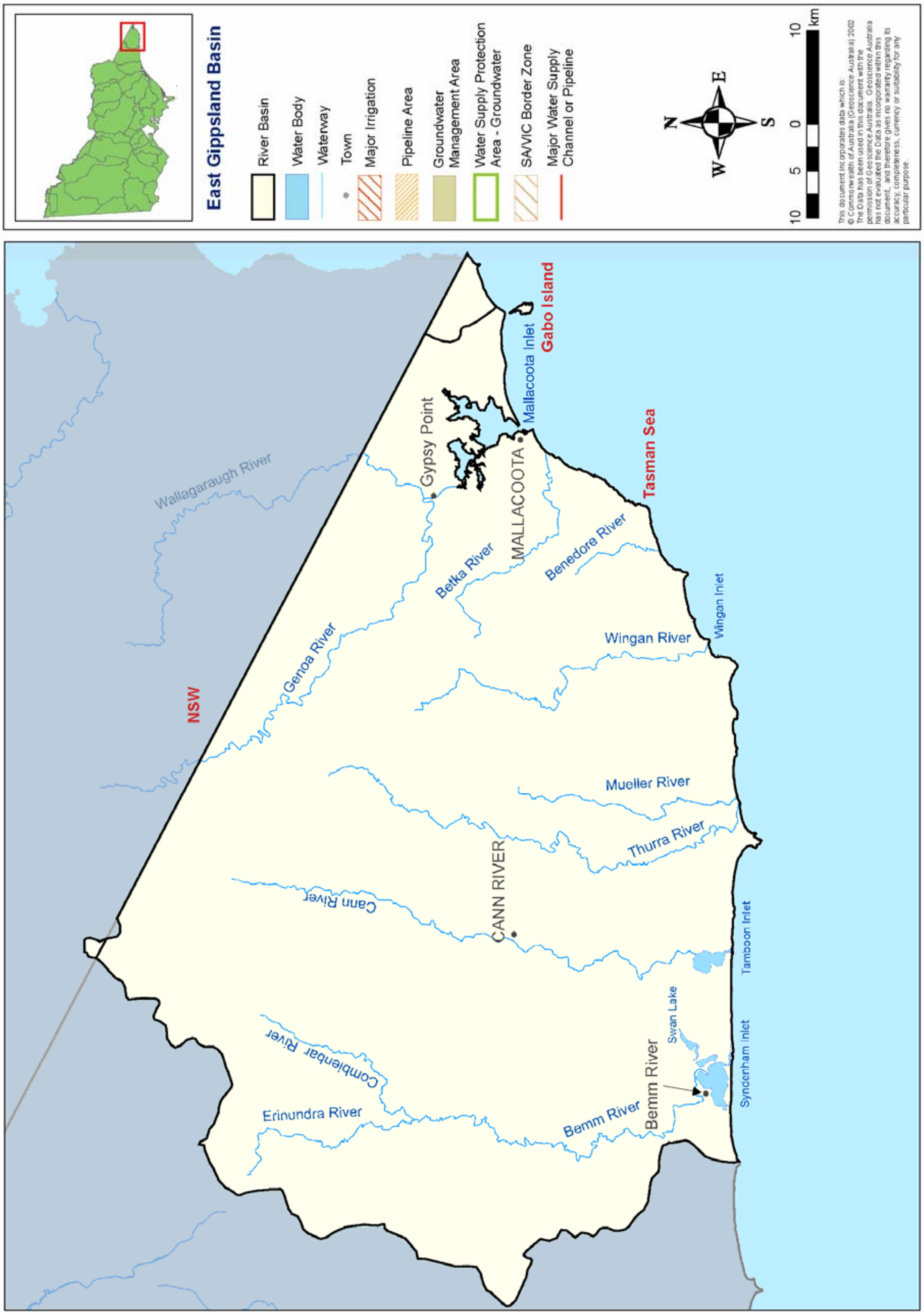
Rainfall conditions in the East Gippsland basin in 2004/05 were slightly drier than average at around 80-100% of the long-term average annual rainfall. Despite experiencing close to average rainfall, streamflows were well below average due to the ongoing effect of previous dry years having depleted soil moisture. This was reflected in the streamflow recorded at Cann River (gauge number 221201) where the streamflow in 2004/05 was only 16% of the long-term average. This was similar to the previous year's run-off, despite much higher rainfall in 2004/05.

As per 2003/04, no urban or irrigation restrictions were imposed in the basin in 2004/05. Urban water consumption was slightly less in 2004/05 due to a cooler and wetter summer period. There are no seasonal allocations in the East Gippsland basin.

Water quality in the basin remained generally good and there were no reports of poor water quality affecting consumptive use.

A statewide assessment of stream condition found that 99% of streams in the East Gippsland basin are in good or excellent condition. An assessment of the environmental health of rivers and streams in the East Gippsland basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net). Details of works undertaken to improve the basin's long-term water quality and river health during 2004/05 are available from the East Gippsland Catchment Management Authority.

Figure 16-1 Map of the East Gippsland basin



16.4 Summary of the 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 16-1. As shown, there is very low extraction of surface water relative to the available resource in the basin. All treated effluent is used for productive purposes.

Table 16-1 Summary of total water resource and water use in the East Gippsland basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	159,300	1,700
Groundwater (1)	0	0
Recycled Water	30	30

Note:

(1) There are no GMAs or WSPAs in the East Gippsland basin. Groundwater use from unincorporated areas was not available for the water accounts.

16.5 Water for the Environment

No formal environmental water reserve is established in the East Gippsland basin. In 2004/05, minimum passing flows for habitat provision were delivered through management of licensed extractions and bulk entitlements.

The environment's share of total flow at the basin outlet was 157,500 ML, which is approximately 99% of total inflows (Table 16-2). The 157,500 ML represents all water flowing from the basin which was not taken out of waterways for consumptive uses.

16.6 Surface Water Resources

16.6.1 Water Balance

The surface water balance for the East Gippsland basin for 2004/05 is shown in Table 16-2. The 2003/04 surface water balance is also provided in this table for comparison. As shown, the two years were almost identical in terms of both availability and use of surface water resources.

No reservoir information is recorded in the water balance as there are no major storages in the East Gippsland basin with a capacity greater than 1,000 ML.

The inflows to the East Gippsland basin originate from both New South Wales and Victoria and 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, as the contribution from each State cannot be readily separated for individual years. In 2004/05, the total inflows to the East Gippsland Basin were only 14% of their long-term average of 1,122,000 ML a year.

Approximately 1% of the catchment inflows were diverted for consumptive use, predominantly by small catchment dams.

As part of the water balance calculation, the estimation of inflows for the East Gippsland basin were based on the sum of outflows plus diversions. It was assumed that there were no in-stream losses to groundwater and evaporation, as these could not readily be calculated.

Table 16-2 Balance of surface water in the East Gippsland basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
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)	159,300	160,500
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	0	0
Sub-total	**159,300**	**160,500**
Usage		
Urban diversions	240	260
Licensed private diversions from unregulated streams	400	600
Small catchment dams	1,100	1,100
Sub-total	**1,700**	**1,900**
Losses		
Net evaporation losses from major storages	0	0
Losses from small catchment dams	100	100
In-stream infiltration to groundwater, flows to floodplain and evaporation (2)	0	0
Sub-total	**100**	**100**
Water Passed at Outlet of Basin		
River outflows to the ocean	157,500	158,500
Environment's Share of Total Flow in the East Gippsland Basin	**157,500**	**158,500**

Notes:

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

(2) Assumed to be zero because data is not readily available.

16.6.2 Small Catchment Dams

The capacity of small catchment dams in the East Gippsland basin is estimated to be around 1,700 ML (Table 16-3). Usage in 2004/05 is estimated to be approximately equal to the average annual usage of 1,100 ML and, after allowing for losses, the total catchment run-off that is harvested as a result of the small catchment dams is estimated to be approximately 1,200 ML.

Table 16-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	800	400	n/a
Irrigation	900	700	n/a
Total	**1,700**	**1,100**	**1,200**

Note:

(1) n/a: information not available

16.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water entitlements, diversion licences or sales water within the basin in 2004/05.

16.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 16-4.

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 2004/05. Full details of compliance with bulk entitlements are provided in the resource manager's 2004/05 Report for the Gippsland Basin Water Accounts (Southern Rural Water, 2005).

Licensed water use on unregulated streams is not currently metered and hence compliance has not been assessed. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 16-4 Volume of water diverted under surface water entitlements in the East Gippsland basin

Entitlement	Period of Bulk Entitlement (years)	Total Bulk Entitlement –30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?
East Gippsland Water						
Bemm River	1	100	0	100	33	Yes
Cann River	1	192	0	192	53	Yes
Mallacoota	1	330	0	330	155	Yes
Total Annual Volume of Bulk Entitlements		**622**	**0**	**622**	**241**	
Licensed Diversions from Unregulated Streams	1	724	0	724	400	

16.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

Only the Mallacoota bulk entitlement has a passing flow requirement. East Gippsland Water did not report any non-compliance with passing flows in 2004/05.

The maintenance of these passing flow requirements was not independently audited.

16.6.6 Compliance with Streamflow Management Plans

There is no streamflow management plan currently in operation in the East Gippsland basin.

16.7 Groundwater Resources

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. The bore was not used in 2004/05.

There are no groundwater management areas or water supply protection areas located within the East Gippsland basin. However, groundwater is used to supply urban water for the township of Mallacoota. The licensed entitlements and metered use for this groundwater supply is provided in Table 16-5. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 16-5 Urban groundwater usage

Town Supplied	Licensed Allocation ML	Metered Use
Mallacoota	70	0

16.8 Recycled Water

The sewage treatment plant at Mallacoota is operated by East Gippsland Water. All of the volume of effluent passed through this treatment plant was recycled (Table 16-6). Water recycled by East Gippsland Water is reused for a number of applications including pasture and tree plantations.

In 2004/05, major construction work on the Cann River Sewerage Scheme was undertaken. This scheme will take several years to become fully operational, and will provide for the connection of additional properties to the treated effluent pipeline and allow the storage and reuse of treated wastewater for irrigation purposes, such as fodder production and cattle grazing.

Table 16-6 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Mallacoota	33	33	0	33	0	0	0	0
Total	**33**	**33**	**0**	**33**	**0**	**0**	**0**	**0**

Notes:

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

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

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

17 Snowy Basin

17.1 Location of Water Resources

The Snowy basin is located within the South East Coast Drainage Division in eastern Victoria. The Snowy River starts its course in New South Wales and forms part of the Snowy Mountains Hydroelectric Scheme. In Victoria, major tributaries such as the Deddick River, Buchan River and Brodribb River, join the Snowy River before it flows into the ocean near Orbost. The Snowy River is one of the region's heritage-listed rivers. A map of the river basin is shown in Figure 17-1.

It should be noted when reading this chapter that details of the operation of the Snowy Mountains Hydroelectric Scheme in New South Wales are not reported on, other than to report the volume of water that the Snowy River in Victoria receives from New South Wales at the border.

Groundwater management areas (GMAs) within the Snowy basin include the whole of the Orbost GMA.

17.2 Responsibilities for Management of Water Resources

Southern Rural Water is the licensing authority and manages groundwater and surface water licensed diversions. East Gippsland Water is responsible for urban water supply in the basin, which includes the towns of Buchan and Orbost. The East Gippsland Catchment Management Authority is responsible for waterway management in the Snowy basin.

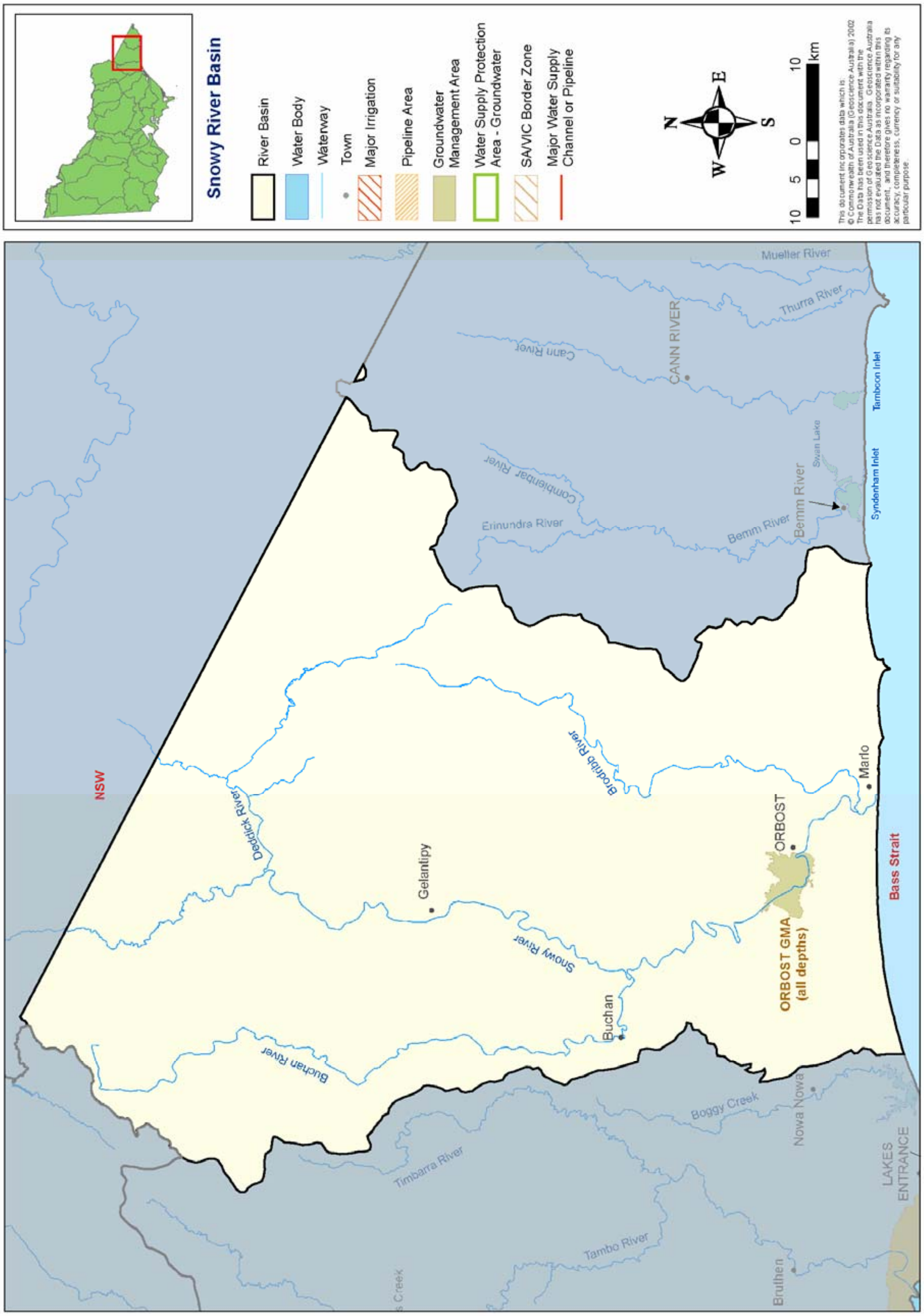
17.3 Seasonal Overview

Rainfall conditions in the Snowy basin in 2004/05 were slightly drier than average at around 80-100% of the long-term average annual rainfall. Despite experiencing close to average rainfall, streamflows were well below average due to the ongoing effect of previous dry years having depleted soil moisture. This was reflected in the streamflow in the Brodribb River (gauge number 222202) which in 2004/05 was only 36% of the long-term average. Total streamflows in 2004/05 were very similar to those estimated in 2003/04.

The impacts of the 2003 bushfires remain significant. Rainfall in January 2005 stirred up the remnants of debris still in the waterways after the bushfires, resulting in the need for East Gippsland Water to revert to alternative emergency water supplies. Due to poor water quality in the Buchan River (rather than a shortage of water quantity), residents of Buchan were subject to Stage 2 water restrictions for much of the year.

A statewide assessment of stream condition found that 66% of streams in the Snowy Basin are in good or excellent condition. Most of the sections of river found to be in poor or very poor condition were along the Snowy River, which is impacted on significantly by reduced flows from water diversions to the Snowy Mountains Hydroelectric Scheme. An assessment of the environmental health of rivers and streams in the Snowy basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net). Details of works undertaken to improve the basin's long-term water quality and river health during 2004/05 are available from the East Gippsland Catchment Management Authority.

Figure 17-1 Map of the Snowy basin



17.4 Summary of the 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 17-1. As shown, there is a very low extraction of surface water relative to the available resource in the basin. All treated effluent is reused for productive purposes.

Table 17-1 Summary of total water resource and water use in the Snowy basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	530,200	6,600
Groundwater (1)	1,200	300
Recycled Water	220	220

Note:

(1) Approximately 95% of the Snowy basin is an unincorporated area that contains a significant groundwater resource not represented in these totals.

17.5 Water for the Environment

The Victorian Government is committed to collective action between governments to restore the health of the Snowy River. Victoria has secured commitment from the New South Wales and the Commonwealth Governments to return 212,000 ML (21%) of the original flow to the Snowy River by 2012. Ultimately, the inter-governmental commitment aims to return 294,000 ML (28%) of original flow levels to the Snowy River.

In 2004/05, recent water savings projects allowed the establishment of bulk entitlements in the Goulburn and Murray basins to provide for the Snowy environmental water reserve. This reserve is yet to be utilised for the provision of environmental flow releases in the Snowy basin. In 2004/05, minimum passing flows for habitat provision were provided through the management of licensed extractions and bulk entitlements.

In addition to the volume currently specified in the Goulburn and Murray System Snowy environmental water reserves, further water savings projects are underway to achieve the 141,000 ML of flow Victoria has committed to the Snowy River.

Within the Victorian boundary of the Snowy basin, the environment's share of total flow was 523,000 ML, which is around 99% of the total streamflow in the Victorian portion of the basin (Table 17-2). This amount includes environmental flows required under bulk entitlements, and all other water flowing in the basin which was not taken out of waterways for consumptive uses.

17.6 Surface Water Resources

17.6.1 Water Balance

A surface water balance for the Snowy basin is shown in Table 17-2. As the State Water 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 major storages in the Victorian Snowy basin with a capacity greater than 1,000 ML.

The total volume of water flowing into the Victorian Snowy basin was recorded to be 530,200 ML in 2004/05. Of this total, 85,900 ML or 16% of the total inflows represented water flowing into Victoria from New South Wales. The inflow from the Victorian catchment of the Snowy basin was estimated to be 444,300 ML in 2004/05, representing only 34% of the long-term average, which is 1,317,000 ML a year (Department of Natural Resources and Environment, 2002).

The diversions in Victoria from the Snowy River represented 1% of the total inflows.

As part of the water balance calculation, the estimation of inflow from the Victorian catchment of the Snowy basin was based on the sum of diversions and outflows, minus inflows from New South Wales. It was assumed that there were no in-stream losses to groundwater and evaporation, as this could not be readily calculated.

Table 17-2 Balance of surface water in the Snowy basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
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)	444,300	468,600
Catchment inflow from NSW (2)	85,900	76,000
Return flow from irrigation	0	0
Treated effluent discharged back to river	0	0
Sub-total	**530,200**	**544,300**
Usage		
Urban diversions	870	800
Licensed private diversions from unregulated streams	2,300	2,800
Small catchment dams	3,400	3,400
Sub-total	**6,600**	**7,000**
Losses		
Net evaporation losses from major storages	0	0
Losses from small catchment dams	600	700
In-stream infiltration to groundwater, flows to floodplain and evaporation (3)	0	0
Sub-total	**600**	**700**
Water Passed at Outlet of Basin		
River outflows to the ocean	523,000	536,600
Environment's Share of Total Flow in the Snowy Basin	**523,000**	**536,600**

Notes:

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

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

(3) Assumed to be zero because data is not readily available.

17.6.2 Small Catchment Dams

The capacity of small catchment dams in the Snowy basin is estimated to be around 5,200 ML (Table 17-3). Usage in 2004/05 is estimated to be approximately equal to the average annual usage of 3,400 ML and, after allowing for losses, the total catchment run-off that is harvested as a result of the small catchment dams is estimated to be 4,000 ML.

Table 17-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	3,100	1,600	n/a
Irrigation	2,100	1,800	n/a
Total	**5,200**	**3,400**	**4,000**

Note:
(1) n/a: information not available

17.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water entitlements, diversion licences or sales water within the basin in 2004/05.

17.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 17-4. 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 2004/05. Full details of compliance with bulk entitlements are provided in the resource manager's 2004/05 Report for the Gippsland Basin (Southern Rural Water, 2005).

Licences on unregulated streams are not currently metered and hence compliance has not been assessed. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 17-4 Volume of water diverted under surface water entitlements in the Snowy basin

Entitlement	Period of Bulk Entitlement (years)	Total Bulk Entitlement –30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?
East Gippsland Water						
Buchan	1	170	0	170	20	Yes
Orbost	1	2,031	0	2,031	851	Yes
Total Annual Volume of Bulk Entitlements		**2,201**	**0**	**2,201**	**871**	
Licensed Diversions from Unregulated Streams		3,856	0	3,856	2,300	

17.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

Only the Orbost Bulk Entitlement has a passing flow requirement. East Gippsland Water did not report any non-compliance with passing flows in 2004/05.

17.6.6 Compliance with Streamflow Management Plans

There are no streamflow management plans currently in operation or planned in the Snowy basin.

17.7 Groundwater Resources

The Snowy basin contains all of the Orbost GMA. Licensed groundwater entitlements and use for the Orbost GMA in the Snowy basin, excluding stock and domestic use, are shown in Table 17-5. This table illustrates that the Orbost GMA is 100% allocated.

An estimate of stock and domestic groundwater use is provided in Table 17-6. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 17-5 Compliance with licensed groundwater volumes, Snowy basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Orbost GMA (100%)	ALL	1,200	1,200	270	0	270	1,200

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

Table 17-6 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Orbost GMA	0	0

Note:

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

17.8 Recycled Water

The sewage treatment plant at Orbost is operated by East Gippsland Water. All of the volume of effluent passed through this treatment plant was recycled (Table 17-7) and used on a number of applications including pasture and tree plantations.

Table 17-7 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Orbost	217	217	0	217	0	0	0	0
Total	217	217	0	217	0	0	0	0

Notes:

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

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

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

18 Tambo Basin

18.1 Location of Water Resources

The Tambo basin is located with the South East Coast Drainage Division in eastern Victoria. The basin contains the Tambo River and the Nicholson River, which flow into the Gippsland Lakes. The Gippsland Lakes are Ramsar-listed. A map of the river basin is shown in Figure 18-1. There are no groundwater management areas or water supply protection areas in the Tambo basin.

18.2 Responsibilities for Management of Water Resources

Southern Rural Water is the licensing authority and manages groundwater and surface water licensed diversions. East Gippsland Water is responsible for urban water supply in the Tambo basin, including the towns of Lakes Entrance and Bruthen. The East Gippsland Catchment Management Authority is responsible for waterway management in the Tambo basin.

18.3 Seasonal Overview

Rainfall conditions in the Tambo basin in 2004/05 were slightly drier than average at around 80-100% of the long-term average annual rainfall. Despite experiencing close to average rainfall, streamflows were well below average due to the ongoing effect of previous dry years having depleted soil moisture. This was reflected in the streamflow in the Tambo River at downstream of Ramrod Creek (gauge number 223205) which in 2004/05 was only 32% of the long-term average. Overall streamflows were slightly higher in 2004/05 than in the previous season, however streamflows in both years remained well below average at less than 20% of the estimated long-term average.

The effect of the bushfires on run-off volumes into streams is clearly evident. In parts of the basin that were completely or substantially burnt (Tambo River upstream of streamflow gauge 223213 at Duggan Creek and upstream of streamflow gauge 223202 at Swifts Creek), streamflow in 2004/05 was 63-70% of the long-term average. In parts of the basin that were not burnt substantially or at all (streamflow gauge 223205 Tambo River at Ramrod Creek and streamflow gauge 223212 Timbarra River at Wilkinson Creek), streamflow in 2004/05 was only 32-38% of the long-term average. Long-term averages at all sites were based on a concurrent period. This highlights that the lack of vegetation cover in areas that were burnt has most likely increased run-off to streams. This effect is expected to last for several years.

The impacts of the 2003 bushfires have been significant and there continues to be ongoing problems with water quality (such as excessive nutrients and sediments), particularly during high flows. Investigations into the recovery status of fire-affected catchments have noted that some areas have been slow to recover, which poses a potential risk to the receiving waters through sedimentation and nutrient transport.

Rainfall in January 2005 again stirred up the remnants of debris still in the waterways after the huge bushfires, meaning that East Gippsland Water had to revert to alternative emergency supplies. Due to poor water quality in the Tambo River (rather than a shortage of water quantity), residents of Swifts Creek were subject to Stage 2 water restrictions for much of the year.

There are no seasonal allocations for irrigation diversions in the Tambo basin.

An assessment of the environmental health of rivers and streams in the Tambo basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net).

Figure 18-1 Map of the Tambo basin

18.4 Summary of the 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 18-1. The total diversion does not include the surface water transferred from the Mitchell River to the towns of Bruthen, Nicholson, Johnsonville, Swan Reach, Metung and Lakes Entrance located in this basin. As shown, there is a very low extraction of surface water relative to the available resource in the basin. All treated effluent is reused for productive purposes.

Table 18-1 Summary of total water resource and water use in the Tambo basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	97,400	6,500
Groundwater (1)	0	0
Recycled Water	770	770

Note:

(1) There are no groundwater management areas or water supply protection areas located within the Tambo basin. Groundwater entitlements and use for unincorporated areas has not been included in the 2004/05 water accounts.

18.5 Water for the Environment

No formal environmental water reserve is established in the Tambo basin. In 2004/05, minimum passing flows for habitat provision were delivered through management of licensed extractions.

The environment's share of total flow at the basin outlet was 88,900 ML in 2004/05, which is about 91% of the total streamflow in the basin (Table 18-2). This amount includes environmental flows required under bulk entitlements, and all other water flowing in the basin which was not taken out of waterways for consumptive uses. The outlet of the basin is the Tambo River, which flows into the Gippsland Lakes.

18.6 Surface Water Resources

18.6.1 Water Balance

A surface water balance for the Tambo basin is shown in Table 18-2. Inflows to the Tambo basin were only 17% of the long-term average, which is 570,000 ML a year (Department of Natural Resources and Environment, 2002). The largest diversion of water from the basin was via farm dams.

No reservoir information is recorded in the water balance as there are no major storages in the Tambo basin with a capacity greater than 1,000 ML.

As part of the water balance calculation, the estimation of inflows for the Tambo basin was based on the sum of outflows plus diversions. It was assumed that there were no in-stream losses to groundwater and evaporation, as this could not readily be calculated.

Table 18-2 Balance of surface water in the Tambo basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
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)	97,400	89,200
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	0	0
Sub-total	**97,400**	**89,200**
Usage		
Urban diversions	60	50
Licensed private diversions from unregulated streams	2,500	3,100
Small catchment dams	3,900	4,000
Sub-total	**6,500**	**7,100**
Losses		
Net evaporation losses from major storages	0	0
Losses from small catchment dams	2,000	2,000
In-stream infiltration to groundwater, flows to floodplain and evaporation (2)	0	0
Sub-total	**2,000**	**2,000**
Water Passed at Outlet of Basin		
River outflows to the ocean	88,900	80,100
Environment's Share of Total Flow in the Tambo Basin	**88,900**	**80,100**

Notes:

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

(2) Assumed to be zero because data is not readily available.

18.6.2 Small Catchment Dams

The capacity of small catchment dams in the Tambo basin is estimated to be around 6,600 ML (Table 18-3). Usage in 2004/05 is estimated to be approximately equal to the average annual usage of 3,900 ML and, after allowing for losses, the total catchment run-off that is harvested as a result of the small catchment dams is estimated to be 5,900 ML.

Specific information on small catchment dam usage and losses for 2004/05 is not readily available, and the values provided in the table below are based on the estimated average annual impact.

Table 18-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	4,500	2,200	n/a
Irrigation	2,100	1,700	n/a
Total	**6,600**	**3,900**	**5,900**

Note:

(1) n/a: information not available

18.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water entitlements, diversion licences or sales water within the basin in 2004/05.

18.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 18-4. 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 2004/05. Full details of compliance with bulk entitlements are provided in the resource manager's 2004/05 Report for the Gippsland Basin (Southern Rural Water, 2005).

Licences on unregulated streams are not currently metered and hence compliance has not been assessed. 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 the Bairnsdale bulk entitlement.

Table 18-4 Volume of water diverted under surface water entitlements in the Tambo basin

Entitlement	Period of Bulk Entitlement (years)	Total Bulk Entitlement –30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?
East Gippsland Water						
Bruthen (1)	1	313	0	313	0	Yes
Lakes Entrance (1)	1	2,993	0	2,993	0	Yes
Nowa Nowa	1	118	0	118	22	Yes
Swifts Creek	1	224	0	224	38	Yes
Total Annual Volume of Bulk Entitlements		**3,648**	**0**	**3,648**	**59**	**Yes**
Licensed Diversions from Unregulated Streams		4,082	0	4,082	2,500	

Note:
(1) Bruthen and Lakes Entrance are now supplied from the Mitchell River system

18.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

There are no minimum passing flow requirements of any bulk entitlement in the Tambo basin.

18.6.6 Compliance with Streamflow Management Plans

There is no streamflow management plan currently in operation in the Tambo basin.

18.7 Groundwater Resources

There are no groundwater management areas or water supply protection areas located within the Tambo basin.

Groundwater allocation and use for unincorporated areas have not been included in the 2004/05 water accounts.

18.8 Recycled Water

The sewage treatment plants at Lakes Entrance and Metung are operated by East Gippsland Water. All of the effluent passed through these treatment plants was recycled (Table 18-5) and used on a number of applications including pasture and tree plantations, racecourses and golf courses.

The construction of the Bruthen Sewerage scheme was completed in June 2004. The connection of the town to sewerage will help to minimise local health risks and environmental degradation associated with poorly functioning septic tank systems.

Table 18-5 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Lakes Entrance	656	656	66	591	0	0	0	0
Metung	116	116	0	116	0	0	0	0
Total	**772**	**772**	**66**	**706**	**0**	**0**	**0**	**0**

Notes:

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

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

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

19 Mitchell Basin

19.1 Location of Water Resources

The Mitchell basin is located within the South East Coast Drainage Division and flows into the Gippsland Lakes near Bairnsdale. The Mitchell River and one of its tributaries, the Wonnangatta River, are heritage rivers. A map of the river basin is shown in Figure 19-1. Groundwater water supply protection areas (WSPAs) within the Mitchell basin include the whole Wy Yung WSPA.

19.2 Responsibilities for Management of Water Resources

Southern Rural Water is the licensing authority and manages groundwater and surface water licensed diversions. East Gippsland Water is responsible for urban water supply in the basin, which includes the town of Bairnsdale. The East Gippsland Catchment Management Authority is responsible for waterway management in the Mitchell basin.

19.3 Seasonal Overview

Rainfall conditions in the Mitchell basin in 2004/05 were slightly drier than average at around 80-100% of long-term average annual rainfall. Overall streamflows were only 45% of the estimated average, and were slightly less than those estimated in 2003/04. Heavy rains in September 2004 and February 2005 resulted in minor flooding in the Mitchell River.

The 2003 bushfires continue to cause ongoing problems with water quality in the affected catchments and waterways, particularly during high flows. Run-off from these areas can cause excessive nutrient and sediment input to waterways. Investigations into the recovery status of fire-affected catchments have noted that some areas have been slow to recover, which poses an increased risk to receiving waters through sedimentation and nutrient transport.

An assessment of the environmental health of rivers and streams in the Mitchell basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net). Details of works undertaken to improve the basin's long-term water quality and river health during 2004/05 are available from the East Gippsland Catchment Management Authority.

19.4 Summary of the 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 19-1. It can be seen from this table that the total extraction is small relative to the total water resource in this basin. The Mitchell River is also the source of supply for the towns of Bruthen, Nicholson, Johnsonville, Swan Reach, Metung and Lakes Entrance in adjacent river basins.

Figure 19-1 Map of the Mitchell basin

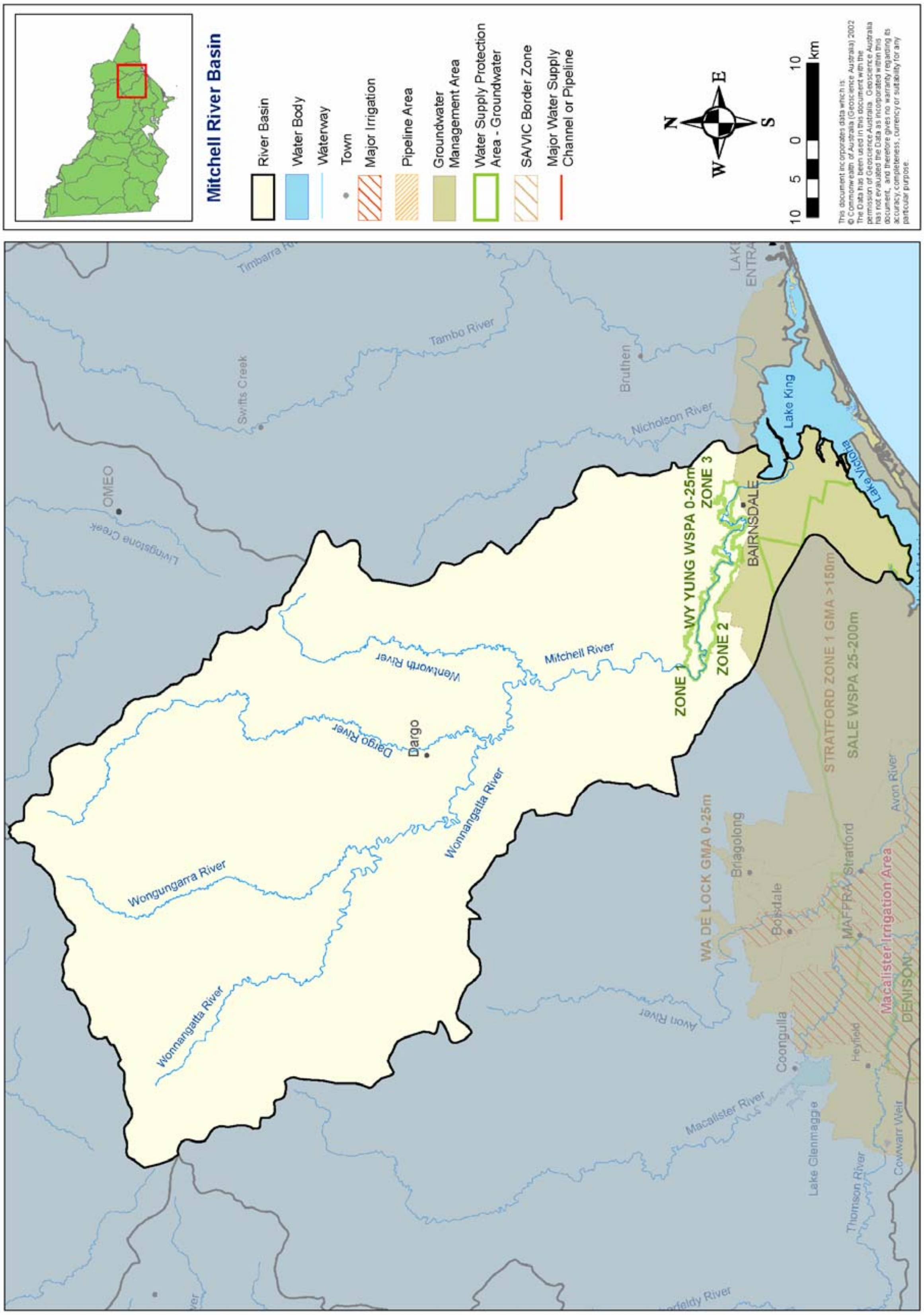


Table 19-1 Summary of total water resource and water use in the Mitchell basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	614,000	18,300
Groundwater (1)	7,500	800
Recycled Water	1,700	1,700

Note:

(1) Groundwater management units in the Mitchell basin cover less than 10% of the basin surface area and refer to specific aquifer depths. Aquifers not included in the management plans (e.g. the shallow aquifer in the Stratford GMA) and the unincorporated areas contain a significant groundwater resource.

19.5 Water for the Environment

No formal environmental water reserve is established in the Mitchell basin. In 2004/05, minimum passing flows for habitat provision were delivered through management of licensed extractions and bulk entitlements.

The environment's share of total flow at the basin outlet was around 97% of the total amount of streamflow in the basin (Table 19-2). This amount includes environmental flows required under bulk entitlements, and all other water flowing in the basin which was not taken out of waterways for consumptive uses. The environment's share of total flow in the Mitchell River passes out of the basin into the Gippsland Lakes, which have high environmental values that are listed under the Ramsar Convention.

Concern has been raised about the levels of water extraction in the Mitchell River and the consequent impact on the environmental health of the river system, particularly over summer. No additional licences for summer diversions are issued to prevent any increase in flow stress over the summer periods.

The Mitchell basin, along with the Tambo, Nicholson and Avon, are capped at the current level of diversions plus an additional 2,000 ML across the four basins for the interim period, pending the findings of an investigation of the freshwater needs of the Gippsland Lakes.

19.6 Surface Water Resources

19.6.1 Water Balance

A water balance for the Mitchell basin is shown in Table 19-2. During 2004/05, streamflow in the Mitchell basin was approximately 45% of the long-term average flow of 1,355,000 ML a year (Department of Natural Resources and Environment, 2002). Approximately 3% of the total basin inflows were diverted for consumptive use.

No reservoir information is recorded in the water balance as there are no major on-stream storages in the Mitchell basin with a capacity greater than 1,000 ML.

As part of the water balance calculation, the estimation of inflows for the Mitchell basin were based on the sum of diversions and outflows. The loss functions in the Resource Allocation Model (REALM) that incorporates the Mitchell basin indicates that there were no significant in-stream losses to groundwater and evaporation in 2004/05.

Table 19-2 Balance of surface water in the Mitchell basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
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)	614,000	754,300
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	0	0
Sub-total	**614,000**	**754,300**
Usage		
Urban diversions	4,830	4,960
Licensed private diversions from unregulated streams	9,000	11,000
Small catchment dams	4,500	4,600
Sub-total	**18,300**	**20,500**
Losses		
Net evaporation losses from major storages	0	0
Losses from small catchment dams	1,100	1,000
In-stream infiltration to groundwater, flows to floodplain and evaporation (2)	0	0
Sub-total	**1,100**	**1,000**
Water Passed at Outlet of Basin		
River outflows to the ocean	594,600	732,700
Environment's Share of Total Flow in the Mitchell Basin	**594,600**	**732,700**

Notes:

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

(2) Losses are estimated to be zero based on the Mitchell River REALM.

19.6.2 Small Catchment Dams

The capacity of small catchment dams in the Mitchell basin is estimated to be around 7,100 ML (Table 19-3). Usage in 2004/05 is estimated to be approximately equal to the average annual usage of 4,500 ML and, after allowing for losses, the total catchment run-off that is harvested as a result of the small catchment dams is estimated to be 5,600 ML.

Table 19-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	4,200	2,100	n/a
Irrigation	2,900	2,400	n/a
Total	**7,100**	**4,500**	**5,600**

Note:

(1) n/a: information not available

19.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water entitlements, diversion licences or sales water within the basin in 2004/05.

19.6.4 Volume Diverted

The volume of water diverted under the single bulk entitlement specified for the Mitchell basin is shown in Table 19-4. 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 2004/05. Full details of compliance with bulk entitlements are provided in the resource manager's 2004/05 report for the Gippsland Basin (Southern Rural Water, 2005).

Licences on unregulated streams are not currently metered and hence compliance has not been assessed. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 19-4 Volume of water diverted under surface water entitlements in the Mitchell basin

Entitlement	Period of Bulk Entitlement (years)	Total Bulk Entitlement –30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?
East Gippsland Water						
Bairnsdale	1	5,902	0	5,902	4,833	Yes
Total Annual Volume of Bulk Entitlements		**5,902**	**0**	**5,902**	**4,833**	
Licensed Diversions from Unregulated Streams		15,401	0	15,401	9,000	

19.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

East Gippsland Water complied with the passing flow requirements of the Bairnsdale bulk entitlement during 2004/05.

19.6.6 Compliance with Streamflow Management Plans

There is no streamflow management plan currently in operation in the Mitchell basin.

19.7 Groundwater Resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Mitchell basin, excluding stock and domestic use, is presented in Table 19-5. An estimate of stock and domestic groundwater use is provided in Table 19-6.

The Mitchell basin contains the whole Wy Yung WSPA as well as part of the Sale WSPA and Stratford GMA. The volumes described in Table 19-5 and Table 19-6 are totals for the management areas and include the area that falls outside the Mitchell basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 19-5 Compliance with licensed groundwater volumes, Mitchell basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Stratford GMA (7%)	>150	0	31,553	17,230	0	17,230	Not Available (6)
Sale WSPA (7%)	25-200	21,574	21,574	7,680	0	7,680	Not Available (6)
Wy Yung WSPA (100%)	0-25	7,525	7,525	790	0	790	7,525

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 19-6 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Stratford GMA	410	820
Sale WSPA	919	1,838
Wy Yung WSPA	116	232

Note:

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

19.8 Recycled Water

The sewage treatment plants at Bairnsdale and Paynesville are operated by East Gippsland Water. All of the effluent passed through the Paynesville treatment plant was recycled (Table 19-7) and used on a number of applications including pasture and tree plantations, racecourses and golf courses.

The Bairnsdale Wastewater Treatment Plant has as part of its treatment process a series of constructed wetlands located within the Macleod Morass. The constructed wetlands provide additional filtration for water discharged from the treatment plant, before being released into the Morass to provide environmentally beneficial freshwater for the deep freshwater marsh. This discharge is considered a beneficial allocation in Table 19-7.

Table 19-7 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Bairnsdale	1,410	1,410	34	19	1,357	0	0	0
Paynesville	286	286	0	286	0	0	0	0
Total	**1,697**	**1,697**	**34**	**305**	**1,357**	**0**	**0**	**0**

Notes:

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

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

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

20 Thomson Basin

20.1 Location of Water Resources

The Thomson basin is located within the South East Coast Drainage Division. The Thomson Dam is located within the basin and is the largest water supply storage for Melbourne. The Thomson River and the Macalister River also supply the Macalister Irrigation District. The Thomson and Macalister Rivers join the Latrobe River before flowing into the Gippsland Lakes. The Avon River is included in the basin; this river flows directly into Lake Wellington. A map of the river basin is shown in Figure 20-1.

Water supply protection areas (WSPAs) in the Thomson basin include part of the Sale WSPA and Denison WSPA. Groundwater management areas (GMAs) within the Thomson basin include the Wa De Lock GMA, Rosedale GMA and Stratford GMA.

20.2 Responsibilities for Management of Water Resources

Melbourne Water is responsible for management of the Thomson Reservoir, which supplies water to Melbourne, and makes releases to the Thomson River for the Macalister Irrigation District and the environment.

Southern Rural Water is responsible for operation of Lake Glenmaggie and irrigation supplies to the Macalister Irrigation District. Southern Rural Water is also the licensing authority and manages groundwater and surface water licensed diversions in the basin.

Gippsland Water is responsible for urban water supply in the Thomson basin, which includes the towns of Sale, Maffra and Heyfield.

The West Gippsland Catchment Management Authority is responsible for waterway management in the Thomson Basin.

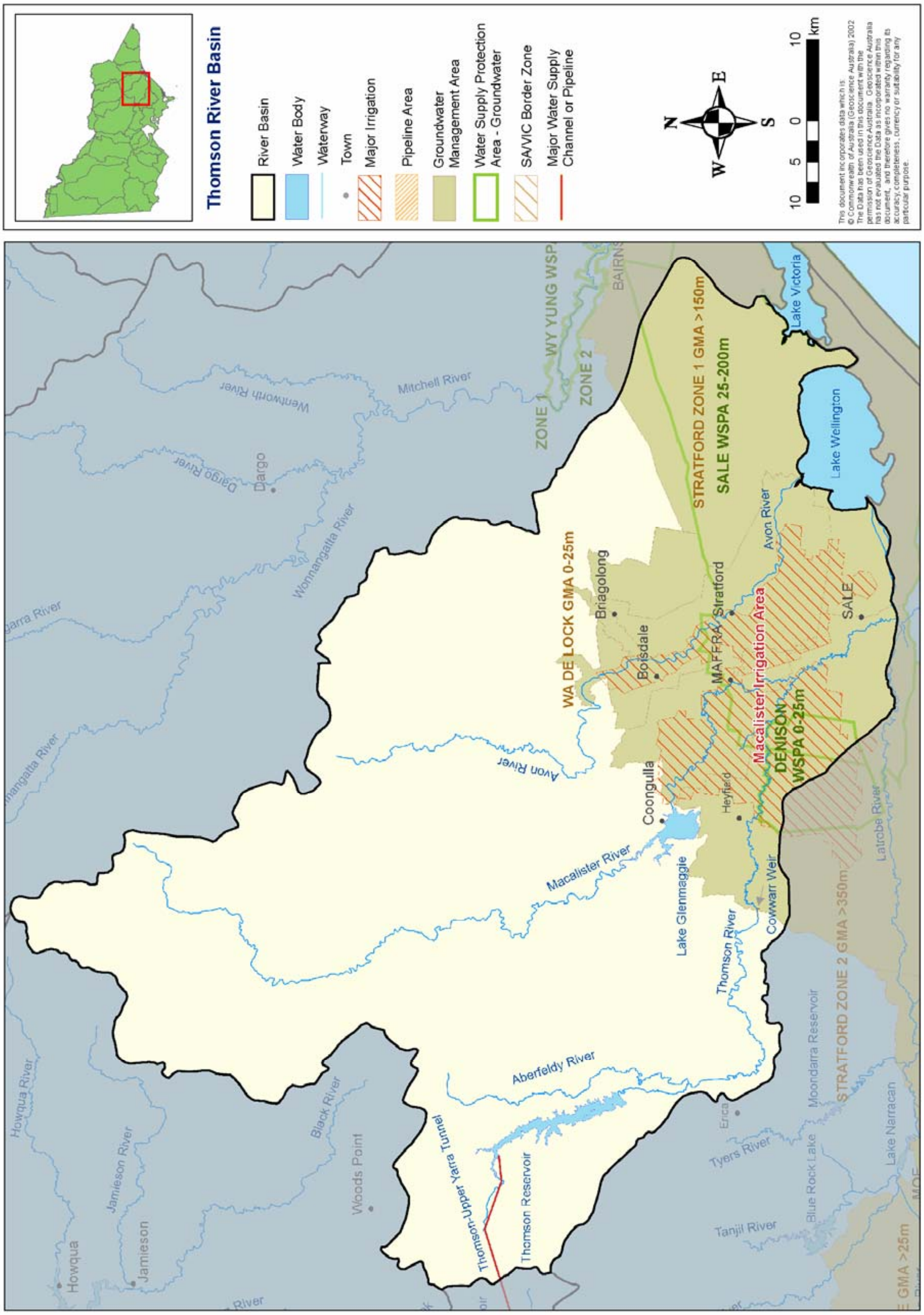
20.3 Seasonal Overview

Rainfall conditions in the Thomson basin in 2004/05 were slightly drier than average at around 80-100% of long-term average annual rainfall. Streamflows varied across the basin. In the streamflow gauge 225209 Macalister River at Licola, 2004/05 streamflows were 78% of the long-term average, whereas at streamflow gauge 225201 Avon River at Stratford, streamflows were only 33% of the long-term average. The reasons for this high variation are not clear, but may be due to localised rainfall conditions or quicker recovery of soil moisture from the recent extended drought in the wetter and steeper sloped alpine areas. Overall, total streamflows were significantly below average (49%), and were less than those estimated in 2003/04 (60%).

In 2004/05 the irrigation seasonal allocation (final announcement) for the Thomson basin was 140% of entitlement, and 125% was actually delivered. The allocation was the same for the Macalister and Thomson River licensed diverters as for the Macalister Irrigation District. Stage 1 (of four stages) urban water restrictions applied to all towns throughout the year in the Thomson basin, which was less severe than the previous year.

An amendment to Southern Rural Water’s bulk entitlement in June 2005 recognised the conversion of 790 ML of system losses into water entitlement for irrigation use in the Macalister Irrigation District. The water was created by the generation of permanent water savings resulting from the Nuntin Pipeline Project and is to be auctioned in 2005/06. An amendment was also made to Gippsland Water’s bulk entitlement for the Thomson-Macalister system in June 2005 to better align urban and rural restrictions in the Macalister Irrigation District, so that water shortages are more evenly shared across the two user groups.

Figure 20-1 Map of the Thomson basin



An assessment of the environmental health of rivers and streams in the Thomson basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net). Details of works undertaken to improve the basin's long-term water quality and river health during 2004/05 are available from the West Gippsland Catchment Management Authority.

The designs for the modifications to the Glenmaggie Weir that will enable environmental flows to be released during the irrigation season were completed. The construction works on the weir have been scheduled for winter 2006.

20.4 Summary of the 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 20-1. The total diversion includes 71,710 ML transferred from the Thomson basin to the Yarra basin by Melbourne Water.

Table 20-1 Summary of total water resource and water use in the Thomson basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	707,400	366,900
Groundwater	not available	not available
Recycled Water	550	510

Note:

(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90% of their surface area within the river basin boundary.

20.5 Water for the Environment

In 2004/05, minimum passing flows for habitat provision were delivered in accordance with bulk entitlements, and through the management of licensed extractions. A formal environmental bulk entitlement was established in the Thomson basin soon after the 2004/05 year, but was not in operation during 2004/05. This bulk entitlement comes after much work over previous years by the Thomson Macalister Environmental Flows Task Force. Based on the Task Force report, over the next ten years the government will progressively improve the environmental flows and river habitat of the two rivers whilst maintaining the current capability to meet irrigator and Melbourne's water demands.

The environment's share of total flow in the Thomson River flows out of the basin into the Latrobe River and then into the Gippsland Lakes, which have high environmental values and are listed under the Ramsar Convention. In the Thomson basin, the environment's share of total flow in 2004/05 was 240,300 ML, which is about 34% of the total amount of water in the basin (Table 20-2). This amount consists of minimum flows released from the Thomson Reservoir and Lake Glenmaggie under bulk entitlements, and all other water flowing in the basin which was not taken out of the streams for consumptive uses.

20.6 Surface Water Resources

20.6.1 Water Balance

A water balance for the Thomson basin is shown in Table 20-2. Inflows to the basin were 49% of their long-term average of 1,414,000 ML (Department of Natural Resources and Environment, 2002). The largest diversions occurring within the basin were for irrigation usage and were equivalent to 100% of total inflows. The Thomson Reservoir supplies water to Melbourne. In 2004/05 Melbourne Water transferred 71,710 ML, or 10% of the basin inflows, from the Thomson basin to the Yarra basin.

As part of the water balance calculation, the estimation of inflows for the Thomson basin was based on the sum of diversions and outflows. The Resource Allocation Model (REALM) that incorporates the Thomson basin was used to estimate the in-stream losses to groundwater and evaporation. It should be noted that the basis of calculating those losses in 2004/05 has changed from the previous year to improve the accuracy of that loss estimation, which was previously largely unknown.

Table 20-2 Balance of surface water in the Thomson basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
Volume in storage at start of year	465,300	364,000
Volume in storage at end of year	533,400	465,300
Change in storage	68,100	101,300
Inflows		
Catchment inflow (1)	688,800	843,900
Transfers from other basins	0	0
Return flow from irrigation	18,600	19,200
Treated effluent discharged back to river	40	50
Sub-total	**707,400**	**863,100**
Usage		
Urban diversions to towns in Thomson River Basin	2,000	86,500
Urban diversions to Yarra River Basin	71,710	
Irrigation district diversions	274,600	254,700
Licensed private diversions from unregulated streams	11,600	11,400
Small catchment dams	7,000	7,000
Sub-total	**366,900**	**359,600**
Losses		
Net evaporation losses from major storages	14,900	9,300
Losses from small catchment dams	2,500	2,500
In-stream infiltration to groundwater, flows to floodplain and evaporation (2)	14,700	79,900
Sub-total	**32,100**	**91,700**
Water Passed at Outlet of Basin		
River outflows to the Latrobe River	168,600	260,200
River outflows direct to Lake Wellington	71,700	50,300
Environment's Share of Total Flow in the Thomson Basin	**240,300**	**310,500**

Notes:

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

(2) Losses estimated based on loss functions within the Thomson-Macalister REALM. The volume of estimated losses reduced from the previous year primarily due to improvement in the calculation method.

20.6.2 Small Catchment Dams

The capacity of small catchment dams in the Thomson basin is estimated to be around 10,600 ML (Table 20-3). Usage in 2004/05 is estimated to be approximately equal to the average annual usage of 7,000 ML and, after allowing for losses, the total catchment run-off that is harvested as a result of the small catchment dams is estimated to be 9,500 ML.

Table 20-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	5,600	2,800	n/a
Irrigation	5,000	4,200	n/a
Total	**10,600**	**7,000**	**9,500**

Note:
(1) n/a: information not available

20.6.3 Water Entitlement Transfers

Permanent and temporary transfers of irrigation entitlements occurred within the Macalister Irrigation District in 2004/05. This consisted of 87 ML that was permanently transferred, and 1,951 ML that was temporarily transferred.

20.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 20-4. 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 2004/05. Full details of compliance with bulk entitlements are provided in the resource manager's 2004/05 report for the Thomson basin (West Gippsland Catchment Management Authority, 2005). Bulk entitlements held by Melbourne Water and Southern Rural Water in the basin are applied over a five year period, where the five year rolling average usage must be less than the bulk entitlement volume.

Licences on unregulated streams are not currently metered and hence compliance has not been assessed. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 20-4 Volume of water diverted under surface water entitlements in the Thomson basin

Entitlement	Period of Bulk Entitle-ment (years)	Total Bulk Entitlement – 30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?	Volume Diverted in 2004/05 (ML)
Gippsland Water							
Thomson/ Macalister Urbans	1	n/a	0	n/a	1,998	n/a	1,998
Melbourne Water							
Thomson River	5	859,000	0	859,000	633,323	Yes	71,712
Southern Rural Water							
Thomson/ Macalister	5	1,374,000	0	1,374,000	1,182,636	Yes	274,588
Total Annual Volume of Bulk Entitlements		**446,600**	**0**	**446,600**	**365,189**		**346,300**
Licensed Diversions from Unregulated Streams		13,830	0	13,830	11,600		11,600

Notes:
(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2004, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2004-05 period. The *actual* maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

(2) n/a: bulk entitlement conversion order was not finalised at the beginning of 2004/05

20.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

Southern Rural Water is responsible for meeting a passing flow at the Wandocka Gauging station on the Thomson River at the Maffra Weir on the Macalister River. Melbourne Water must provide environmental flows to satisfy three compliance points in the 23 kilometre reach immediately downstream of the Thomson Dam. In 2004/05 Southern Rural Water and Melbourne Water complied with environmental flow requirements. Full details of compliance with environmental flows are provided in the resource manager's 2004/05 report for the Thomson basin (West Gippsland Catchment Management Authority, 2005).

20.6.6 Compliance with Streamflow Management Plans

There is no streamflow management plan currently in operation in the Thomson basin.

20.7 Groundwater Resources

A summary of the licensed entitlements and use for groundwater management areas that overlap the Thomson basin, excluding stock and domestic use, is presented in Table 20-5. An estimate of stock and domestic groundwater use is provided in Table 20-6. 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 20-7.

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. The volumes described in Table 20-5 and Table 20-6 are totals for the management areas and include the area that falls outside the Thomson basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 20-5 Compliance with licensed groundwater volumes, Thomson basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Rosedale GMA (35%)	50-150	9,000	21,241	9,920	0	9,920	Not Available (6)
Stratford GMA (42%)	>150	0	31,553	17,230	0	17,230	Not Available (6)
Wa De Lock Zone GMA (100%)	0-25	11,500	26,865	0	9,403	9,403	11,500
Denison WSPA (51%)	0-25	13,733	13,733	6,500	0	6,500	Not Available (6)
Sale WSPA (72%)	25-200	21,574	21,574	7,680	0	7,680	Not Available (6)

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 20-6 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Rosedale GMA	1	2
Stratford GMA	410	820
Wa De Lock Zone GMA	482	964
Denison WSPA	297	594
Sale WSPA	919	1,838

Note:

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

Table 20-7 Urban groundwater usage

Town Supplied	Licensed Allocation ML	Metered Use
Sale	3,500	2,046
Briagolong	160	93
Boisdale	37	18

20.8 Recycled Water

Gippsland Water operates four sewage treatment plants in the Thomson basin. Recycled water is applied to a number of different uses including irrigation of pasture and reuse at recreational reserves such as the Maffra Recreational Reserve. All effluent was reused, except for effluent from the Rawson treatment plant (Table 20-8). A total of 93% of effluent was reused in the basin.

Table 20-8 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Heyfield	96	96	0	96	0	0	0	0
Maffra	279	279	10	269	0	0	0	0
Rawson	40	0	0	0	0	0	40	0
Stratford	135	135	0	135	0	0	0	0
Total	**550**	**510**	**10**	**500**	**0**	**0**	**40**	**0**

Notes:

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

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

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

21 Latrobe Basin

21.1 Location of Water Resources

The Latrobe basin is located within the South East Coast Drainage Division in eastern Victoria. The Latrobe River, Moe River and Tanjil River all flow into Lake Narracan before the Latrobe River flows past Traralgon and into the Gippsland Lakes. A map of the river basin is shown in Figure 21-1.

Water supply protection areas (WSPAs) within the Latrobe basin include part of the Denison WSPA and Sale WSPA. Groundwater management areas (GMAs) within the Latrobe basin include all of the Moe GMA, in addition to part of the Rosedale GMA and Stratford GMA.

21.2 Responsibilities for Management of Water Resources

Southern Rural Water is responsible for managing part of the Latrobe water supply system including Blue Rock Lake and Lake Narracan. Southern Rural Water is also the licensing authority and manages groundwater and surface water licensed diversions.

Gippsland Water is responsible for urban and major industrial water supply in the Latrobe basin, including the towns of Warragul, Moe, Morwell and Traralgon. It is also responsible for management of Moondarra Reservoir. The West Gippsland Catchment Management Authority is responsible for waterway management in the Latrobe basin.

21.3 Seasonal Overview

Rainfall conditions in the Latrobe basin in 2004/05 were slightly drier than average at around 80-100% of long-term average annual rainfall. Streamflows were similarly slightly lower than average. The Tanjil River at Tanjil Junction (streamflow gauge 226226) upstream of Blue Rock Lake, for example, was 91% of the long-term average. Overall, streamflows in the basin in 2004/05 were above those estimated in 2003/04, however both years were still below the estimated long-term average (80% and 65% respectively).

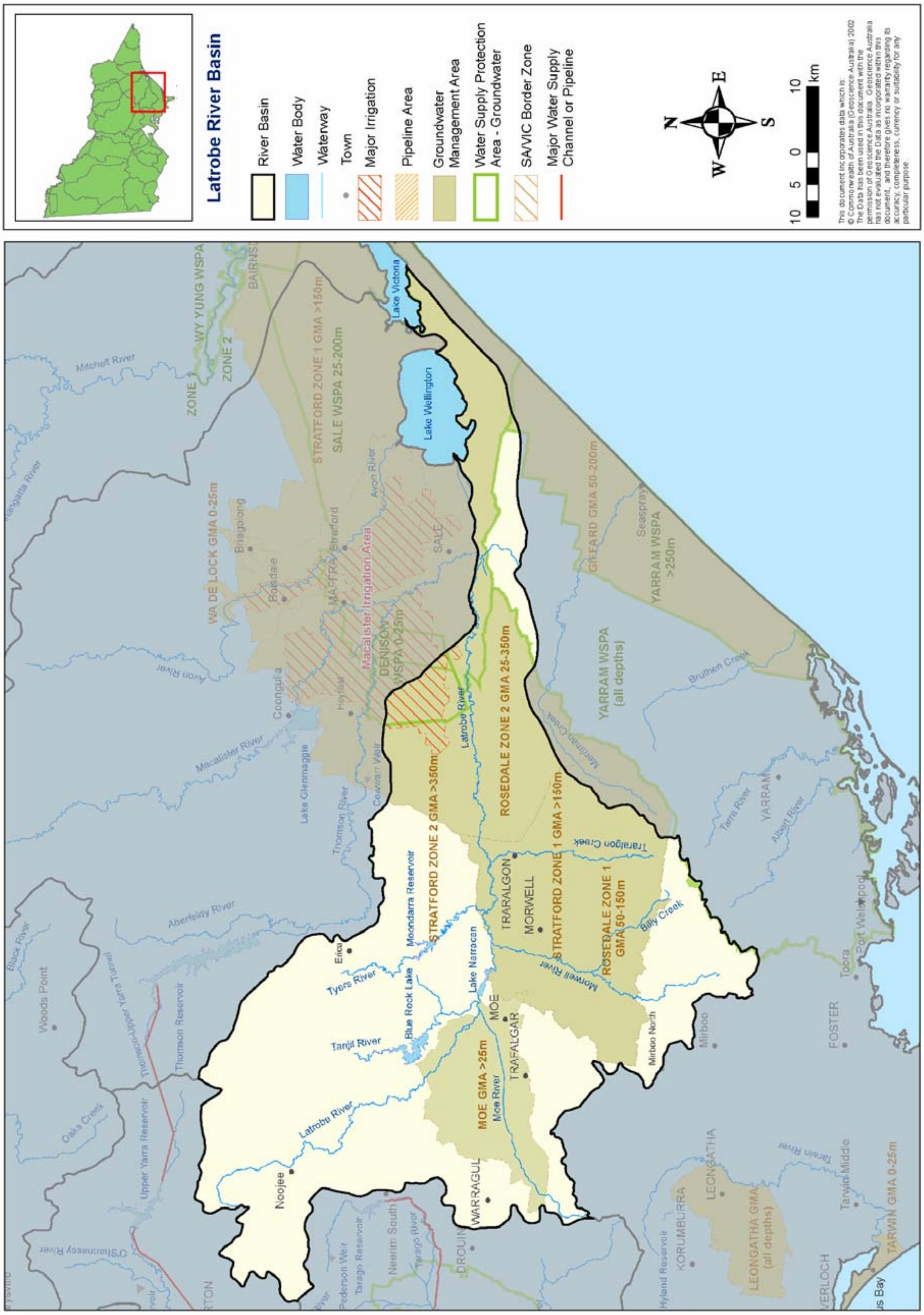
In 2004/05 there were a number of flood events in the Latrobe River. In September and November 2004 minor flooding occurred downstream of Rosedale. In September minor flooding also occurred in the Moe River at Darnum. In February 2005, minor flooding occurred in Latrobe River downstream of Yallourn and in the Moe and Morwell Rivers, and major flooding occurred in the upper Tanjil River.

Stage 1 (of four stages) urban water restrictions applied to all towns throughout the year in the Latrobe basin. These restrictions have been in place since December 2002.

A statewide assessment of stream condition found that 35% of streams in the Latrobe basin are in good or excellent condition, 35% are in moderate condition, and 30% are in poor condition.

An assessment of the environmental health of rivers and streams in the Latrobe basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net). Details of works undertaken to improve the basin's long-term water quality and river health during 2004/05 are available from the West Gippsland Catchment Management Authority. During 2004/05 Yallourn Energy carried out a 3.5 km diversion of the Morwell River (Morwell River Diversion No. 4)to allow the expansion of the coal fields. As part of this work a short section of pipe that the Morwell River flowed through has been removed and the river restored to a more natural configuration.

Figure 21-1 Map of the Latrobe basin



21.4 Summary of the 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 21-1.

Table 21-1 Summary of total water resource and water use in the Latrobe basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	840,500	169,200
Groundwater [(1)]	not available	not available
Recycled Water	23,530	90

Note:

(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90% of their surface area within the river basin boundary.

21.5 Water for the Environment

In 2004/05, there was no formal environmental water reserve established in the Latrobe basin. Minimum environmental passing flows for habitat provision were delivered in accordance with bulk entitlements, and through the management of licensed extractions.

The environment's share of total flow at the basin outlet was 621,200 ML, which is about 74% of the total amount of water in the basin (Table 21-2). The environment's share flows out of the basin into the Gippsland Lakes, which have high environmental values and are listed under the Ramsar convention. Water for the environment consisted of environmental flows required under bulk entitlements in the basin, water returned to the river and all other water flowing in the basin that was not taken out of the streams for consumptive uses.

In 2004/05, an assessment of the environmental flow requirements for the Latrobe River was undertaken, which will be used to develop more ecologically beneficial environmental flow rules for the basin.

21.6 Surface Water Resources

21.6.1 Water Balance

A water balance for the Latrobe basin is shown in Table 21-2. There are three major storages located in the Latrobe basin, Blue Rock Reservoir, Lake Narracan and Moondarra Reservoir. Storage volume increased slightly in 2004/05 to around 89% of capacity by the end of the year.

The major industrial water users in the basin include the power companies and Australian Paper Manufacturers. In 2004/05, the power companies returned approximately 55,600 ML of water to the river. This water is sourced both from river diversions and groundwater.

It should be noted that the basis of calculating river losses in 2004/05 has changed from the previous year to improve accuracy. Losses were previously estimated based on back-calculation, whereas in 2004/05 these have now been estimated based on loss functions in the Latrobe River Resource Allocation Model (REALM). Knowledge of the destination of treated effluent discharge from wastewater treatment plants has also improved, which largely explains the difference in the volume of treated effluent discharged to rivers compared to the value shown in 2003/04.

Table 21-2 Balance of surface water in the Latrobe basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
Volume in storage at start of year	179,500	237,300
Volume in storage at end of year	220,200	179,500
Change in storage	40,700	-57,900
Inflows		
Catchment inflow [1]	780,500	628,200
Transfers from other basins	0	0
Return flow from power stations and major industry	55,600	50,000
Return flow from irrigation	0	0
Treated effluent discharged back to river	4,360	21,980
Sub-total	**840,500**	**700,200**
Usage		
Urban and industrial diversions	130,890	125,210
Licensed private diversions from regulated streams	7,000	19,600
Licensed private diversions from unregulated streams	10,800	
Small catchment dams	20,500	20,600
Sub-total	**169,200**	**165,300**
Losses		
Net evaporation losses from major storages	3,700	3,700
Losses from small catchment dams	5,700	5,600
In-stream infiltration to groundwater, flows to floodplain and evaporation [2]	0	90,300
Sub-total	**9,400**	**99,600**
Water Passed at Outlet of Basin		
River outflows to the Gippsland Lakes (excluding Thomson River)	621,200	493,100
River outflows to the Gippsland Lakes (including Thomson River)	789,800	753,300
Environment's Share of Total Flow in the Latrobe Basin	**621,200**	**493,100**

Notes:

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

(2) Losses are estimated to be zero in Latrobe River REALM. The volume of estimated losses reduced from the previous year due to improvement in the calculation method.

21.6.2 Small Catchment Dams

The capacity of small catchment dams in the Latrobe basin is estimated to be around 29,700 ML. Usage in 2004/05 is estimated to be approximately equal to the average annual usage of 20,500 ML and, after allowing for losses, the total catchment run-off that is harvested as a result of the small catchment dams is estimated to be 26,200 ML.

Table 21-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	13,000	6,500	n/a
Irrigation	16,700	14,000	n/a
Total	**29,700**	**20,500**	**26,200**

Note:

(1) n/a: information not available

21.6.3 Water Entitlement Transfers

Temporary transfers of water entitlement within the Latrobe basin totalled 1,593 ML in 2004/05. No permanent transfers were reported.

21.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 21-4. 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 2004/05. Full details of compliance with bulk entitlements are provided in the resource manager's 2004/05 report for the Latrobe basin (Southern Rural Water, 2005).

The Bulk Entitlement (CGRWA – Blue Rock) Conversion Order 1997 covers all water extracted from the Tanjil River by Gippsland Water to supply Moe and Willow Grove. Moe can also be supplied via Narracan Creek under a separate bulk entitlement. Given sufficient flows in Narracan Creek in 2004/05, this source was used in preference to the Tanjil River for operation efficiency reasons.

The bulk entitlement for Gippsland Water to extract from the Tanjil River is also used to transfer water from Blue Rock Reservoir to Moondarra Reservoir. In 2004/05, 1,565 ML was transferred from Blue Rock Reservoir to Moondarra Reservoir.

The Yallourn Energy Ltd for SECV and Blue Rock unallocated entitlements are not currently being utilised.

Licences on unregulated streams are not currently metered and hence compliance has not been assessed. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

21.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

All bulk entitlements with monitoring programs complied with their passing flow obligations specified in their bulk entitlements. Full details of compliance with bulk entitlements are provided in the resource manager's 2004/05 report for the Latrobe basin (Southern Rural Water, 2005).

21.6.6 Compliance with Streamflow Management Plans

There is no streamflow management plan (SFMP) currently in operation in the Latrobe basin. A SFMP is being prepared for the Upper Latrobe River.

21.7 Groundwater Resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Latrobe basin, excluding stock and domestic use, is presented in Table 21-5. An estimate of stock and domestic groundwater use is provided in Table 21-6.

The Latrobe basin contains the whole Moe GMA as well as part of the Sale WSPA, Yarram WSPA, Denison WSPA, Stratford GMA and Rosedale GMA. The volumes described in Table 21-5 and Table 21-6 are totals for the management areas and include the area that falls outside the Latrobe basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 21-4 Volume of water diverted under surface water entitlements, Latrobe basin

Entitlement	Period of Bulk Entitle-ment (years)	Total Bulk Entitlement –30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?	Volume Diverted in 2004/05 (ML)
Gippsland Water							
Boolarra	1	145	0	145	84	Yes	84
Erica	1	340	0	340	103	Yes	103
Mirboo North	1	270	0	270	192	Yes	192
Moe - Narracan Creek	1	3,884	0	3,884	3,719	Yes	3,719
Noojee	1	73	0	73	0	Yes	0
Thorpdale	1	80	0	80	24	Yes	24
CGRWA - Blue Rock (2)	3	45,450	0	45,450	19,529	Yes	2,165
Moondarra Reservoir	2	124,000	0	124,000	100,504	Yes	49,556
Southern Rural Water							
Yallourn Energy Ltd for SRW	1	20,000	0	20,000	19,213	Yes	19,213
Latrobe	2	26,800	0	26,800	13,873	Yes	7,002
Great Energy Alliance Corporation Pty Ltd							
Yallourn Energy Ltd for Loy Yang Power Ltd	1	40,000	0	40,000	23,630	Yes	23,630
Minister for Environment (on behalf of the Treasurer)							
Yallourn Energy Ltd for SECV	1	25,000	0	25,000	0	Yes	0
Yallourn Energy Ltd							
Yallourn Energy Ltd	1	36,500	0	36,500	32,210	Yes	32,210
Unallocated							
Blue Rock-unallocated	1	40,000	0	40,000	0	Yes	0
Total Annual Volume of Bulk Entitlements		**256,842**	**0**	**256,842**	**142,872**		**137,897**
Licensed Diversions from Unregulated Streams		18,351	0	18,351	10,800		10,800

Notes:

(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2004, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2004-05 period. The *actual* maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

(2) The volume diverted refers to Willow Grove, Moe and Moondarra Reservoir diversions. To enable the transfer of water to Moondarra Reservoir, an additional 2,967 ML was released to the Latrobe River in 2004/05 to run the turbines at Blue Rock Reservoir.

Table 21-5 Compliance with licensed groundwater volumes, Latrobe basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Moe GMA (100%)	>25	8,193	3,096	0	1,084	1,084	8,193
Rosedale GMA (58%)	50-150	9,000	21,241	9,920	0	9,920	Not Available (6)
Stratford GMA (38%)	>150	0	31,553	17,230	0	17,230	Not Available (6)
Denison WSPA (49%)	0-25	13,733	13,733	6,500	0	6,500	Not Available (6)
Sale WSPA (16%)	25-200	21,574	21,574	7,680	0	7,680	Not Available (6)
Yarram WSPA (7%)	>250	25,657	25,657	8,100	0	8,100	Not Available (6)

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 21-6 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Moe GMA	197	394
Rosedale GMA	1	2
Stratford GMA	410	820
Denison WSPA	297	594
Sale WSPA	919	1,838
Yarram WSPA	970	1,940

Note:

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

21.8 Recycled Water

Gippsland Water operates six sewage treatment plants in the Latrobe basin. Effluent is reused in Mirboo North and Willow Grove. Less than 1% of all effluent was reused in the basin (Table 21-7), with most of the water being discharged to the ocean.

Gippsland Water and the Department of Sustainability and Environment are both currently investigating opportunities for large scale reuse of recycled water in the Latrobe basin.

Table 21-7 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Mirboo North	64	64	23	41	0	0	0	0
Moe	2,056	0	0	0	0	0	2,056	0
Morwell	672	0	0	0	0	0	672	0
Warragul	1,630	0	0	0	0	0	1,630	0
Willow Grove	24	24	0	24	0	0	0	0
Dutson Downs (Regional Outfall Sewer)	11,629	0	0	0	0	0	0	11,629
Saline Water Outfall Pipeline	7,456	0	0	0	0	0	0	7,456
Total	**23,531**	**88**	**23**	**65**	**0**	**0**	**4,358**	**19,085**

Notes:

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

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

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

22 South Gippsland Basin

22.1 Location of Water Resources

The South Gippsland basin is located within the South East Coast Drainage Division. The basin includes the Bass River (located north of San Remo) that flows into Western Port, and rivers flowing directly to the ocean between San Remo and Seaspray. A map of the river basin is shown in Figure 22-1.

Water supply protection areas (WSPAs) within the South Gippsland basin include most of the Yarram WSPA. Groundwater management areas (GMAs) within the South Gippsland Basin include the Leongatha GMA, Corinella GMA, Giffard GMA and Tarwin GMA.

22.2 Responsibilities for Management of Water Resources

Southern Rural Water is the licensing authority and manages groundwater and surface water licensed diversions within the basin. South Gippsland Water is responsible for urban water supply in the South Gippsland basin, including the towns of Inverloch, Wonthaggi and Leongatha. Westernport Water supplies San Remo and Phillip Island, and Gippsland Water supplies the town of Seaspray in the far east of the basin. The West Gippsland Catchment Management Authority is responsible for waterway management in the South Gippsland basin.

22.3 Seasonal Overview

Rainfall conditions in the South Gippsland basin in 2004/05 were slightly drier than average at around 80-100% of long-term average annual rainfall. Streamflows across the basin were generally around average, with the year's flows in the Tarwin River at Meeniyan (streamflow gauge 227202) being 103% of long-term average streamflows and flows in the Franklin River at Toora (streamflow gauge 227237) being 115% of long-term average streamflows. The average streamflow conditions during the 2004/05 season were higher than those estimated in 2003/04, which were approximately 78% of the estimated long-term average.

The generally average surface water availability resulted in few restrictions. Urban water restrictions were only imposed on Wonthaggi, Cape Patterson and Inverloch in June 2005. This was due to the drawing down of Lance Creek Reservoir for maintenance on the dam wall in early 2005. No other towns experienced water restrictions in 2004/05.

An assessment of the environmental health of rivers and streams in the South Gippsland basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net). During 2004/05, ongoing stream restoration work continued in the South Gippsland basin. Details of the work are available from the West Gippsland Catchment Management Authority.

22.4 Summary of the 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 22-1.

Figure 22-1 Map of the South Gippsland basin

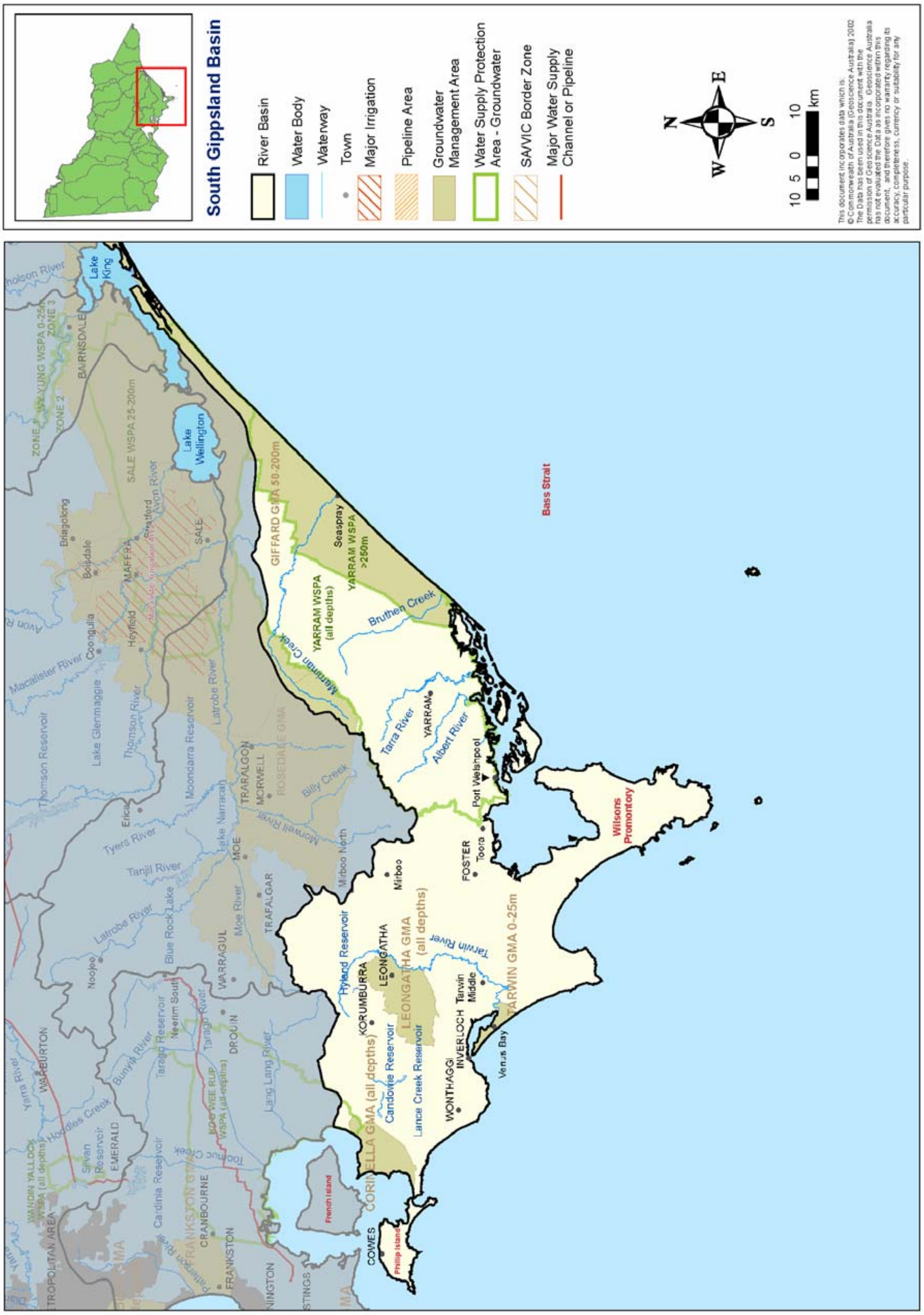


Table 22-1 Summary of total water resource and water use in the South Gippsland basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	1,121,100	40,700
Groundwater (1)	39,600	11,300
Recycled Water	5,630	290

Note:

(1) Groundwater management areas in the South Gippsland basin cover less than 25% 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 Yarram WSPA) and the unincorporated areas contain a significant groundwater resource.

22.5 Water for the Environment

In 2004/05 there was no formal environmental water reserve in the South Gippsland basin. Minimum environmental passing flows for habitat provision were delivered in accordance with bulk entitlements, and through the management of licensed extractions.

The environment's share of total flow was 1,077,600 ML, which is about 96% of the total amount of water in the basin (Table 22-2). This amount consists of environmental flows required under passing flow obligations in consumptive bulk entitlements in the basin, and all other water flowing in the basin which was not taken out of the streams for consumptive uses.

22.6 Surface Water Resources

22.6.1 Water Balance

A water balance for South Gippsland basin is shown in Table 22-2.

There are four reservoirs with a capacity greater than 1,000 ML located within the basin used to store water for urban water supply by South Gippsland Water and Westernport Water. These storages are Candowie Reservoir, Lance Creek Reservoir, Hyland Reservoir and Western Reservoir. These reservoirs held 42% of total capacity at the end of the year.

The largest diversion of water from the basin was via small catchment dams, which accounted for nearly 60% of all diversions.

To calculate the water balance, the estimation of inflows for the South Gippsland basin was based on the sum of diversions and outflows. It was assumed that there were no in-stream losses to groundwater and evaporation because these could not be readily calculated.

22.6.2 Small Catchment Dams

The capacity of small catchment dams in the South Gippsland basin is estimated to be around 38,200 ML (Table 22-3). Usage in 2004/05 is estimated to be approximately equal to the average annual usage of 24,300 ML and, after allowing for losses, the total catchment run-off that is harvested by the dams is estimated to be 29,200 ML.

22.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water rights, diversion licences or sales water within the basin in 2004/05.

Table 22-2 Balance of surface water in the South Gippsland basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
Volume in storage at start of year	6,600	3,300
Volume in storage at end of year	4,100	6,600
Change in storage	-2,500	3,300
Inflows		
Catchment inflow (1)	1,120,100	908,200
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	1,040	4,550
Sub-total	**1,121,100**	**912,800**
Usage		
Urban diversions	8,630	9,040
Licensed private diversions from unregulated streams	7,800	7,500
Small catchment dams	24,300	24,300
Sub-total	**40,700**	**40,800**
Losses		
Net evaporation losses from major storages	400	500
Losses from small catchment dams	4,900	5,000
In-stream infiltration to groundwater, flows to floodplain and evaporation (2)	0	24,400
Sub-total	**5,300**	**29,900**
Water Passed at Outlet of Basin		
River outflows to the oceans	1,077,600	838,800
Environment's Share of Total Flow in the South Gippsland Basin	**1,077,600**	**838,800**

Notes:

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

(2) Assumed to be zero because data is not readily available. The volume of estimated losses reduced from the previous year as 2003/04 losses were estimated by back-calculation.

Table 22-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	23,000	11,500	n/a
Irrigation	15,200	12,800	n/a
Total	**38,200**	**24,300**	**29,200**

Note:

(1) n/a: information not available

22.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 22-4. 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 2004/05. Full details of compliance with bulk entitlements are provided in the resource manager's 2004/05 report for the Gippsland basin (Southern Rural Water, 2005).

Licences on unregulated streams are not currently metered and hence compliance has not been assessed. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

South Gippsland Water approached the resource manager and the Department of Sustainability and Environment regarding a qualification of rights for its Tarra River bulk entitlement, however sufficient rainfall occurred which avoided the need for the qualification. South Gippsland Water is currently evaluating options to increase its storage on the Tarra to improve its reliability of supply and reduce the need to seek future qualifications of its entitlement during low flow periods.

Table 22-4 Volume of water diverted under surface water entitlements in the South Gippsland basin

Entitlement	Period of Bulk Entitlement (years)	Total Bulk Entitlement –30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?
Gippsland Water						
Seaspray	1	61	0	61	43	Yes
South Gippsland Water						
Devon North, Alberton, Yarram and Port Albert	1	853	0	853	533	Yes
Dumbalk	1	100	0	100	42	Yes
Fish Creek	1	251	0	251	199	Yes
Foster	1	326	0	326	187	Yes
Korrumburra	1	1,000	0	1,000	775	Yes
Leongatha	1	2,476	0	2,476	2,067	Yes
Loch, Poowong and Nyora	1	420	0	420	237	Yes
Meeniyan	1	200	0	200	68	Yes
Toora, Port Franklin, Welshpool and Port Welshpool	1	1,617	0	1,617	622	Yes
Wonthaggi – Inverloch	1	3,800	0	3,800	1,844	Yes
Westernport Water						
Westernport	1	2,911	0	2,911	2,009	Yes
Total Annual Volume of Bulk Entitlements		**14,015**	**0**	**14,015**	**8,626**	
Licensed Diversions from Unregulated Streams		11,890	0	11,890	7,800	

22.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

All bulk entitlements complied with their passing flow obligations.

22.6.6 Compliance with Streamflow Management Plans

There is no streamflow management plan (SFMP) currently in operation in the South Gippsland basin. A SFMP is being developed for the Tarra River.

22.7 Groundwater Resources

A summary of the licensed entitlements and use for groundwater management units that overlap the South Gippsland basin, excluding stock and domestic use, is presented in Table 22-5. An estimate of stock and domestic groundwater use is provided in Table 22-6. In the South Gippsland basin, groundwater is used as an urban water supply for the township of Leongatha. The licensed entitlement and metered use for this groundwater supply is provided in Table 22-7.

The South Gippsland basin contains all of the Yarram WSPA, Tarwin GMA, Corinella GMA, Giffard GMA and Leongatha GMA, as well as part of the Sale WSPA, Rosedale GMA and Stratford GMA. The volumes described in Table 22-5 and Table 22-6 are totals for the management areas and include the area that falls outside the South Gippsland basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 22-5 Compliance with licensed groundwater volumes, South Gippsland basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Corinella GMA (100%)	ALL	2,550	164	0	57	57	2,550
Giffard GMA (99%)	50-200	3,000	5,705	2,520	0	2,520	3,000
Leongatha GMA (100%)	ALL	6,500	1,471	0	515	515	6,500
Rosedale GMA (6%)	50-150	9,000	21,241	9,920	0	9,920	Not Available (6)
Stratford GMA (7%)	>150	Not determined	31,553	17,230	0	17,230	Not Available (6)
Tarwin GMA (98%)	0-25	1,300	41	0	14	14	1,300
Sale WSPA (5%)	25-200	21,574	21,574	7,680	0	7,680	Not Available (6)
Yarram WSPA (100%)	>250	25,657	25,657	8,100	0	8,100	25,657

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(1) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 22-6 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Corinella GMA	157	314
Giffard GMA	171	342
Leongatha GMA	114	228
Rosedale GMA	1	2
Stratford GMA	410	820
Tarwin GMA	806	242 (2)
Koo-Wee-Rup WSPA	600	1,200
Sale WSPA	919	1,838
Yarram WSPA	970	1,940

Notes:

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

(2) Household supply is the dominant stock and domestic use in the Nepean GMA. An estimate of 0.3 ML/bore has been applied as a more realistic approximation of stock and domestic use for this area.

Table 22-7 Urban groundwater usage

Town Supplied	Licensed Allocation ML	Metered Use
Leongatha	400	0

22.8 Recycled Water

South Gippsland Water is responsible for 11 sewage treatment plants within the basin, but only reuses effluent from the Inverloch and Tarraville treatment plants. In 2004/05 only a small volume of treated effluent was reused at Inverloch, as water was not required for agricultural purposes due to wet conditions in the summer period. South Gippsland Water has recently created a staff position dedicated to increasing the rate of reuse of treated effluent in its management area.

Westernport Water reuses water from both of its treatment plants at Coronet Bay and Cowes.

Across the basin only 5% of effluent is reused (Table 22-8).

Table 22-8 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Cape Paterson	125	0	0	0	0	0	0	125
Coronet Bay	176	117	0	117	0	0	0	59
Cowes	1,124	79	47	7	0	25	0	1,045
Foster	146	0	0	0	0	0	0	146
Inverloch	410	1	0	1	0	0	0	409
Korumburra	454	0	0	0	0	0	454	0
Korumburra Trade Waste	199	0	0	0	0	0	0	199
Leongatha	582	0	0	0	0	0	582	0
Leongatha Trade Waste	1,320	0	0	0	0	0	0	1,320
Tarraville	92	92	0	92	0	0	0	0
Toora	150	0	0	0	0	0	0	150
Welshpool	41	0	0	0	0	0	0	41
Wonthaggi	815	0	0	0	0	0	0	815
Total	**5,634**	**289**	**47**	**217**	**0**	**25**	**1,036**	**4,309**

Notes:

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

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

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

23 Bunyip Basin

23.1 Location of Water Resources

The Bunyip basin is located within the South East Coast Drainage Division in eastern Victoria. The basin includes the Lang Lang and Bunyip Rivers which flow into Western Port, and the Patterson River which flows into Port Phillip Bay. The south-eastern suburbs of Melbourne are located within the Bunyip basin. A map of the river basin is shown in Figure 23-1.

Water supply protection areas (WSPAs) within the Bunyip basin include the whole Koo Wee Rup WSPA. Groundwater management areas (GMAs) within the Bunyip basin include the whole Frankston GMA and Nepean GMA, and part of the Moorabbin GMA.

23.2 Responsibilities for Management of Water Resources

Southern Rural Water is responsible for managing groundwater pumping and private diversions within the Bunyip basin.

Melbourne Water as bulk water supplier and South East Water as retail water supplier are responsible for water supply to that part of the metropolitan area in the Bunyip basin, including Dandenong, Frankston, Pakenham and the Mornington Peninsula. This water is imported into the Bunyip basin from the Yarra/Thomson supply system. Melbourne Water owns and operates Tarago Reservoir and the Tarago-Western Port Pipeline.

Gippsland Water supplies towns in the east of the basin including Drouin and Neerim South and Warragul in the Latrobe basin. The Port Phillip and Westernport Catchment Management Authority is responsible for waterway management in the Bunyip basin.

23.3 Seasonal Overview

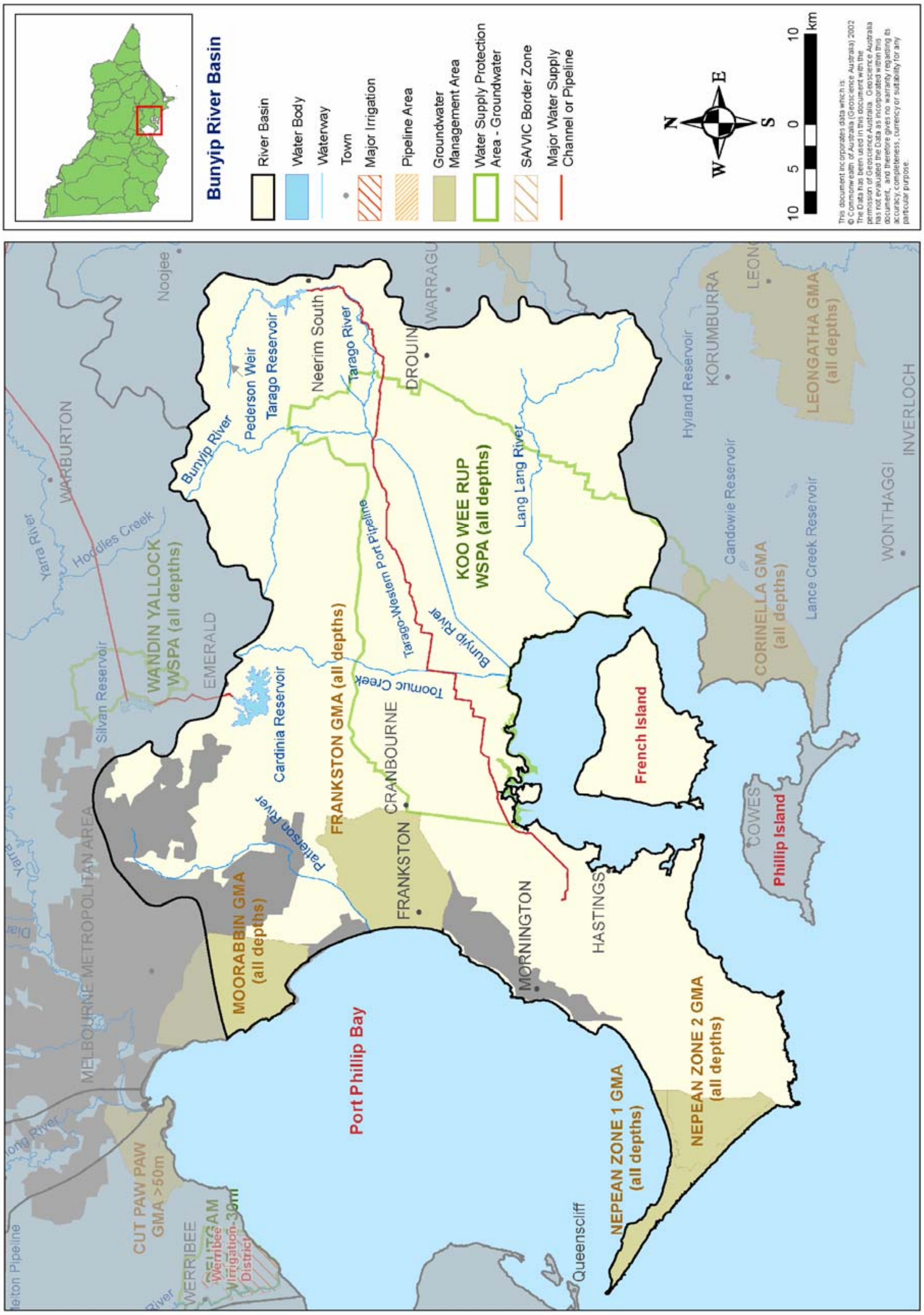
In 2004/05, the rainfall recorded in the Bunyip basin was approximately equal to the long-term average, with slightly higher rainfall relative to average conditions in the catchments that discharge to Port Phillip Bay. Total streamflows were slightly below the estimated long-term average, and slightly above that estimated in 2003/04.

Stage 1 urban restrictions were applied throughout the year to towns supplied by Gippsland Water (Warragul, Drouin, and Neerim South). These restrictions have been in place since December 2002. In contrast to conditions in the previous season, no irrigation restrictions were imposed during 2004/05.

A statewide assessment of stream condition found that 44% of streams in the Bunyip basin are in poor or very poor condition. Several rivers within the Bunyip basin flow into Western Port, which has high environmental values and has wetlands listed under the Ramsar Convention. Sea grasses in receiving waters are sensitive to changes in sediment load from rivers in the basin.

An assessment of the environmental health of rivers and streams in the Bunyip basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net). Details of works undertaken to improve the basin's long-term water quality and river health during 2004/05 are available from Melbourne Water.

Figure 23-1 Map of the Bunyip basin



23.4 Summary of the 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 23-1. This excludes water delivered directly to customers from Melbourne Water's supply system in the Yarra River basin. It can be seen from this table that surface water extraction is a small proportion of total streamflow and that treated effluent is currently an underutilised resource. The State Government is currently examining options to increase recycling from the Eastern Treatment Plant, which is located within this river basin.

Table 23-1 Summary of total water resource and water use in the Bunyip basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	464,300	27,300
Groundwater [(1)]	not available	not available
Recycled Water	165,570	17,500

Note:

(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90% of their surface area within the river basin boundary.

23.5 Water for the Environment

In 2004/05 there was no formal environmental water reserve established or in operation in the Bunyip basin. Minimum environmental passing flows for habitat provision were delivered through the management of licensed extractions.

The environment's share of total flow at the basin outlet was 433,600 ML, which is about 93% of the total inflows (Table 23-2). This amount consists of water flowing in the basin that was not taken out of streams for consumptive uses.

23.6 Surface Water Resources

23.6.1 Water Balance

A water balance for the Bunyip basin is shown in Table 23-2. The basin includes Tarago Reservoir, which is not currently used for metropolitan water supply, however it will be in coming years following the completion of a water treatment plant at the reservoir.

Inflows during the year were 86% of the estimated long-term average of 541,000 ML a year (Department of Natural Resources and Environment, 2002). As part of the water balance calculation, the estimation of inflows for the Bunyip basin was based on the sum of outflows plus diversions and losses.

23.6.2 Small Catchment Dams

The capacity of small catchment dams in the Bunyip basin is estimated to be around 21,700 ML (Table 23-3). Usage in 2004/05 is estimated to be approximately equal to the average annual usage of 15,520 ML and, after allowing for losses, the total catchment run-off that is harvested as a result of the small catchment dams is estimated to be 16,100 ML.

Table 23-2 Balance of surface water in the Bunyip basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
Volume in storage at start of year	23,900	27,600
Volume in storage at end of year	24,100	23,900
Change in storage	200	-3,700
Inflows		
Catchment inflow (1)	463,200	432,500
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	1,070	650
Sub-total	**464,300**	**433,110**
Usage		
Urban diversions	4,020	4,340
Licensed private diversions from regulated streams	2,400	3,000
Licensed private diversions from unregulated streams	5,400	6,000
Small catchment dams	15,500	15,500
Sub-total	**27,300**	**28,800**
Losses		
Net evaporation losses from major storages	1,700	1,800
Losses from small catchment dams	600	600
In-stream infiltration to groundwater, flows to floodplain and evaporation (2)	900	61,400
Sub-total	**3,200**	**63,800**
Water Passed at Outlet of Basin		
River outflows to the ocean	433,600	344,200
Environment's Share of Total Flow in the Bunyip Basin	**433,600**	**344,200**

Notes:

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

(2) Losses estimated using loss functions in the Tarago River REALM. The volume of estimated losses reduced from the previous year due to an improvement of the calculation method.

Table 23-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	8,000	4,000	n/a
Irrigation	13,700	11,500	n/a
Total	**21,700**	**15,500**	**16,100**

Note:

(1) n/a: information not available

23.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water entitlements, diversion licences or sales water within the basin in 2004/05.

23.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 23-4. 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 2004/05.

No bulk entitlements for the Bunyip basin were in place in 2004/05 and hence compliance is not reported against these bulk entitlements.

Licences on unregulated streams are not currently metered and hence compliance has not been assessed. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 23-4 Volume of water diverted under surface water entitlements in the Bunyip basin

Entitlement	Period of Bulk Entitlement (years)	Total Bulk Entitlement –30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?
Gippsland Water						
Tarago / Bunyip	1	n/a	0	n/a	4,017	n/a
Melbourne Water						
Tarago / Bunyip	1	n/a	0	n/a	0	n/a
Southern Rural Water						
Tarago / Bunyip	1	n/a	0	n/a	2,390	n/a
Total Annual Volume of Bulk Entitlements		**n/a**	**0**	**n/a**	**6,407**	
Licensed Diversions from Unregulated Streams		12,269	0	12,269	5,400	

Note:

(1) n/a: bulk entitlement conversion order was not finalised at the beginning of 2004/05

23.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

There were no bulk entitlements in operation in the Bunyip basin in 2004/05.

23.6.6 Compliance with Streamflow Management Plans

There are no streamflow management plans currently in operation in the Bunyip basin and none are planned in the short-term.

23.7 Groundwater Resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Bunyip basin, excluding stock and domestic use, is presented in Table 23-5. An estimate of stock and domestic groundwater use is provided in Table 23-6.

The Bunyip basin contains the whole Frankston GMA, Nepean GMA and Koo-Wee-Rup WSPA as well as part of the Moorabbin GMA. The volumes described in Table 23-5 and Table 23-6 are totals for the management areas and include the area that falls outside the Bunyip basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 23-5 Compliance with licensed groundwater volumes, Bunyip basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Frankston GMA (100%)	ALL	3,200	1,098	0	384	384	3,200
Moorabbin GMA (63%)	ALL	4,305	2,071	0	725	725	Not Available (6)
Koo-Wee-Rup WSPA (97%)	ALL	13,769	13,769	3,070	0	3,070	13,769
Nepean GMA (100%)	ALL	5,000	6,049	0	2,117	2,117	5,000

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 23-6 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Frankston GMA	199	398
Moorabbin GMA	238	476
Koo-Wee-Rup WSPA	600	1,200
Nepean GMA	1,162	349 (2)

Notes:

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

(2) Household supply is the dominant stock and domestic use in the Nepean GMA. An estimate of 0.3 ML/bore has been applied as a more realistic approximation of stock and domestic use for this area.

23.8 Recycled Water

Gippsland Water, South East Water and Melbourne Water operate sewage treatment plants within the Bunyip basin.

The largest is the Eastern Treatment Plant operated by Melbourne Water, which had a total effluent volume of 152,387 ML in 2004/05. Of this total, 10% of effluent was reused - mostly on-site. Recycled effluent was also used on golf courses, recreational areas and residential gardens. Melbourne Water also sells recycled water to some customers. The State Government is currently investigating options to better utilise treated effluent from the Eastern Treatment Plant.

Other treatment plants within the basin recycled 19% of effluent. The total proportion of recycled effluent in the basin was 11% (Table 23-7).

Table 23-7 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)					Volume Discharged to the Environment (ML)	Other (ML) (3)
			To Retailers	Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Blind Bight	176	176	0	0	176	0	0	0	0
Boneo	3,367	49	0	1	0	0	49	3,318	1
Cranbourne	194	194	0	0	194	0	0	0	0
Drouin	537	209	0	0	209	0	0	328	0
Eastern Treatment Plant	152,387	15,034	1,626	0	0	0	13,408	0	137,353
Kooweerup	137	130	0	0	130	0	0	8	0
Lang Lang	63	63	0	0	63	0	0	0	0
Longwarry	135	135	0	0	135	0	0	0	0
Mt Martha	5,169	523	0	10	16	0	450	4,693	-48
Neerim South	55	0	0	0	0	0	55	0	55
Pakenham	1,657	921	0	45	876	0	0	736	0
Somers	1,690	66	0	39	27	0	0	1,624	0
Total	**165,568**	**17,500**	**1,626**	**95**	**1,826**	**0**	**13,961**	**10,707**	**137,361**

Notes:

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

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

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

24 Yarra Basin

24.1 Location of Water Resources

The Yarra River basin is located within the South East Coast Drainage Division. Melbourne Water harvests the basin's water in the Upper Yarra Reservoir, O'Shannassy Reservoir, Sugarloaf Reservoir and Maroondah Reservoir. The Yarra River originates in the Yarra Ranges National Park and flows through the heart of Melbourne before reaching Port Phillip Bay. A map of the river basin is shown in Figure 24-1.

Water supply protection areas (WSPAs) within the Yarra basin include the whole of the Wandin Yallock WSPA for groundwater and the Plenty River, Diamond Creek, Hoddles Creek, Olinda Creek, Stringybark Creek and 'Steels, Pauls and Dixons Creeks' WSPAs for surface water. Groundwater management areas (GMAs) within the Yarra Basin include part of the Kinglake GMA and Moorabbin GMA.

24.2 Responsibilities for Management of Water Resources

Melbourne Water as bulk water supplier and Yarra Valley Water, South East Water and City West Water as retail water suppliers are responsible for water supply in the Yarra basin. Melbourne Water is the licensing authority responsible for surface water licensed diversions and Southern Rural Water is the licensing authority responsible for groundwater licensed diversions within the Yarra basin.

Melbourne Water was responsible for waterway management in the Yarra Basin in 2004/05.

24.3 Seasonal Overview

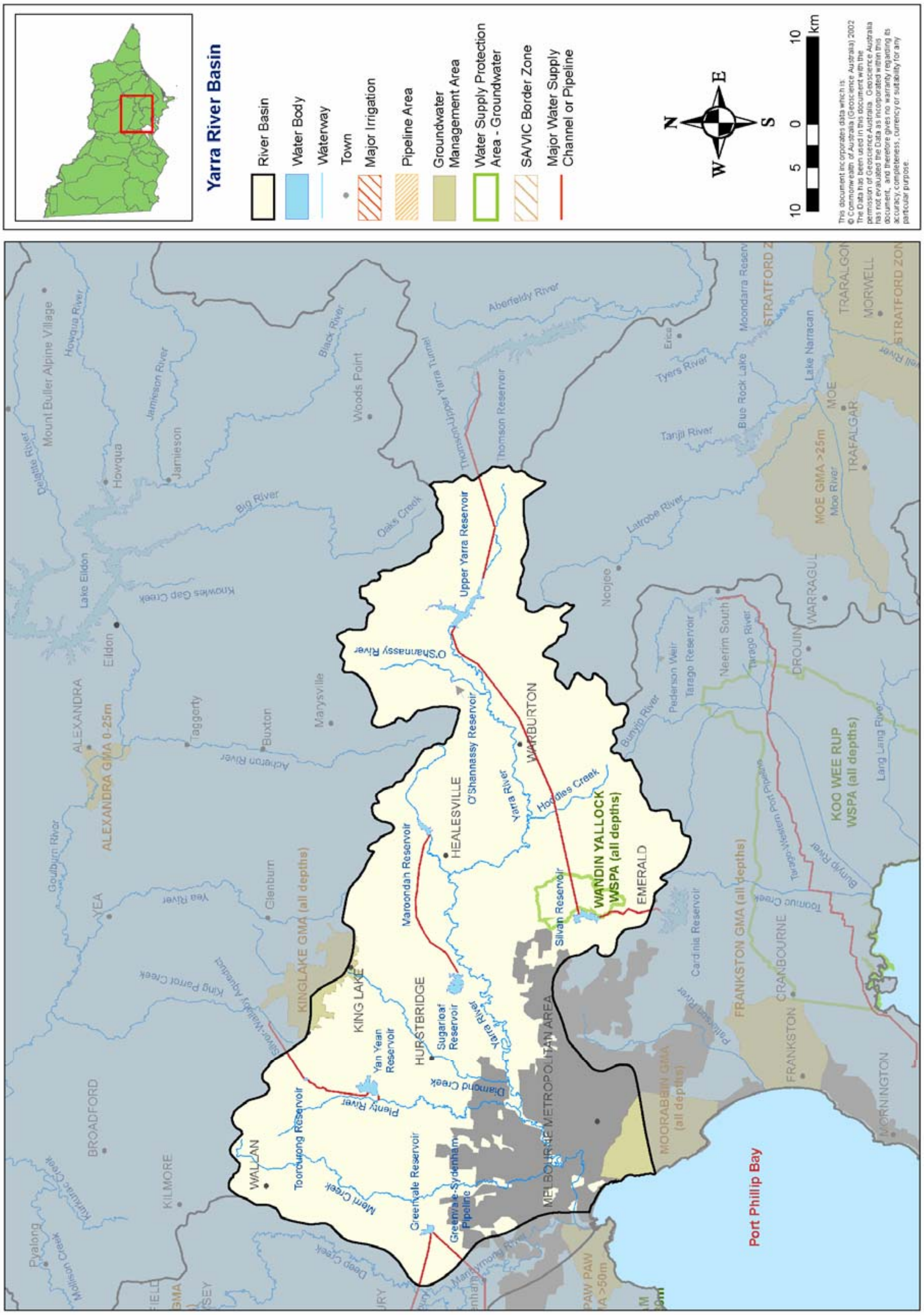
Average rainfall conditions prevailed across the Yarra basin in 2004/05. Rainfall levels were aided by a major flood event in February 2005, which flooded areas of Southbank and deposited a large volume of silt and debris into Port Phillip Bay. Total streamflows were slightly above the long-term average (110%) in 2004/05, and significantly above that recorded in 2003/04 (at an estimated 82% of the long-term average). However, certain individual streams recorded very low streamflows.

The average rainfall conditions resulted in a general easing of restrictions in this basin. Stage 2 urban restrictions were lifted from areas supplied by the retail companies in March 2005. These restrictions had previously been in place since August 2003.

The Yarra catchment had a number of irrigation bans imposed during 2004/05. These occurred in:

- Diamond Creek during July 2004, for most of August, October and January, and then from late March 2005 onwards;
- Pauls Creek, and Steels and Dixons Creeks from July to September 2004, November 2004 to January 2005, then again in June 2005;
- Plenty River during November 2004, then from March 2005 onwards;
- Darebin Creek from March 2005 to May 2005;
- Hoddles Creek for short periods in October 2004 and February 2005, part of January 2005, and from March 2005 onwards;
- Stringybark Creek during March and April 2005; and
- The Wandin Yallock Creek and Woori Yallock Creek during June 2005.

Figure 24-1 Map of the Yarra basin



In addition, extractions from the Little Yarra River were restricted from March 2005 to May 2005.

An assessment of the environmental health of rivers and streams in the Yarra basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net). A separate assessment of urban streams is available from Melbourne Water.

Details of works undertaken to improve the basin's long-term water quality and river health during 2004/05 are available from Melbourne Water.

24.4 Summary of the 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 24-1. The total surface water available includes 81,000 ML of water transferred from the Thomson and Goulburn River basins to the Yarra River upstream of Upper Yarra Reservoir.

Table 24-1 Summary of total water resource and water use in the Yarra basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	1,098,600	483,900
Groundwater (1)	not available	not available
Recycled Water	9,200	210

Note:

(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90% of their surface area within the river basin boundary.

24.5 Water for the Environment

In 2004/05 there was no formal environmental water reserve established in the Yarra basin. Minimum environmental passing flows for habitat provision were delivered through the management of licensed extractions. An environmental flow study was completed during the year, which will be used to set environmental flows in the Yarra River.

The environment's share of total flow at the basin outlet was 607,700 ML, which is equivalent to about 55% of the inflows to the Yarra basin (Table 24-2). This amount consists of minimum passing flows managed by Melbourne Water and all other water flowing in the basin that was not taken out of the streams for consumptive uses.

At a catchment scale, there are issues related to the timing of diversions in unregulated streams of the basin. In many of the tributaries of the Yarra, private diversions during the irrigation season can have a significant impact on the flow regime, resulting in negative effects on aquatic habitats and populations. Streamflow management plans are being developed in these catchments to develop water sharing rules to minimise the impacts of such diversions and to ensure the water resources of the area are managed equitably and sustainably.

24.6 Surface Water Resources

24.6.1 Water Balance

A water balance for the Yarra basin is shown in Table 24-2. Melbourne Water operates seven major storages within the Yarra basin. Upper Yarra Reservoir, O'Shannassy Reservoir and Maroondah Reservoir all harvest water. Sugarloaf Reservoir, an off-stream storage, has a dual role to harvest water and to act as a seasonal balancing reservoir. Silvan Reservoir, Yan Yean Reservoir, and Greenvale Reservoir are off-stream storages and act as seasonal balancing reservoirs. The volume in on-stream storages started and ended the 2004/05 year at just over 60% of capacity.

Across the whole basin the year's inflows were equivalent to 110% of the long-term average inflows. In Table 24-2 the inflows also include transfers from other basins. During the year there was a net transfer of water into the Yarra basin from other basins. Melbourne Water imported 71,712 ML from the Thomson basin and 9,300 ML from the Goulburn basin to supply Melbourne urban demands. Southern Rural Water utilised the Melbourne distribution system including Western Water's Sydenham to Melton Pipeline to transfer 2,390 ML to the Werribee Irrigation District via the Werribee River at Werribee Weir.

To calculate the water balance in 2004/05, the estimation of inflows for the Yarra basin were based on the sum of diversions, losses and outflows, minus inflows from other basins and treated effluent discharged to rivers, and taking into account the change in storage volume over the year.

Table 24-2 Balance of surface water in the Yarra basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
Volume in storage at start of year (3)	133,600	218,100
Volume in storage at end of year	131,100	260,400
Change in storage	-2,500	42,300
Inflows		
Catchment inflow (1)	1,008,700	755,700
Transfers from other basins	81,000	87,600
Return flow from irrigation	0	0
Treated effluent discharged back to river	8,870	8,380
Sub-total	**1,098,600**	**851,700**
Usage		
Urban diversions	441,010	438,800
Licensed private diversions from unregulated streams	27,000	26,100
Small catchment dams	15,900	15,800
Transfers to Werribee Weir	2,400	0
Sub-total	**483,900**	**480,700**
Losses		
Net evaporation losses from major storages (3)	8,200	16,700
Losses from small catchment dams	1,300	1,400
In-stream infiltration to groundwater, flows to floodplain and evaporation (2)	0	6,100
Sub-total	**9,500**	**24,200**
Water Passed at Outlet of Basin		
River outflows to Port Phillip Bay	607,700	304,400
Environment's Share of Total Flow in the Yarra Basin	**607,700**	**304,400**

Notes:

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

(2) Losses estimated to be zero in the Yarra River REALM. The volume of estimated losses reduced from the previous year as 2003/04 losses were estimated by back-calculation.

(3) Start storage of current year and end storage of previous year do not match because the off-stream storages of Sugarloaf Reservoir, Greenvale Reservoir and Silvan Reservoir are no longer included in the storage calculation in 2004/05. These storages were removed from the storage evaporation calculation in 2004/05.

24.6.2 Small Catchment Dams

The capacity of small catchment dams in the Yarra basin is estimated to be around 23,100 ML (Table 24-3). Usage in 2004/05 is estimated to be approximately equal to the average annual usage of 15,900 MLand, after allowing for losses, the total catchment run-off that is harvested as a result of the small catchment dams is estimated to be 17,200 ML.

Table 24-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	10,500	5,300	n/a
Irrigation	12,600	10,600	n/a
Total	**23,100**	**15,900**	**17,200**

Note:

(1) n/a: information not available

24.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water entitlements, diversion licences or sales water within the basin in 2004/05.

24.6.4 Volume Diverted

The volume of water diverted under bulk entitlements is shown in Table 24-4. Compliance with individual bulk entitlement volumes is deemed to occur in Table 24-4 if water use is not more than the maximum volume allowed to be diverted in 2004/05. However, as the bulk entitlement in the Yarra basin was not completed by the start of 2004/05, compliance is not assessed.

Approximately one-third of licences on unregulated streams are metered. Compliance for these individual water users is not included in the aggregated values for the water accounts. Total licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 24-4 Volume of water diverted under surface water entitlements in the Yarra basin

Entitlement	Period of Bulk Entitlement (years)	Total Bulk Entitlement –30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?
Melbourne Water						
Melbourne Supply System	1	n/a	0	n/a	441,010	n/a
Total Annual Volume of Bulk Entitlements		**n/a**	**0**	**n/a**	**441,010**	
Licensed Diversions from Unregulated Streams		35,982	0	35,982	27,000	

Note:

(1) n/a: bulk entitlement conversion order was not finalised at the beginning of 2004/05

24.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

In 2004/05 there were no bulk entitlements operating in the Yarra basin.

24.6.6 Compliance with Streamflow Management Plans

There are two completed streamflow management plans (SFMPs) within the Yarra basin: Diamond Creek and Hoddles Creek.

Very dry conditions were noted in the annual report for the Diamond Creek Streamflow Management Plan in 2004/05, resulting in prolonged bans in extracting water resources. The Streamflow Management Plan specifies that a permanent ban occur from 1 January to 31 March in each year. Due to an implementation oversight, streamflows were managed based on normal low-flow period environmental flows, resulting in only partial bans over the permanent ban period in 2005. The maximum volume of licences under the plan was exceeded in 2004/05 by almost 40% due to higher than previously estimated farm dam volumes following the completion of the farm dam registration process. No other non-compliances were reported.

No non-compliances were reported by Melbourne Water for the Hoddles Creek Streamflow Management Plan in 2004/05. Very dry conditions were also recorded in this catchment.

The following SFMPs are also being developed in the Yarra basin:

- Plenty River;
- Paul, Steels, Dixons Creek;
- Olinda Creek;
- Stringybark Creek;
- Woori Yallock Creek; and
- Little Yarra/Don Rivers.

24.7 Groundwater Resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Yarra basin, excluding stock and domestic use, is presented in Table 24-5. An estimate of stock and domestic groundwater use is provided in Table 24-6.

The Yarra basin contains the whole Wandin Yallock WSPA as well as part of the Kinglake GMA and Moorabbin GMA. The volumes described in Table 24-5 and Table 24-6 are totals for the management areas and include the area that falls outside the Yarra basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 24-5 Compliance with licensed groundwater volumes, Yarra basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Kinglake GMA (22%)	ALL	3,830	1,840	0	644	644	Not Available (6)
Moorabbin GMA (37%)	ALL	4,305	2,071	0	725	725	Not Available (6)
Wandin Yallock WSPA (100%)	ALL	3,043	3,043	300	0	300	3,043

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 24-6 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Kinglake GMA	342	684
Moorabbin GMA	238	476
Wandin Yallock WSPA	163	326

Note:

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

24.8 Recycled Water

Yarra Valley Water operates nine sewage treatment plants within the Yarra basin. Two of the plants, Avonsleigh and Emerald, were closed during the year and were replaced with a pumped connection to the Eastern Treatment Plant operated by Melbourne Water.

Effluent was reused at three of the plants in 2004/05. Overall, 2% of effluent was reused in the basin. New projects are planned to increase the proportion of water recycled by Yarra Valley Water, including reuse projects at Whittlesea and Epping North.

Table 24-7 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Brushy Creek	4,138	38	0	38	0	1	4,100	0
Craigieburn	1,057	91	0	76	0	15	967	-1
Emerald - Ferres Road	45	0	0	0	0	0	45	0
Avonsleigh - Symons Road	75	0	0	0	0	0	75	0
Healesville	390	0	0	0	0	0	390	0
Lilydale	2,572	0	0	0	0	0	2,572	0
Monbulk	15	0	0	0	0	0	15	0
Upper Yarra	710	0	0	0	0	0	710	0
Whittlesea	198	77	0	77	0	0	0	121
Total	**9,200**	**206**	**0**	**190**	**0**	**16**	**8,874**	**120**

Notes:

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

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

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

25 Maribyrnong Basin

25.1 Location of Water Resources

The Maribyrnong basin is located within the South East Coast Drainage Division. The headwaters are located near Lancefield and Macedon and the Maribyrnong River flows through Melbourne before joining the Yarra River estuary just upstream of Port Phillip Bay. A map of the river basin is shown in Figure 25-1.

Groundwater management areas (GMAs) within the Maribyrnong basin include the whole Lancefield GMA and part of the Cut Paw Paw GMA.

25.2 Responsibilities for Management of Water Resources

Melbourne Water is the licensing authority responsible for managing private diversions in the lower Maribyrnong basin commencing below the confluence with Deep Creek and the Maribyrnong River. Melbourne Water, as bulk supplier, and City West Water, as retail water supplier, are responsible for water supply in metropolitan Melbourne, while Western Water is responsible for supplying urban areas located outside the metropolitan area.

Southern Rural Water is the licensing authority responsible for managing private diversions in the upper Maribyrnong Basin and groundwater in the whole of the Maribyrnong basin. Southern Rural Water also manages Rosslynne Reservoir.

The Port Phillip and Westernport Catchment Management Authority was responsible for co-ordinating natural resources and catchment management in the Maribyrnong Basin in 2004/05. The Government's *Our Water Our Future* action plan determined that Melbourne Water be given responsibility for waterways, drainage and floodplain management in the entire Port Phillip and Westernport region. This responsibility was formalised in November 2005.

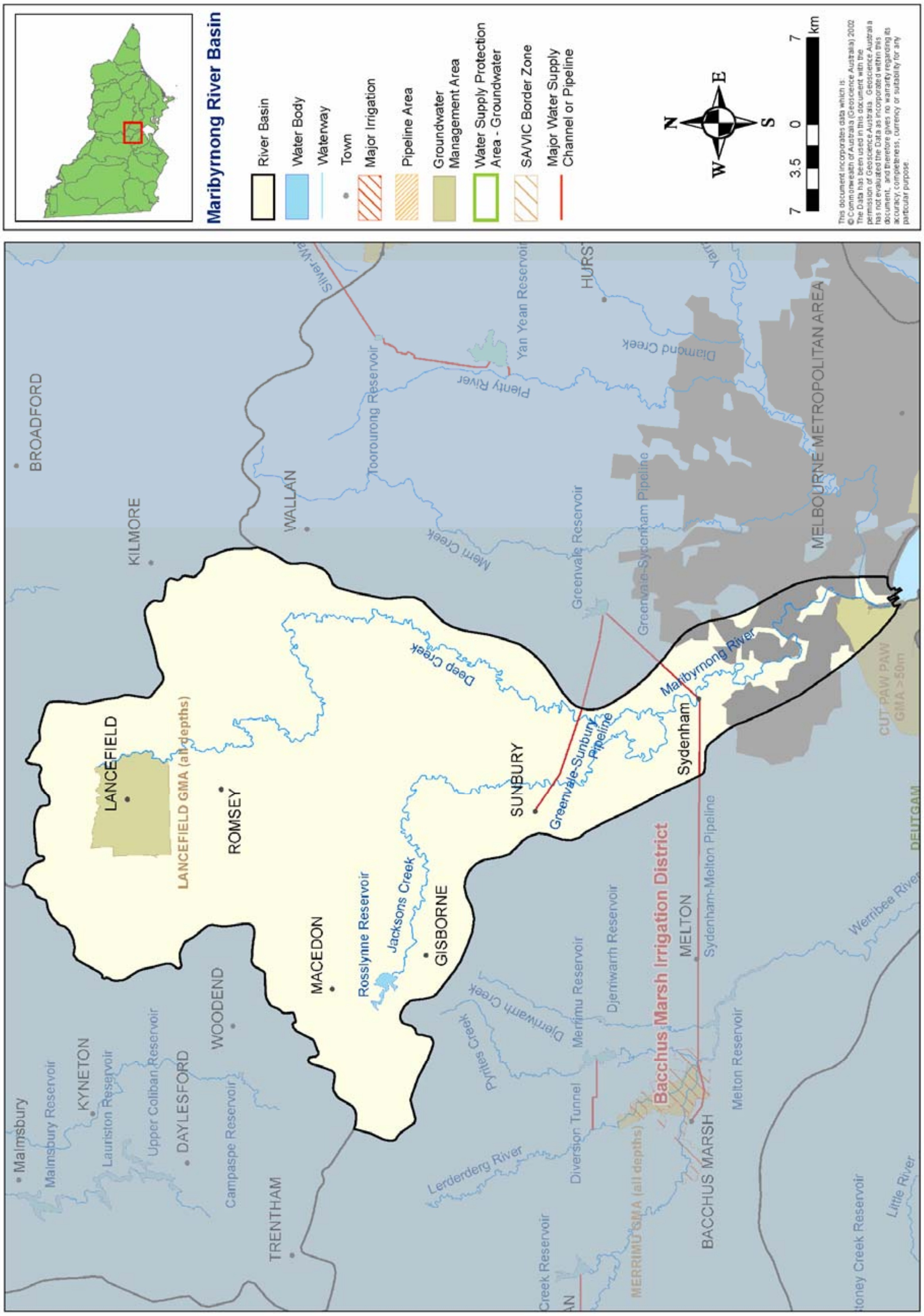
25.3 Seasonal Overview

Rainfall conditions in the Maribyrnong Basin in 2004/05 were close to average at around 80-100% of long-term average annual rainfall, however streamflows remained well below average. This is most likely due to the prolonged effects of the recent drought having depleted soil moisture. Saltwater Creek, one of the main tributaries flowing into Rosslynne Reservoir, recorded only 16% of its long-term average in 2004/05 (at gauge 230210), whilst streamflow in Riddells Creek (at gauge 230204) was 31% of the long-term average. Total streamflows in 2004/05 and 2003/04 were almost identical.

Water restrictions were in place to varying degrees across the basin and were lifted as water availability improved for the first time in several years. The restrictions previously applied to Gisborne, Macedon, Mount Macedon and Riddells Creek were eased in December 2004, and then lifted in March 2005 along with previous restrictions to Lancefield, Sunbury, Bulla, Diggers Rest, and Romsey. Gisborne, Mount Macedon, Macedon and Riddells Creek, which are supplied from Rosslynne Reservoir, had previously been on Stage 4 restrictions (of four stages).

In July 2004, pumping bans were in place for Barringo Creek, Bolinda Creek, Main Creek, Deep Creek, Charlie Creek, Witch Creek, Number 3 Creek, Riddells Creek, Turitable Creek, Willimigongon Creek and Jacksons Creek. These restrictions were lifted in the following month, except for Jacksons Creek, which was lifted in October 2004. With the exceptions of Charlie Creek and Witch Creek, which were without restriction for the remainder of the

Figure 25-1 Map of the Maribyrnong basin



2004/05 period, bans for all aforementioned creeks were reinstated from January 2005 onwards. The Maribyrnong River, which has its regulated licences managed by Melbourne Water, was also subject to a ban in March 2005 and May 2005, as well as Monument Creek from April 2005 onwards.

There was not enough water in Melbourne Water's share of Rosslynne Reservoir to provide a seasonal allocation for licensed private diverters. Southern Rural Water provided a seasonal allocation of 25% in February for diverters on Jacksons Creek, however only a small proportion of this allocation was accessed given that water was unavailable until late in the season.

An assessment of the environmental health of rivers and streams in the Maribyrnong basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net). A separate assessment of urban streams is available from Melbourne Water.

25.4 Summary of the 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 25-1.

Table 25-1 Summary of total water resource and water use in the Maribyrnong basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	39,300	13,300
Groundwater [(1)]	not available	not available
Recycled Water	2,950	2,090

Note:

(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90% of their surface area within the river basin boundary.

25.5 Water for the Environment

In 2004/05 there was no formal environmental water reserve established in the Maribyrnong basin.

The environment's share of total flow at the basin outlet was around 16,700 ML, which is about 42% of the total amount of water in the basin (Table 25-2). This amount consists of environmental flows required under passing flow obligations in consumptive bulk entitlements in the basin, and all other water flowing in the basin which was not taken out of streams for consumptive uses.

Maribyrnong River flows have been reduced significantly and the seasonal flow pattern in the regulated reaches of the basin has been modified. As a result of providing water to meet irrigation demand, the flow regime of Jacksons Creek has changed significantly from the natural pattern, with higher than natural flows during the irrigation season and often low flows at other times. However, in 2004/05 and other years of low allocation, higher than natural flows during the irrigation season would not have occurred.

A Streamflow Management Plan is proposed for the Upper Maribyrnong River to develop water sharing rules to minimise the impacts of such diversions and to ensure the water resources of the area are managed equitably and sustainably.

25.6 Surface Water Resources

25.6.1 Water Balance

A surface water balance for the Maribyrnong basin is shown in Table 25-2.

Rosslynne Reservoir is the only large storage located within the basin. The storage volume was extremely low at the start of the year, at only 6% of total capacity. The storage volume increased during 2004/05, but was still only 13% full at the end of June 2005.

Catchment inflows were only 32% of their long-term average. By far the largest diversion of water was for farm dams, making up about two thirds of the total diversions.

As part of the water balance calculation, the estimation of inflows for the Maribyrnong basin was based on the sum of diversions, losses and outflows, minus inflows from treated effluent discharged to rivers, and taking into account the change in storage volume over the year.

Table 25-2 Balance of surface water in the Maribyrnong basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
Volume in storage at start of year	1,600	2,700
Volume in storage at end of year	3,600	1,600
Change in storage	2,000	-1,100
Inflows		
Catchment inflow (1)	37,300	36,700
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	1,970	1,210
Sub-total	**39,300**	**37,900**
Usage		
Urban diversions	3,840	2,730
Licensed private diversions from regulated streams	400	300
Licensed private diversions from unregulated streams	1,300	1,300
Small catchment dams	7,800	7,800
Sub-total	**13,300**	**12,100**
Losses		
Net evaporation losses from major storages	200	1,200
Losses from small catchment dams	4,800	4,800
In-stream infiltration to groundwater, flows to floodplain and evaporation (2)	2,300	4,400
Sub-total	**7,300**	**10,400**
Water Passed at Outlet of Basin		
River outflows to the ocean	16,700	16,500
Environment's Share of Total Flow in the Maribyrnong Basin	**16,700**	**16,500**

Notes:

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

(2) Losses estimated using loss functions from the Maribyrnong REALM. The volume of estimated losses reduced from the previous year due to an improvement of the calculation method.

25.6.2 Small Catchment Dams

The capacity of small catchment dams in the Maribyrnong basin is estimated to be around 11,600 ML. Usage in 2004/05 is estimated to be approximately equal to the average annual usage of 7,800 ML and, after allowing for losses, the total catchment run-off that is harvested by the dams is estimated to be 12,600 ML.

Table 25-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	5,800	2,900	n/a
Irrigation	5,800	4,900	n/a
Total	**11,600**	**7,800**	**12,600**

Note:
(1) n/a: information not available

25.6.3 Water Entitlement Transfers

Temporary transfers of water entitlement within the Maribyrnong basin totalled 76 ML in 2004/05. No permanent transfers occurred in the basin over the year.

25.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 25-4. 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 2004/05.

Licences on unregulated streams are not currently metered and hence compliance has not been assessed. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

25.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

Western Water reported minor non-compliances with passing flow conditions from Macedon to Rosslynne and diversions from Main Creek. The non-compliances occurred during a heavy rainfall event in September 2004.

A proposal to improve flow monitoring to provide closer control of compliance is currently being reviewed.

25.6.6 Compliance with Streamflow Management Plans

There is no streamflow management plan (SFMP) currently in operation in the Maribyrnong basin, however a SFMP is being developed for the Upper Maribyrnong River.

Table 25-4 Volume of water diverted under surface water entitlements in the Maribyrnong basin

Entitlement	Period of Bulk Entitle-ment (years)	Total Bulk Entitlement – 30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?	Volume Diverted in 2004/05 (ML)
Western Water							
Gisborne-Barringo Creek	1	n/a	0	n/a	0	n/a	0
Lancefield	1	315	0	315	76	Yes	76
Macedon and Mt Macedon (2)	1	n/a	0	n/a	816	n/a	816
Riddells Creek	1	300	0	300	65	Yes	65
Romsey	1	460	0	460	452	Yes	452
Maribyrnong	5	30,500	0	30,500	9,799	Yes	2,065
Melbourne Water							
Maribyrnong	5	5,725	0	5,725	1,873	Yes	343
Southern Rural Water							
Maribyrnong	5	1,910	0	1,910	400	Yes	26
Total Annual Volume of Bulk Entitlements		**8,702**	**0**	**8,702**	**3,823**		**3,843**
Licensed Diversions from Unregulated Streams		2,063	0	2,063	1,300		1,300

Notes:

(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2004, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2004-05 period. The *actual* maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

(2) Average Bulk Entitlement is 645 ML/yr, but up to 873 ML can be diverted in any one year.

(3) n/a: bulk entitlement conversion order was not finalised at the beginning of 2004/05

25.7 Groundwater Resources

Licensed groundwater entitlements and use for the Cut Paw Paw GMA and Lancefield GMA in the Maribyrnong basin, excluding stock and domestic use, are shown in Table 25-5. An estimate of stock and domestic groundwater use is provided in Table 25-6. 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 groundwater supply is provided in Table 25-7.

The Maribyrnong basin contains the whole Lancefield GMA and part of the Cut Paw Paw GMA. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 25-5 Compliance with licensed groundwater volumes, Maribyrnong basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Cut Paw Paw GMA (21%)	>50	3,650	531	0	186	186	Not Available (6)
Lancefield GMA (100%)	ALL	1,485	1,373	110	0	110	1,485

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 25-6 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Cut Paw Paw GMA	2	4
Lancefield GMA	76	152

Note:

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

Table 25-7 Urban groundwater usage

Town Supplied	Licensed Allocation ML	Metered Use
Lancefield	585	248

25.8 Recycled Water

All sewage treatment plants within the basin are operated by Western Water. Overall 71% of the effluent was reused (Table 25-8).

Recycled water was supplied to customers, and also released on a temporary basis into Jacksons Creek from Sunbury and Gisborne sewage treatment plants to assist in maintaining stream flow and river health.

Table 25-8 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Gisborne	398	398	85	0	284	29	0	0
Riddells Creek	85	85	0	85	0	0	0	0
Romsey	279	279	0	279	0	0	0	0
Sunbury	2,188	1,325	202	230	821	72	863	0
Total	**2,950**	**2,087**	**287**	**594**	**1,105**	**101**	**863**	**0**

Notes:

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

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

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

26 Werribee Basin

26.1 Location of Water Resources

The Werribee basin is located within the South East Coast Drainage Division and includes Melbourne's western suburbs. The Werribee River and Lerderderg River meet upstream of Melton Reservoir and the river flows through Werribee before entering Port Phillip Bay. A map of the river basin is shown in Figure 26-1.

Water supply protection areas (WSPAs) within the Werribee basin include the whole Deutgam WSPA. Groundwater management areas within the Werribee basin include the whole Merrimu GMA and part of the Cut Paw Paw GMA.

26.2 Responsibilities for Management of Water Resources

Southern Rural Water is responsible for managing the Werribee and Bacchus Marsh irrigation supply systems and is the licensing authority for groundwater and surface water licensed diversions within the Werribee Basin. Southern Rural Water operates Pykes Creek Reservoir, Melton Reservoir, and Merrimu Reservoir, and Western Water operates Djerriwarrh Reservoir.

Melbourne Water as bulk supplier to City West Water, and City West Water as retail supplier, are responsible for supplying water to those parts of the metropolitan area within the basin. Western Water is responsible for supplying urban demands in the north of the basin, including Melton and Bacchus Marsh.

The Port Phillip and Westernport Catchment Management Authority was responsible for co-ordinating natural resources and catchment management in the Werribee Basin in 2004/05 and Melbourne Water had responsibility for waterway management in catchments in the lower eastern part of the Werribee Basin only. The Government's *Our Water Our Future* action plan determined that Melbourne Water be given responsibility for waterways, drainage and floodplain management in the entire Port Phillip and Westernport region. This responsibility was formalised in November 2005.

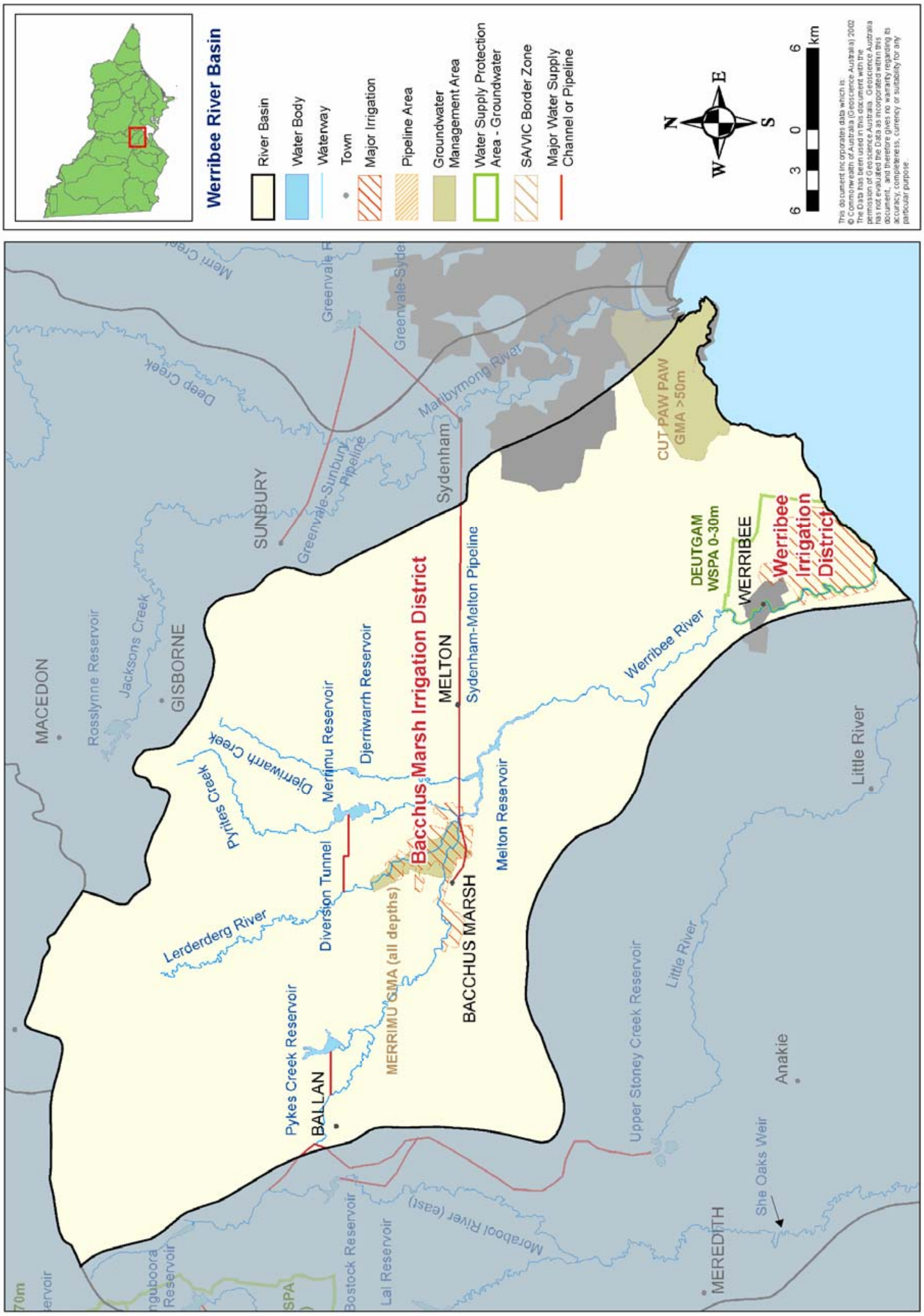
26.3 Seasonal Overview

During 2004/05, rainfall in the Werribee River catchment was approximately equal to the long-term average. Streamflows increased from the previous year, but varied considerably across the catchment. Streamflows recorded for 2004/05 in the upper reaches of the Lerderderg River (gauge 231213) were only 23% of their long-term average. In contrast, Toolern Creek near Melton (streamflow gauge 231231) received 178% of its long-term average flow, however it received more than its average annual rainfall in one day during a storm event in February 2005. Overall, streamflows in 2004/05 were approximately double those estimated in 2003/04, however were still well below average at an estimated 63% of the long-term average.

The seasonal allocation for irrigators in the Werribee and Bacchus Marsh Irrigation Districts returned to 100% of entitlement (announced in late February 2005), following the previous year's 40% allocation which was the lowest seasonal allocation since the 1940s. Irrigators in the Werribee Irrigation District had access to 100% of their entitlement, plus additional water supplied as part of the Werribee Irrigation District water recycling scheme (potable water was supplied prior to scheme commencement, then Class A recycled water from January 2005).

The higher rainfall conditions in 2004/05 resulted in an easing of restrictions to urban water supplies relative to the previous year. Stage 2 restrictions in Bacchus Marsh, Melton,

Figure 26-1 Map of the Werribee basin



Rockbank, Long Forest and Toolern Vale were lifted in March 2005. Stage 4 restrictions (of four stages) at Myrniong, which is supplied from Pykes Creek Reservoir, were lifted in June 2005. Both supply systems had experienced several years of restrictions.

Irrigation diversions were banned for much of the 2004/05 season from the Lerderderg River and Kororoit Creek, managed by Southern Rural Water, with diversions only allowed in November and December 2004. Melbourne Water also banned diversions from Kororoit Creek from March 2005 until the end of the 2004/05 period.

An assessment of the environmental health of rivers and streams in the Werribee basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net). A separate assessment of urban streams is available from Melbourne Water.

26.4 Summary of the 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 26-1.

Table 26-1 Summary of total water resource and water use in the Werribee basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	86,600	29,800
Groundwater (1)	not available	not available
Recycled Water	175,130	24,720

Notes:

(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90% of their surface area within the river basin boundary.

26.5 Water for the Environment

There was no formal environmental water reserve established in the Werribee basin in 2004/05.

The environment's share of total flow at the basin outlet was 24,400 ML, which is about 28% of the catchment inflows in the basin (Table 26-2). This amount consists of environmental passing flows required under bulk entitlements in the basin, and all other water flowing in the basin which was not taken out of the streams for consumptive uses.

26.6 Surface Water Resources

26.6.1 Water Balance

A surface water balance for the Werribee basin is shown in Table 26-2.

Storage volumes at the start of the year were very low at only 7% of capacity, recovering to around 34% of capacity by the end of the year. Storage volumes shown in the water balance for 2003/04 did not include the unallocated share of Merrimu Reservoir, however this share has been included in the 2004/05 water balance. The estimate of evaporation losses from major storages was improved in 2004/05 compared to the previous season, and was based on average storage volumes rather than storage capacity.

A transfer of 2,390 ML occurred via Western Water's Melton pipeline from the Yarra River Basin to the Werribee River for diversion at Werribee Weir by Southern Rural Water.

As part of the water balance calculation, the estimation of inflows for the Werribee basin was based on the sum of diversions, losses and outflows, minus inflows from treated effluent discharged to rivers, and taking into account the change in storage volume over the year.

Table 26-2 Balance of surface water in the Werribee basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
Volume in storage at start of year	5,100	8,300
Volume in storage at end of year	22,900	4,800
Change in storage	17,800	-3,600
Inflows		
Catchment inflow (1)	83,600	43,700
Transfers from other basins	2,400	0
Return flow from irrigation	600	400
Treated effluent discharged back to river	0	5,680
Sub-total	**86,600**	**49,700**
Usage		
Urban diversions	3,930	3,780
Irrigation district diversions	16,200	8,800
Licensed private diversions from unregulated streams	400	400
Small catchment dams	9,300	9,400
Sub-total	**29,800**	**22,400**
Losses		
Net evaporation losses from major storages	1,300	4,200
Losses from small catchment dams	5,400	5,300
In-stream infiltration to groundwater, flows to floodplain and evaporation (2)	7,900	10,400
Sub-total	**14,600**	**20,000**
Water Passed at Outlet of Basin		
River outflows to Port Phillip Bay	24,400	11,000
Environment's Share of Total Flow in the Werribee Basin	**24,400**	**11,000**

Notes:

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

(2) Losses estimated using loss functions from the Werribee REALM. The volume of estimated losses reduced from the previous year due to an improvement of the calculation method.

26.6.2 Small Catchment Dams

The capacity of small catchment dams in the Werribee basin is estimated to be around 13,500 ML (Table 26-3). Usage in 2004/05 is estimated to be approximately equal to the average annual usage of 9,300 ML and, after allowing for losses, the total catchment run-off that is harvested by the dams is estimated to be 14,700 ML.

Table 26-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	5,900	2,900	n/a
Irrigation	7,600	6,400	n/a
Total	**13,500**	**9,300**	**14,700**

Note:

(1) n/a: information not available

26.6.3 Water Entitlement Transfers

Both permanent and temporary water entitlement transfers occurred in 2004/05 within the Werribee system managed by Southern Rural Water. Some 6 ML of water entitlements were permanently transferred, whilst 1,388 ML were transferred on a temporary basis, i.e. only for the 2004/05 season.

26.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 26-4. 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 2004/05.

The remainder of bulk entitlements for the Werribee basin were completed by the start of 2004/05 and values are reported against those bulk entitlements for the first time.

Central Highlands Water did not use any water from their Ballan bulk entitlement because the demand was supplied from Lal Lal Reservoir in the Moorabool basin.

Licences on unregulated streams are not currently metered and hence compliance has not been assessed. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 26-4 Volume of water diverted under surface water entitlements in the Werribee basin

Entitlement	Period of Bulk Entitle-ment (years)	Total Bulk Entitlement – 30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?	Volume Diverted in 2004/05 (ML)
Central Highlands Water							
Ballan	1	451	0	451	0	Yes	0
Blackwood and Barry's Reef	1	140	0	140	44	Yes	44
Western Water							
Myrniong	1	n/a	0	n/a	3	n/a	3
Werribee System - Urban	5	n/a	0	n/a	25,663	n/a	3,927
Southern Rural Water							
Werribee System	5	135,200	0	135,200	69,863	Yes	13,818
Total Annual Volume of Bulk Entitlements		**27,631**	**0**	**27,631**	**19,152**		**17,792**
Licensed Diversions from Unregulated Streams		921	0	921	400		400

Notes:

(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2004, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2004-05 period. The *actual* maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

(2) n/a: bulk entitlement conversion order was not finalised at the beginning of 2004/05

26.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

The passing flow obligations associated with bulk entitlements in the basin were complied with during 2004/05.

26.6.6 Compliance with Streamflow Management Plans

There is no streamflow management plan (SFMP) currently in operation in the Werribee basin.

26.7 Groundwater Resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Werribee basin, excluding stock and domestic use, is presented in Table 26-5. An estimate of stock and domestic groundwater use is provided in Table 26-6.

The Werribee basin contains the whole Deutgam WSPA and Merrimu WSPA as well as part of the Cut Paw Paw GMA. The volumes described in Table 26-5 and Table 26-6 are totals for the management areas and include the area that falls outside the Werribee basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 26-5 Compliance with licensed groundwater volumes, Werribee basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Cut Paw Paw GMA (70%)	>50	3,650	531	0	186	186	Not Available (6)
Merrimu WSPA (100%)	ALL	451	451	90	0	90	451
Deutgam WSPA (100%)	0-30	5,234	5,234	960	0	960	5,234

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 26-6 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Cut Paw Paw GMA	2	4
Merrimu WSPA	13	26
Deutgam WSPA	257	514

Note:

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

26.8 Recycled Water

Five sewage treatment plants operate within the Werribee basin. Overall, 14% of effluent is reused (Table 26-7).

Melbourne Water operates the Western Treatment Plant, which is the largest sewage treatment plant in the basin. The volume reused at the Western Treatment Plant includes the recycling of 20,676 ML for agricultural purposes.

In mid-2004/05, the Werribee Irrigation District water recycling scheme was launched by Melbourne Water and Southern Rural Water. This scheme has a 2010 recycling target of 8,500 ML per year. In 2004/05, 201 ML of high quality Class A recycled water was supplied to Southern Rural Water for delivery to vegetable growers in the district.

Table 26-7 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)					Volume Discharged to the Environment (ML)	Other (ML) (3)
			To Retailers	Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Altona	5,800	0	0	0	0	0	0	0	5,800
Ballan	153	81	0	0	81	0	0	0	72
Melton	2,852	2,852	0	9	2,843	0	0	0	0
Parwan	757	757	0	0	757	0	0	0	0
Western Treatment Plant	165,569	21,033	201	156	20,676	0	0	0	144,536
Total	**175,131**	**24,723**	**201**	**165**	**24,357**	**0**	**0**	**0**	**150,408**

Notes:

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

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

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

27 Moorabool Basin

27.1 Location of Water Resources

The Moorabool basin is located within the South East Coast Drainage Division, west of Melbourne. A map of the river basin is shown in Figure 27-1. The Moorabool River joins the Barwon River near Geelong which flows into Bass Strait (the Barwon River Basin is separately reported in Chapter 28). The Moorabool basin also includes the Little River that flows into Port Phillip Bay.

Groundwater management areas (GMAs) within the Moorabool basin include part of the Bungaree WSPA.

27.2 Responsibilities for Management of Water Resources

Southern Rural Water is the licensing authority responsible for managing both groundwater and surface water licensed diversions.

Barwon Water obtains water from both the Barwon and Moorabool basins to supply the urban demand of Greater Geelong. Central Highlands Water harvests water in the upper reaches of the Moorabool basin to provide around 95% of Ballarat's demand as well as to supply smaller towns such as Bungaree and Wallace. Both Geelong and Ballarat are located in the Barwon basin.

The Corangamite Catchment Management Authority is responsible for waterway management in the Moorabool basin.

27.3 Seasonal Overview

The Moorabool basin experienced close to average (80-100%) rainfall conditions during 2004/05. The year's streamflow in the Little River (streamflow gauge 232200) was 175% of its average annual streamflow, however just over half of the 2004/05 total occurred on one day in February 2005. These significant rains (a one-in-20 year event) in February 2005 resulted in an ecologically beneficial flow from the Moorabool River into the Barwon River at Fyansford. Outflow from the basin in the Moorabool River at Batesford (streamflow gauge 232202) was 46% of the long-term average outflow. Total streamflows in 2004/05 are estimated to be more than triple those of 2003/04, yet still below the long-term average (78%).

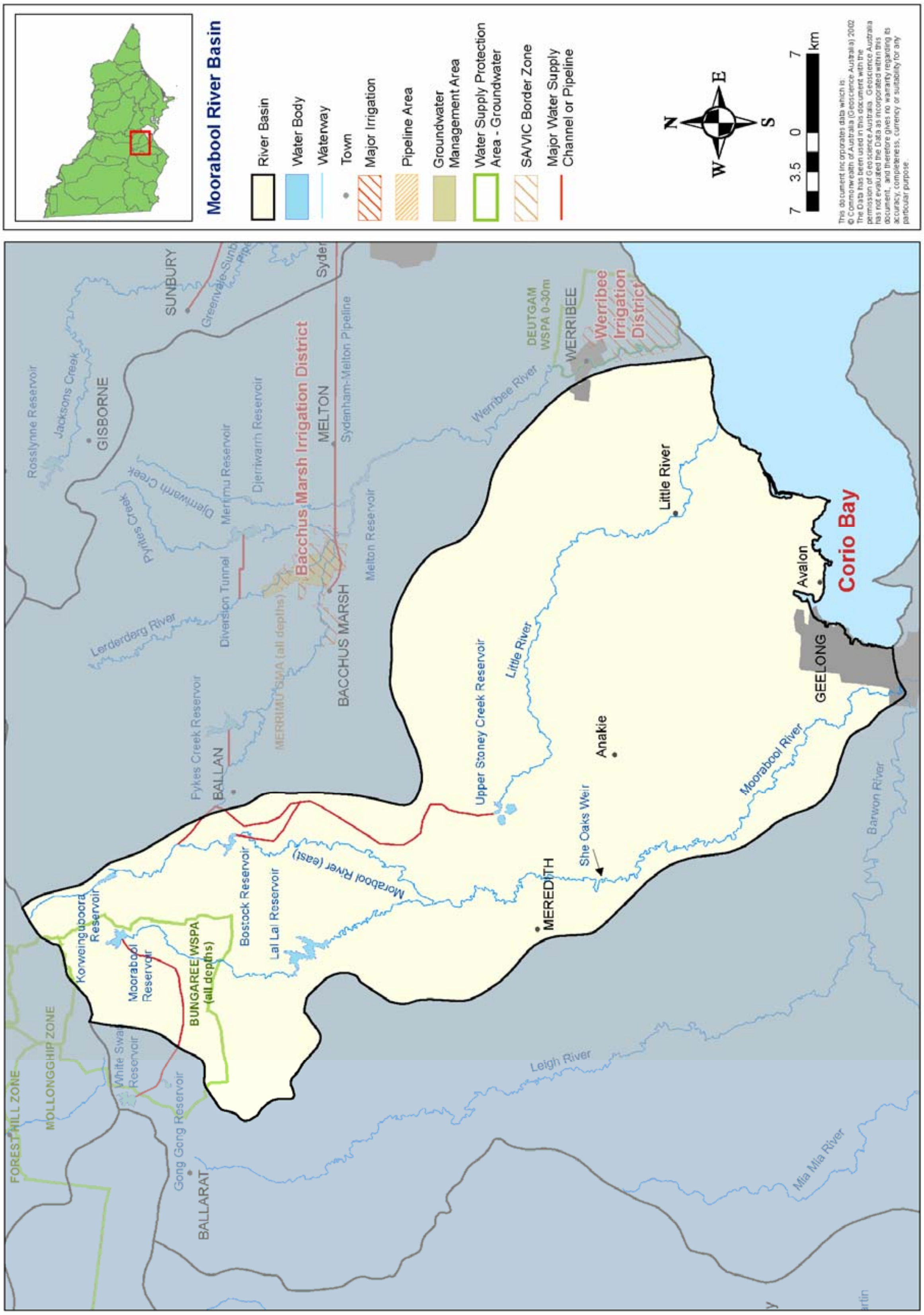
Adverse water quality of releases from Lal Lal at She Oaks following large rainfall events prevented some extraction for urban water supply during the year. Barwon Water cited this reason, as well as fluctuating demands, for approximately one quarter of Lal Lal releases not being taken for supply purposes by the authority.

Urban water supply storages recovered slowly in 2004/05, but remained sufficiently low to warrant ongoing water restrictions. Ballarat and surrounding towns supplied by the Ballarat system were subject to Stage 3 restrictions (of a four stage policy) until the end of March 2005. The Stage 3 restrictions were previously in place since September 2003. The restrictions were subsequently relaxed to Stage 2, with all towns in the Ballarat system continuing on Stage 2 restrictions for the remainder of 2004/05.

No restrictions were in place for water supplied by Barwon Water from the Moorabool basin.

Licensed diverters on the Moorabool River were subject to Stage 3 restrictions in July 2004, followed by various levels of restriction from January 2005 until the end of the 2004/05 period. Restrictions over this period ranged from an irrigation ban on winterfill to a complete ban on irrigation in January, April and May 2005.

Figure 27-1 Map of the Moorabool basin



An assessment of the environmental health of rivers and streams in the Moorabool basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net). A separate assessment of urban streams is available from Melbourne Water.

During 2004/05 a number of stream restoration works were carried out within the basin as part of the Moorabool Water Supply Catchment Protection Project

27.4 Summary of the 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 27-1. There are no sewage treatment plants located in the Moorabool basin, and so no recycled water is available for reuse.

Table 27-1 Summary of total water resource and water use in the Moorabool basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	108,000	41,100
Groundwater (1)	Not available	Not available
Recycled Water	0	0

Notes:

(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90% of their surface area within the river basin boundary.

27.5 Water for the Environment

There was no formal environmental water reserve established in the Moorabool basin in 2004/05.

The environment's share of total flow at the basin outlet was approximately 43,600 ML, which is about 40% of total inflows to the basin (Table 27-2). This volume represents all water flowing from the basin which was not taken out of waterways for consumptive uses.

The reservoirs that exist in the Moorabool basin are for the purposes of urban water supply, and the bulk entitlements associated with each of these reservoirs specify the rules for passing flows. There is no specific monitoring to determine whether the structures are meeting their passing flow requirements.

The Moorabool Resource Assessment Project, which included an environmental flow assessment of the Moorabool River, was released at the end of June 2005. Minimum passing flow requirements in the bulk entitlements did not meet the environmental flows recommended in this study. The study also highlighted that the basin is clearly over-allocated, based on existing consumptive uses and identified environmental flow requirements.

27.6 Surface Water Resources

27.6.1 Water Balance

A water balance for the Moorabool basin is shown in Table 27-2. Storage volumes within the Moorabool started at 20% of total capacity and increased to 34% of total capacity by June 2005.

Central Highlands Water transferred 8,800 ML from the Moorabool basin to supply water to Ballarat and other towns connected to the Ballarat system.

An estimate of in-stream losses to groundwater and evaporation was made using the Lower Barwon and Moorabool REALM models. 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. Transmission losses in the East Moorabool system are estimated to be 15-20%, mainly due to leakage in the Bostock and Ballan channels, while West Moorabool system transmission losses are estimated to be 10%.

As well as the loss estimation, a number of other changes to the calculation method occurred in 2004/05 compared to 2003/04. Catchment inflows were estimated based on the sum of diversions and outflows (including losses), evaporation losses from major storages were based on net evaporation, whilst urban diversions to supply White Swan Reservoir in the Ballarat system were considered an inter basin transfer rather than an urban diversion because the transfer is to a storage that can spill to rivers in the Barwon River basin. Specific information on small catchment dam usage that was available for 2003/04 was not available for 2004/05, as discussed in Section 27.6.2.

Table 27-2 Balance of surface water in the Moorabool basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
Volume in storage at start of year	11,600	26,300
Volume in storage at end of year	22,400	15,800
Change in storage	10,800	-10,500
Inflows		
Catchment inflow (1)	108,000	34,300
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	0	0
Sub-total	**108,000**	**34,300**
Usage		
Urban diversions	8,840	23,400
Transfers to Barwon Basin (White Swan Reservoir)	8,800	
Licensed private diversions from unregulated streams	1,300	600
Small catchment dams (2)	22,200	11,900
Sub-total	**41,100**	**35,900**
Losses		
Net evaporation losses from major storages (3)	900	4,000
Losses from small catchment dams (2)	7,200	0
In-stream infiltration to groundwater, flows to floodplain and evaporation (4)	4,400	0
Sub-total	**12,500**	**4,000**
Water Passed at Outlet of Basin		
River outflows to Port Phillip Bay	22,300	1,800
River outflows to the Barwon River	21,300	3,100
Environment's Share of Total Flow in the Moorabool Basin	**43,600**	**4,900**

Notes:

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

(2) Refer to Section 27.6.2 for explanation of differences between 2003/04 and 2004/05 figures.

(3) The volume of estimated evaporation losses reduced from the previous year due to an improvement of the calculation method (net evaporation rather than gross).

(4) Losses estimated using loss functions from the Lower Barwon REALM and Moorabool REALM. The volume of estimated losses increased from the previous year due to an improvement of the calculation method.

27.6.2 Small Catchment Dams

The capacity of small catchment dams in the Moorabool basin is estimated to be around 28,900 ML (Table 27-3). Usage from the dams is estimated to be approximately equal to the average annual usage of 22,200 ML and, after allowing for losses, the total catchment run-off that is harvested by the dams is estimated to be 29,400 ML. The values shown in Table 27-3 differ to those reported in 2003/04. The values for 2003/04 were based on modelling results specific for that year, which were not available for 2004/05.

Table 27-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	6,100	3,000	n/a
Irrigation	22,800	19,200	n/a
Total	**28,900**	**22,200**	**29,400**

Note:

(1) n/a: information not available

27.6.3 Water Entitlement Transfers

There were no temporary or permanent transfers of water entitlements or diversion licences within the basin in 2004/05.

27.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 27-4. 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 2004/05.

Licences on unregulated streams are generally not metered and hence compliance has not been assessed. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information. The volume diverted to the Yarrowee-White Swan system under the Upper West Moorabool bulk entitlement is also accounted for as part of the Yarrowee-White Swan bulk entitlement in the Barwon River basin.

Table 27-4 Volume of water diverted under surface water entitlements in the Moorabool basin

Entitlement	Period of Bulk Entitle-ment (years)	Total Bulk Entitlement – 30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?	Volume Diverted in 2004/05 (ML)
Barwon Water							
Meredith	1	600	0	600	283	Yes	283
Upper East Moorabool System	1	9,000	0	9,000	1,550	Yes	1,550
Lal Lal	3	21,000	0	21,000	15,244	Yes	2,060
She Oaks	3	6,000	0	6,000	46	Yes	3
Central Highlands Water							
Upper West Moorabool System	1	10,500	0	10,500	8,839	Yes	8,839
Lal Lal	3	42,000	0	42,000	24,572	Yes	4,946
Total Annual Volume of Bulk Entitlements		**43,100**	**0**	**43,100**	**23,959**		**17,681**
Licensed Diversions from Unregulated Streams		3,327	0	3,327	1,300		1,300

Note:

(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2004, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2004-05 period. The *actual* maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

27.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

Barwon Water reported some non-compliances of daily passing flows in 2004/05. These were primarily due to operational difficulties in responding to changes in streamflow conditions and were considered minor in nature. Specific non-compliances were:

- Meredith – Passing flow non-compliances were recorded on a number of days due to operational difficulty in pumping directly from the river to a small storage basin whilst river flows continually fluctuate. Compliance improved compared to previous years, and was significantly improved in the drier months of December to April, partly due to large flows following above average rainfall in February 2005.
- Upper East Moorabool – minor passing flow compliance failures were recorded at Korweinguboora and Bostock Reservoirs. Passing flow compliance is considered an ongoing issue at Bolwarra Weir due to transmission loss along the East Moorabool River between Korweinguboora and Bolwarra. Non-compliance was also caused whilst adjusting release flows at Bolwarra in response to high rainfall events. Full compliance occurred for the remainder of the year after September 2004.
- Lal Lal – Some minor non-compliances were recorded for passing flows at Lal Lal Reservoir.
- She Oaks – non-compliances were reported due to occasional operating difficulties in adjusting Lal Lal releases to match fluctuating demands for treated water at She Oaks (three day time lag between Lal Lal and point of offtake).

No non-compliances were reported by Central Highlands Water.

27.6.6 Compliance with Streamflow Management Plans

There is no streamflow management plan currently in operation in the Moorabool basin.

27.7 Groundwater Resources

A summary of the licensed entitlements and use for the Bungaree WSPA in the Moorabool basin, excluding stock and domestic use, is presented in Table 27-5. An estimate of stock and domestic groundwater use is provided in Table 27-6. Table 27-5 and Table 27-6 are totals for the Bungaree WSPA, and include the area that falls outside the Moorabool basin.

There is concern that the high level of groundwater extractions in the Bungaree WSPA is reducing streamflows in the Upper Moorabool catchment.

Central Highlands Water holds a licence to supply groundwater to the towns of Gordon and Mt Egerton. No water was extracted under this licence in 2004/05.

Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 27-5 Compliance with licensed groundwater volumes, Moorabool basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Bungaree WSPA (67%)	> 60	5,356	5,356	2,610	0	2,610	Not Available (6)

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 27-6 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Bungaree WSPA	252	504

Note:

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

27.8 Recycled Water

There are no sewerage treatment plants within the Moorabool basin.

28 Barwon Basin

28.1 Location of Water Resources

The Barwon basin is located within the South East Coast Drainage Division in Western Victoria. The Barwon River originates in the Otway Ranges, and receives inflows from the Leigh River and the Moorabool River before flowing into Lake Connewarre and then the ocean at Barwon Heads. A map of the river basin is shown in Figure 28-1.

Water supply protection areas (WSPAs) within the Barwon basin include part of the Bungaree WSPA. Groundwater management areas within the Barwon basin include part of the Gerangamete GMA.

28.2 Responsibilities for Management of Water Resources

Southern Rural Water is responsible for managing groundwater and surface water licensed diversions. Barwon Water supplies the urban demands of Greater Geelong and Central Highlands Water supplies the demands of Ballarat. The Corangamite Catchment Management Authority is responsible for waterway management in the Barwon basin.

28.3 Seasonal Overview

Rainfall in the Barwon basin was close to average (80-100%) during 2004/05, which was reflected in the streamflow conditions across the basin. Streamflows for the year in the Leigh River at Mt Mercer (streamflow gauge 233215) were 81% of the long-term average, whilst streamflows in Boundary Creek at Yeodene (streamflow gauge 233228) in the Upper Barwon River catchment were 5% higher than average. Streamflows in the lower part of the catchment were much lower than average, suggesting lower rainfall, significant diversions or high river losses in this region. The Barwon River at Inverleigh (streamflow gauge 233218), for example, which has only a small part of its catchment run-off harvested in West Barwon Dam, recorded only 48% of its long-term average streamflow. Overall, streamflows in 2004/05 were slightly above those estimated in 2003/04, yet still well below the long-term average (59%).

Urban water supply to Greater Geelong was not restricted during 2004/05. Restrictions to Ballarat are reported under the Moorabool Basin (Section 27.3). The Barwon and Leigh Rivers were subject to an irrigation ban in February 2005, later reduced to Stage 1 restrictions in March and April. The Stage 1 restrictions were lifted in May but were again in place for diversions from both rivers in June 2005.

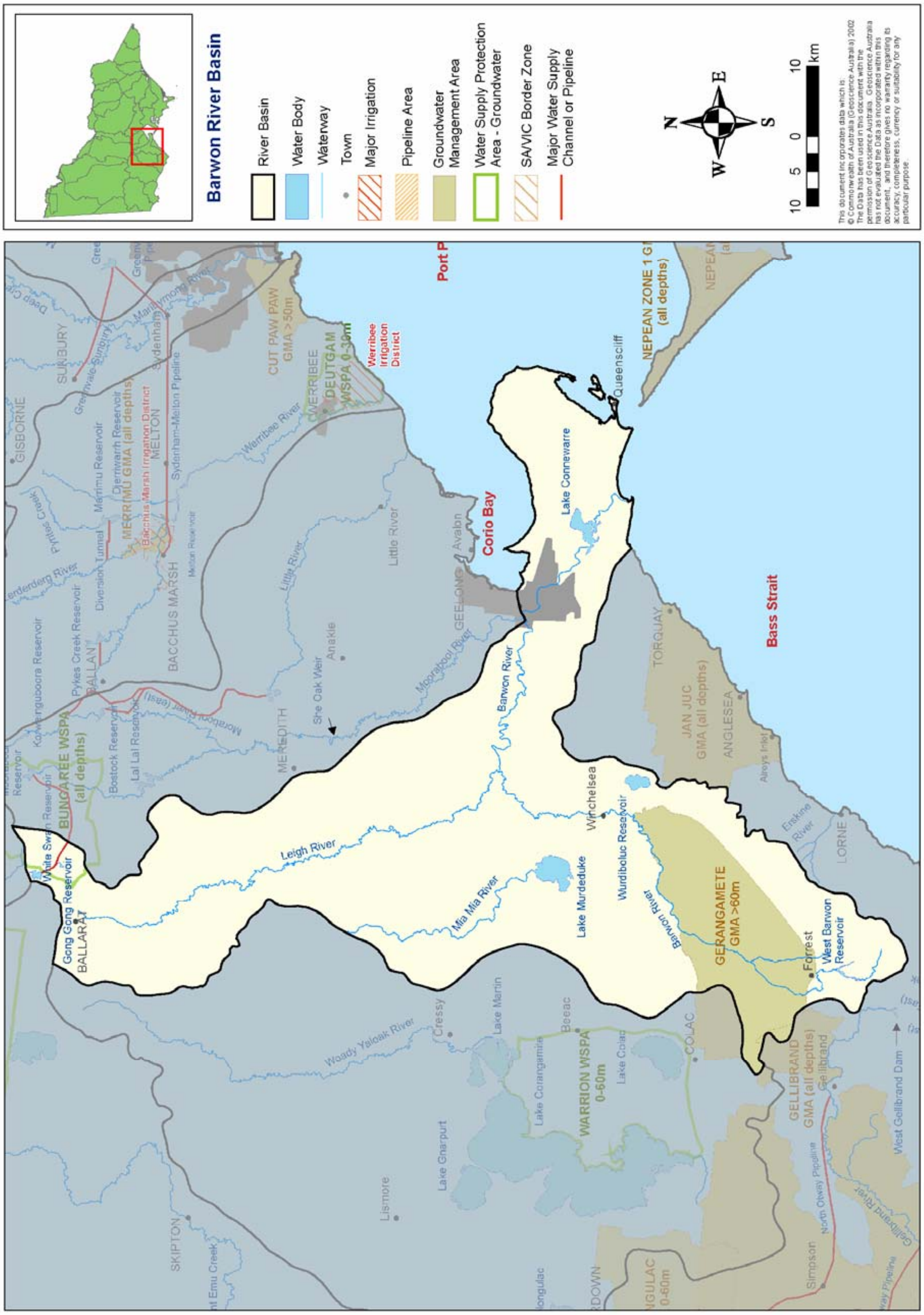
Blue-green algal blooms are a regular occurrence along the Barwon River through Geelong, and have occurred during the last four summer periods. An unusually late outbreak of blue-green algae also occurred in May 2005 due to unseasonal weather and low flow conditions.

In February 2005, significant rainfall (a one-in-20 year event) resulted in an ecologically beneficial over-bank flow from the West Barwon Reservoir to the Barwon Estuary.

An assessment of the environmental health of rivers and streams in the Barwon basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net).

Two major fish kills occurred in Lake Modewarre during 2004/05. In December 2004 a large number of European Carp were reported dead. Testing undertaken by the Environment Protection Authority and Fisheries Victoria staff showed no evidence of bacteria or viruses, and the cause of death was consistent with exposure to salty water. A second event involved the death of several thousand eels.

Figure 28-1 Map of the Barwon basin



During 2004/05 a significant amount of environmental restoration work was carried out as part of riparian and asset protection projects, that provide long-term benefits for water quality and river health in general.

28.4 Summary of the 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 28-1.

Barwon Water sources water from both the Barwon and Moorabool basins to supply Geelong, which is located across both basins.

Table 28-1 Summary of total water resource and water use in the Barwon basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	228,400	74,900
Groundwater [1]	Not available	Not available
Recycled Water	30,890	2,200

Notes:

(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90% of their surface area within the river basin boundary.

28.5 Water for the Environment

In 2004/05 there was no formal environmental water reserve established in the Barwon basin.

The environment's share of total flow at the basin outlet was 125,300 ML, which is about 55% of total catchment inflows to the basin (Table 28-2). This volume represents all water flowing from the basin which was not taken out of waterways for consumptive uses.

At a catchment scale, the timing of private diversions in the unregulated sections of the basin during the irrigation season can have a significant impact on streamflows. A streamflow management plan is planned for the Barwon River to develop water sharing rules to minimise the impacts of such diversions.

The reservoirs that exist in the Barwon basin are for the purposes of urban water supply, and the bulk entitlements associated with each of these structures specifies the rules for passing flows.

28.6 Surface Water Resources

28.6.1 Water Balance

A water balance for the Barwon basin is shown in Table 28-2. Central Highlands Water operates two major storages within the basin, namely White Swan Reservoir and Gong Gong Reservoir, whilst Barwon Water operates the West Barwon Dam. Wurdee Boluc Reservoir, also operated by Barwon Water, was removed from the 2004/05 water balance because it is an off-stream storage.

The catchment inflows of the Barwon basin are estimated to be 189,200 ML in 2004/05. This is equivalent to 59% of the average catchment inflows which are 320,000 ML a year (Department of Natural Resources and Environment, 2002). The Moorabool River also flows into the Barwon River just upstream of Geelong.

Central Highlands Water transferred 8,800 ML from the Moorabool basin into the Barwon Basin to supply water to Ballarat. Skipton, which forms part of the Ballarat water supply system and is located within the Hopkins basin, received a small proportion of this volume.

In contrast to the previous year, there was sufficient volume in storage for Barwon Water to avoid transferring water from the Barwon Downs bore field, located in the Otway Coast Basin, into the Geelong water supply system.

To calculate the water balance, inflows were estimated by the sum of diversions and outflows (including losses).

Table 28-2 Balance of surface water in the Barwon basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
Volume in storage at start of year	15,200	29,700
Volume in storage at end of year	18,700	36,800
Change in storage	3,500	7,100
Inflows		
Catchment inflow (1)	189,200	155,900
Inflows from the Moorabool River	21,300	3,100
Transfers from Moorabool Basin to White Swan Reservoir (2)	8,800	13,800
Return flow from irrigation	0	0
Treated effluent discharged back to river (2)	9,130	27,640
Sub-total	**228,400**	**200,400**
Usage		
Urban diversions	40,710	29,480
Licensed private diversions from unregulated streams	3,300	2,600
Small catchment dams	30,900	30,900
Sub-total	**74,900**	**62,900**
Losses		
Net evaporation losses from major storages (2)	400	7,600
Losses from small catchment dams	12,400	12,400
In-stream infiltration to groundwater, flows to floodplain and evaporation (3)	11,900	13,500
Sub-total	**24,700**	**33,500**
Water Passed at Outlet of Basin		
River outflows to the ocean	125,300	96,800
Environment's Share of Total Flow in the Barwon Basin	**125,300**	**96,800**

Notes:

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

(2) Volume reduced from the previous year due to an improvement of the calculation method.

(3) Losses estimated using loss functions from the Lower Barwon REALM.

28.6.2 Small Catchment Dams

The capacity of small catchment dams in the Barwon basin is estimated to be around 41,000 ML (Table 28-3). Usage from the dams is estimated to be approximately equal to the average annual usage of 30,900 ML and, after allowing for losses, the total catchment run-off that is harvested by the dams is estimated to be 43,300 ML.

Table 28-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	10,400	5,200	n/a
Irrigation	30,600	25,700	n/a
Total	**41,000**	**30,900**	**43,300**

Note:
(1) n/a: information not available

28.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water entitlements or diversion licences within the basin in 2004/05.

28.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 28-4. 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 2004/05.

Licences on unregulated streams are generally not metered and hence compliance has not been assessed. 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 28-4 Volume of water diverted under surface water entitlements in the Barwon basin

Entitlement	Period of Bulk Entitle-ment (years)	Total Bulk Entitlement – 30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?	Volume Diverted in 2004/05 (ML)
Barwon Water							
Upper Barwon System	3	130,400	0	130,400	98,987	Yes	32,749
Central Highlands Water							
Yarrowee - White Swan System	3	36,800	0	36,800	17,285	Yes	7,964
Total Annual Volume of Bulk Entitlements		**55,733**	**0**	**55,733**	**38,757**		**40,713**
Licensed Diversions from Unregulated Streams		5,058	0	5,058	3,300		3,300

Note:
(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2004, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2004-05 period. The *actual* maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

28.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

Barwon Water reported some non-compliances with passing flow obligations under the Upper Barwon bulk entitlement. Overall compliance had improved and was considered very high across all points in the system for passing flow and diversion rates, due mainly to increased flow control at diversion locations. Old weir gates and valve controls have created some difficulty in controlling flow, and subsequently new automated weir gate systems were installed at East Barwon and Callahan's Creek diversions in May and June 2005.

No non-compliances were reported for the bulk entitlement managed by Central Highlands Water.

28.6.6 Compliance with Streamflow Management Plans

There is no streamflow management plan (SFMP) currently in operation in the Barwon basin. A SFMP for the entire Barwon basin is scheduled for development.

28.7 Groundwater Resources

A summary of licensed entitlements and use for groundwater management units that overlap the Barwon basin, excluding stock and domestic use, is presented in Table 28-5. An estimate of stock and domestic groundwater use is provided in Table 28-6. In the Barwon basin groundwater is used as an urban water supply for Greater Geelong. The licensed entitlement and metered use for this groundwater supply is provided in Table 28-7.

The Barwon basin contains part of the Bungaree WSPA and Gerangamete GMA. The volumes described in Table 28-5 and Table 28-6 are totals for the management areas and include the area that falls outside the Barwon basin. Groundwater allocation and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 28-5 Compliance with licensed groundwater volumes, Barwon basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Gellibrand GMA (8%) (6)	All Depths	0	0	0	0	0	Not Available (7)
Gerangamete GMA (86%)	All Depths	0	4,000	0	0	0	Not Available (7)
Bungaree WSPA (24%)	> 60	5,356	5,356	2,610	0	2,610	Not Available (7)

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) The PAV and allocations for the Gellibrand GMA are set at zero because studies indicate that any groundwater extractions will directly impact on streamflow in the Gellibrand River.

(7) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 28-6 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Gellibrand GMA	0	0
Gerangamete GMA	5	10
Bungaree WSPA	252	504

Note:

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

Table 28-7 Urban groundwater usage

Town Supplied	Licensed Allocation ML	Metered Use
Greater Geelong	8,000	0

28.8 Recycled Water

Both Barwon Water and Central Highlands Water operate sewage treatment plants within the Barwon basin.

In 2004/05, all effluent was reused from the smaller plants at Bannockburn, Portarlington and Winchelsea (Table 28-8). Approximately 8% of the effluent from the Black Rock sewage treatment plant (servicing Geelong) was reused, and only a fraction of effluent from Ballarat was reused.

Overall, 7% of the total basin effluent was reused in 2004/05.

Table 28-8 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Bannockburn	57	57	0	57	0	0	0	0
Black Rock	21,209	1,658	0	747	0	911	0	19,550
Portarlington	404	404	0	404	0	0	0	0
Winchelsea	45	45	0	45	0	0	0	0
Ballarat North	2,231	0	0	0	0	0	2,231	0
Ballarat South	6,942	40	0	0	0	40	6,902	0
Total	**30,887**	**2,204**	**0**	**1,253**	**0**	**951**	**9,133**	**19,550**

Notes:

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

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

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

29 Corangamite Basin

29.1 Location of Water Resources

The Corangamite basin is located with the South East Coast Drainage Division in Western Victoria. Rivers and streams within the basin terminate in a series of inland lakes, the largest being Lake Corangamite. A map of the river basin is shown in Figure 29-1.

Water supply protection areas (WSPAs) within the Lake Corangamite basin include the entire Warrion WSPA. Groundwater management areas within the Lake Corangamite basin include part of the Colongulac GMA, Gerangamete GMA and Paaratte GMA.

29.2 Responsibilities for Management of Water Resources

Southern Rural Water is the licensing authority responsible for managing groundwater and surface water licensed diversions. Barwon Water provides the urban water supply to Colac, and South West Water supplies Camperdown, Lismore and Derrinallum. All urban water is supplied from sources located outside of the basin. The Corangamite Catchment Management Authority is responsible for waterway management in the Corangamite basin.

29.3 Seasonal Overview

Average rainfall conditions prevailed in the Corangamite basin during 2004/05 however streamflows were still below the long-term average. The year's flows in Woady Yaloak River at Pitfield (streamflow gauge 234200) and Cressy (streamflow gauge 234201) were 42% and 35% of the long-term average streamflows respectively. Streamflows in Pirron Yallock Creek (streamflow gauge 234203) in the southern part of the basin were much higher at approximately 83% of long-term average streamflows. Streamflow conditions were much higher than that estimated for 2003/04, which was only 31% of the long-term average.

Despite these lower than average streamflows, no restrictions were in place for licensed diverters.

The low lake levels observed in 2003/04 continued in 2004/05, resulting in a continuation of very high salinity levels (150,000 EC). With the exception of Brine Shrimps, Lake Corangamite has very little life because of these high salinity levels. It supports only a small number of the birds that would otherwise reside on this Ramsar-protected waterway. Salinity reduction will require increased flows reaching Lake Corangamite from the Woady Yaloak River.

An assessment of the environmental health of rivers and streams in the Corangamite basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net).

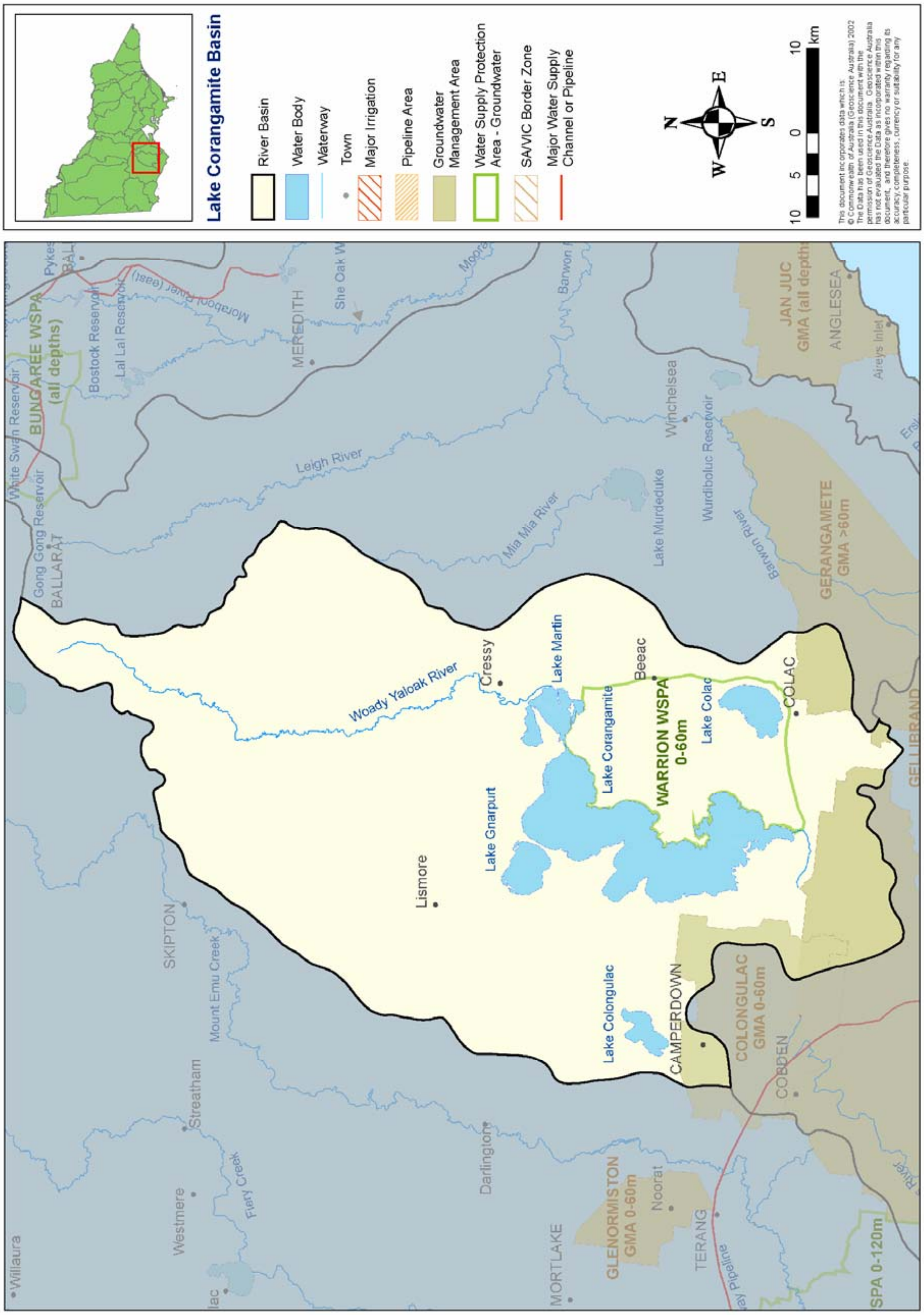
As part of the Borrel-a-Kandelop Project, major rehabilitation works were undertaken in 2004/05 associated with the protection and enhancement of the Western District Lakes Ramsar site and associated wetland systems.

29.4 Summary of the 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 29-1.

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 (Chapter 30).

Figure 29-1 Map of the Corangamite basin



All surface water extractions in the Corangamite basin are from small catchment dams and licensed diverters.

Table 29-1 Summary of total water resource and water use in the Corangamite basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	264,900	13,000
Groundwater (1)	Not available	Not available
Recycled Water	2,450	560

Note:

(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90% of their surface area within the river basin boundary.

29.5 Water for the Environment

In 2004/05 there was no formal environmental water reserve established in the Corangamite basin. The environment's share of total flow at the basin outlet was 245,300 ML, which is about 93% of total inflows to the basin (Table 29-2). This 245,300 ML represents all water flowing from the basin which was not taken out of waterways for consumptive uses.

29.6 Surface Water Resources

29.6.1 Water Balance

A surface water balance for the Corangamite basin is shown in Table 29-2.

The inflows in the Corangamite basin were estimated to be 263,000 ML. This is equivalent to 83% of the long-term average catchment inflows which are 316,000 ML a year (Department of Natural Resources and Environment, 2002). In the Corangamite basin approximately 5% of the total inflows were diverted for consumptive use, the majority being extracted by small catchment dams.

Urban demands are supplied from sources located outside of the basin due to the better quality of water available in the Otway Coast basin. There are no major water storages (i.e. greater than 1,000 ML in size) for consumptive use located in the Corangamite basin.

As part of the water balance calculation, inflows to the Corangamite basin were estimated based on the sum of diversions and outflows.

29.6.2 Small Catchment Dams

The capacity of small catchment dams in the Corangamite basin is estimated to be around 18,000 ML (Table 29-3). Usage from the dams is estimated to be approximately equal to the average annual usage of 12,300 ML and, after allowing for losses, the total catchment run-off that is harvested by the dams is estimated to be 18,900 ML.

Table 29-2 Balance of surface water in the Corangamite basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
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)	263,000	97,600
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	1,880	2,070
Sub-total	**264,900**	**99,700**
Usage		
Urban diversions	0	0
Licensed private diversions from unregulated streams	700	600
Small catchment dams	12,300	12,400
Sub-total	**13,000**	**13,000**
Losses		
Net evaporation losses from major storages	0	0
Losses from small catchment dams	6,600	6,500
In-stream infiltration to groundwater, flows to floodplain and evaporation (2)	0	9,400
Sub-total	**6,600**	**16,000**
Water Passed at Outlet of Basin		
River outflows to the Corangamite Lakes	245,300	70,700
Environment's Share of Total Flow in the Corangamite Basin	**245,300**	**70,700**

Notes:

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

(2) Losses estimated to be zero because data is not readily available. The volume of estimated losses reduced from the previous year as 2003/04 losses were estimated by back-calculation.

Table 29-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	8,100	4,000	n/a
Irrigation	9,900	8,300	n/a
Total	**18,000**	**12,300**	**18,900**

Note:

(1) n/a: information not available

29.6.3 Water Entitlement Transfers

There were no temporary or permanent transfer of water entitlements or diversion licences within the basin in 2004/05.

29.6.4 Volume Diverted

The only licences utilised in the Corangamite basin are licences on unregulated streams, as listed in Table 29-4.

Licences on unregulated streams are not currently metered and hence compliance has not been assessed. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 29-4 Volume of water diverted under surface water entitlements in the Corangamite basin

Entitlement	Period of Bulk Entitlement (years)	Total Bulk Entitlement –30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?
Licensed Diversions from Unregulated Streams		966	0	966	700	

29.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

There are no bulk entitlements currently in operation in the Corangamite basin.

29.6.6 Compliance with Streamflow Management Plans

There is no streamflow management plan currently in operation in the Corangamite basin.

29.7 Groundwater Resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Corangamite basin, excluding stock and domestic use, is shown in Table 29-5. An estimate of stock and domestic groundwater use is provided in Table 29-6.

The Corangamite Basin contains the whole Warion WSPA as well as part of the Colongulac GMA, Gerangamete GMA and Paaratte GMA. The volumes described in Table 29-5 and Table 29-6 are totals for the management areas and include the area that falls outside the Corangamite Basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 29-5 Compliance with licensed groundwater volumes, Corangamite basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Colongulac GMA (35%)	0-60	14271	3600	0	1440	1440	Not Available (6)
Gerangamete GMA (14%)	>60	0	4,000	0	0	0	Not Available (6)
Paaratte GMA (14%)	>120	4606	3192	0	1276.8	1276.8	Not Available (6)
Warrion WSPA (100%)	0-60	14214	14214	4276	0	4276	14,214

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 29-6 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Colongulac GMA	208	416
Gerangamete GMA	5	10
Paaratte GMA	4	8
Warrion WSPA	461	922

Note:

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

29.8 Recycled Water

The sewage treatment plant at Colac is operated by Barwon Water and the plant at Camperdown is operated by South West Water. Approximately 90% of the effluent at Camperdown and 23% of the total basin effluent was reused (Table 29-7).

Table 29-7 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Colac	1,845	12	0	0	0	12	1,834	0
Camperdown	601	552	0	552	0	0	50	-1
Total	**2,446**	**563**	**0**	**552**	**0**	**12**	**1,884**	**-1**

Notes:

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

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

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

30 Otway Coast Basin

30.1 Location of Water Resources

The Otway Coast basin is located within the South East Coast Drainage Division in Western Victoria. It encompasses the numerous small creeks and rivers between Torquay and Peterborough that flow to the coast from the Otway Ranges. A map of the river basin is shown in Figure 30-1.

Water supply protection areas (WSPAs) within the Otway Coast basin include part of the Nullawarre WSPA. Groundwater management areas within the Otway Coast basin include the whole Jan Juc GMA, Newlingrook GMA and Gellibrand GMA, in addition to part of the Colongulac GMA and Paaratte GMA.

30.2 Responsibilities for Management of Water Resources

Southern Rural Water is the licensing authority responsible for managing groundwater and surface water diversions.

Barwon Water supplies water to the majority of towns in the Otway Coast basin, including Torquay, Anglesea, Lorne and Apollo Bay. It also takes water from the Otway Coast basin to supply some towns in the Corangamite basin such as Colac. Wannon Water takes water from the Otway Coast basin to supply towns and farms to the west across parts of the Otway, Corangamite, Hopkins and Portland Coast basins. The Otway water supply system extends as far westward as Warrnambool and Koroit and as far north as Lismore and Derrinallum, supplying Cobden, Camperdown, Terang, Port Campbell and Allansford on the way.

The Corangamite Catchment Management Authority is responsible for waterway management in the Otway Coast basin.

30.3 Seasonal Overview

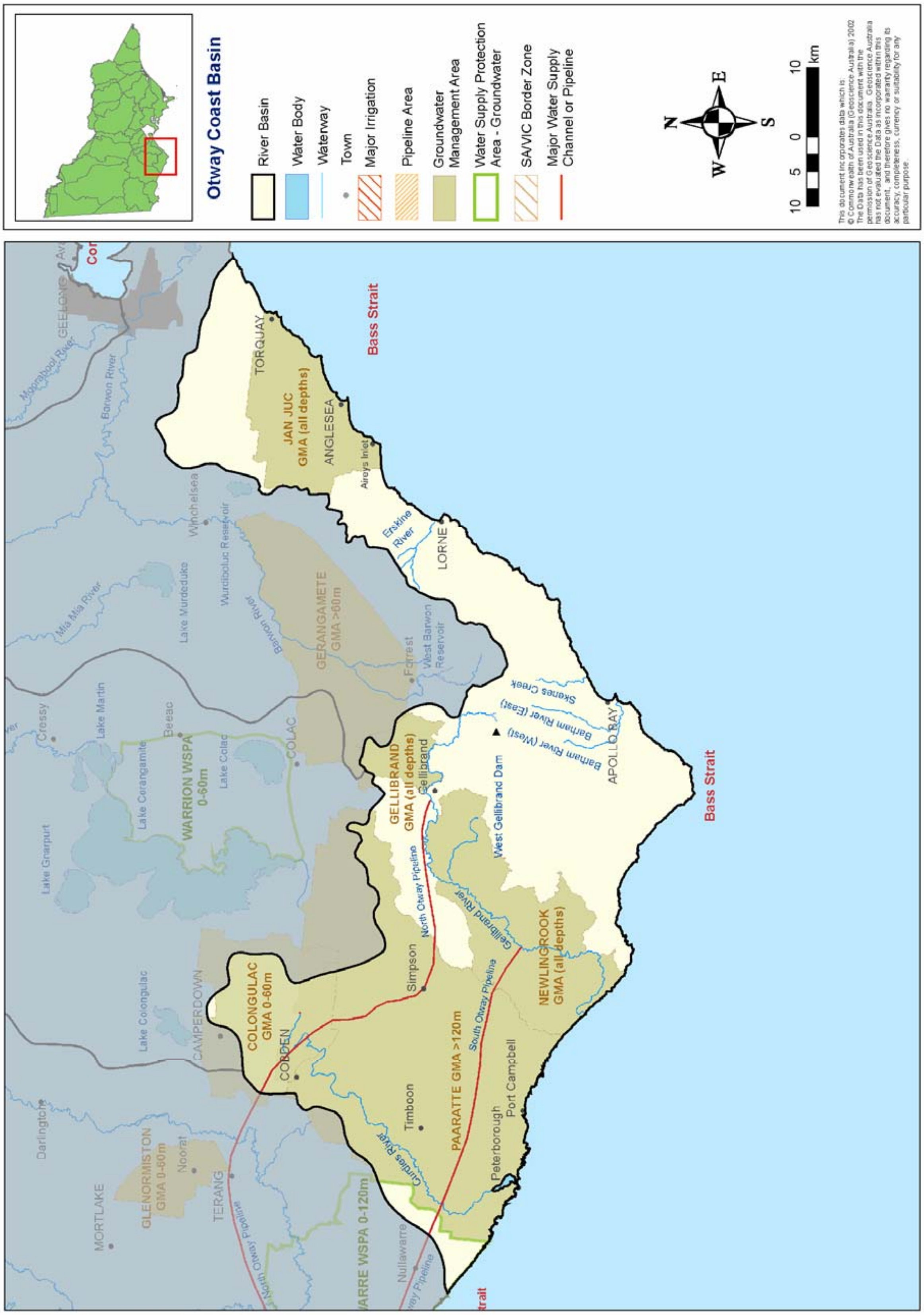
Rainfall in the Otway Coast basin was close to average rainfall conditions (80-100%). Streamflows in the basin were slightly higher than the long-term average. Streamflows across the basin were similarly close to average annual streamflows, with flows in the Aire River (gauge 235219) at 89% of the long-term average in 2004/05. Total streamflows were slightly higher than those estimated in 2003/04.

For the fourth consecutive summer, Stage 1 restrictions were in place for Apollo Bay, Marengo and Skenes Creek in December 2004. The restrictions were increased to Stage 2 in January 2005, and then lifted in mid-March 2005. Although the Marengo basin that services the region was nearly full prior to the restrictions, Barwon Water announced the restrictions to curb the heightened demands over the summer holiday period due to limited storage capacity. Basin levels fell 8% over the Christmas to New Year holiday period whilst the Stage 1 restrictions were in effect. Barwon Water currently has plans to significantly upgrade the water supply system that services these towns in the near future.

In February 2005 the Gellibrand River and Curdies River were subject to a ban on irrigation diversions. In the subsequent months until the end of the season both rivers were subject to varying stages of restrictions, excluding May 2005 for the Gellibrand when all restrictions were lifted for that month only.

An assessment of the environmental health of rivers and streams in the Otway Coast basin is available in the Index of Stream Condition (Department of Sustainability and Environment,

Figure 30-1 Map of the Otway Coast basin



2005). (Go to: www.vicwaterdata.net). Details of works undertaken to improve the basin's long-term water quality and river health during 2004/05 are available from the Corangamite Catchment Management Authority.

30.4 Summary of the 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 30-1.

There was a net transfer of water out of the Otway Coast basin. Barwon Water transferred 4,147 ML from the Otway Coast basin into the Corangamite basin to supply Colac. Wannon Water transferred 10,506 ML from the Otway Coast basin to supply towns in the Corangamite, Hopkins and Portland Coast basins. Barwon Water transferred water from the Barwon basin into the Otway Coast basin to supply 1949 ML to the towns of Torquay and Anglesea (this volume is included in the Barwon basin water balance).

Table 30-1 Summary of total water resource and water use in the Otway Coast basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	981,500	32,300
Groundwater (1)	Not available	Not available
Recycled Water	1,450	470

Notes:

(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90% of their surface area within the river basin boundary.

30.5 Water for the Environment

In 2004/05 there was no formal environmental water reserve established in the Otway Coast basin. The environment's share of total flow at the basin outlet was 945,900 ML, which is about 96% of total inflows to the basin (Table 30-2). This 945,900 ML represents all water flowing from the basin which was not taken out of waterways for consumptive uses.

The draft Gellibrand Streamflow Management Plan (1998) has placed a limit on consumptive water use in this catchment (excluding allocation of new winterfill licences under the statewide Sustainable Diversion Limit rules) and specified water trading rules. Diversion restriction triggers are also included in the draft Gellibrand Streamflow Management Plan.

The reservoirs that exist in the Otway Coast basin are for the purposes of urban water supply, and the bulk entitlements associated with each of these structures specifies the rules for passing flows. These rules may have some relationship to the ecological flow requirements of the river, however there is no specific monitoring to determine whether the structures are meeting their passing flow requirements.

30.6 Surface Water Resources

30.6.1 Water Balance

A water balance for the Otway Coast basin is shown in Table 30-2.

The only major storage in the basin is the West Gellibrand Reservoir which started the year at capacity, and finished the year only slightly below capacity, with 1,900 ML stored. Approximately 3% of the total inflows were diverted for consumptive use.

Treated effluent discharged back to the river is lower in 2004/05 relative to the previous year due to improved knowledge of effluent discharge destinations.

As part of the water balance calculation, inflows to the basin were estimated to be the sum of diversions and outflows. Due to a lack of information it was assumed that there were no in-stream losses to groundwater and evaporation.

Table 30-2 Balance of surface water in the Otway Coast basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
Volume in storage at start of year	2,000	1,500
Volume in storage at end of year	1,900	2,000
Change in storage	-100	500
Inflows		
Catchment inflow (1)	981,420	891,600
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	80	1,070
Sub-total	**981,500**	**892,700**
Usage		
Urban diversions	15,590	14,650
Licensed private diversions from unregulated streams	3,900	4,700
Small catchment dams	12,800	12,700
Sub-total	**32,300**	**32,000**
Losses		
Net evaporation losses from major storages	0	0
Losses from small catchment dams	3,400	3,500
In-stream infiltration to groundwater, flows to floodplain and evaporation (2)	0	0
Sub-total	**3,400**	**3,500**
Water Passed at Outlet of Basin		
River outflows to the ocean	945,900	856,700
Environment's Share of Total Flow in the Otway Coast Basin	**945,900**	**856,700**

Notes:

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

(2) Assumed to be zero because data is not readily available.

30.6.2 Small Catchment Dams

The capacity of small catchment dams in the Otway Coast basin is estimated to be around 19,500 ML (Table 30-3). Usage from the dams is estimated to be approximately equal to the average annual usage of 12,800 ML and, after allowing for losses, the total catchment run-off that is harvested by the dams is estimated to be 16,200 ML.

Table 30-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	10,700	5,400	n/a
Irrigation	8,800	7,400	n/a
Total	**19,500**	**12,800**	**16,200**

Note:

(1) n/a: information not available

30.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water entitlements or diversion licences within the basin in 2004/05.

30.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 30-4. 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 2004/05.

Licences on unregulated streams are not currently metered and hence compliance has not been assessed. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 30-4 Volume of water diverted under surface water entitlements in the Otway Coast basin

Entitlement	Period of Bulk Entitlement (years)	Total Bulk Entitlement –30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?
Barwon Water						
Aireys Inlet	1	317	0	317	209	Yes
Apollo Bay and Skenes Creek	1	365	0	365	333	Yes
Colac	1	5,400	0	5,400	4,147	Yes
Gellibrand	1	60	0	60	18	Yes
Lorne	1	510	0	510	373	Yes
South West Water						
Otway System	1	12,580	0	12,580	10,506	Yes
Total Annual Volume of Bulk Entitlements		**19,232**	**0**	**19,232**	**15,586**	
Licensed Diversions from Unregulated Streams		5,439	0	5,439	3,900	

30.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

No non-compliances were found for the Apollo Bay and Skenes Creek, Colac and Gellibrand bulk entitlements, however complete monitoring is not currently in place to fully measure compliance. No non-compliances were reported for the Lorne bulk entitlement.

Some minor non-compliances were recorded for daily passing flows specified by the Aireys Inlet bulk entitlement in 2004/05. These were thought to be due to plumbing issues with the passing flow meter, as well as operational difficulties in responding to changes in stream flow conditions (in particular the high rainfall event in February).

30.6.6 Compliance with Streamflow Management Plans

There is no streamflow management plan (SFMP) currently in operation in the Otway Coast Basin. A SFMP for the Gellibrand River has been developed and is currently being reviewed before being submitted to the Minister for Water for approval.

30.7 Groundwater Resources

A summary of licensed entitlements and use for groundwater management units that overlap the Otway Coast basin, excluding stock and domestic use, is presented in Table 30-5. An estimate of stock and domestic groundwater use is provided in Table 30-6. 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 entitlement and metered use for this groundwater supply is provided in Table 30-7.

The Otway Coast basin contains all of the Jan Juc GMA and Newlingrook GMA as well as part of the Colongulac GMA, Gellibrand GMA, Paaratte GMA and Nullawarre WSPA. The volumes described in Table 30-5 and Table 30-6 are totals for the management areas and include the area that falls outside the Otway Coast basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 30-5 Compliance with licensed groundwater volumes, Otway Coast basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Colongulac GMA (56%)	0-60	14,271	3,600	0	1,260	1,260	Not Available (6)
Gellibrand GMA (92%) (7)	ALL	0	0	0	0	0	0
Jan Juc GMA (100%)	ALL	6,804	4,000	0	1,400	1,400	6,804
Newlingrook GMA (100%)	ALL	74,970	1,968	0	689	689	74,970
Paaratte GMA (84%)	>120	4,606	3,192	0	1,117	1,117	Not Available (6)
Nullawarre WSPA (11%)	0-120	22,238	22,238	9,490	0	9,490	Not Available (6)

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

(7) The PAV and allocations for the Gellibrand GMA are set at zero because studies indicate that any groundwater extractions will directly impact on streamflow in the Gellibrand River.

Table 30-6 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Colongulac GMA	208	416
Gellibrand GMA	0	0
Jan Juc GMA	0	0
Newlingrook GMA	0	0
Paaratte GMA	4	8
Nullawarre WSPA	1,197	2,394

Note:

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

Table 30-7 Urban groundwater usage

Town Supplied	Licensed Allocation ML	Metered Use
Otway System (Carlisle)	1,800	115
Otway system (Curdie Vale)	2,150	0
Port Campbell Timboon and Peterborough	1,009	352
Koroit	524	0

30.8 Recycled Water

Sewage treatment plants within the Otway Coast basin are operated by Barwon Water and South West Water. All plants have some effluent reuse.

In 2004/05 Aireys Inlet and Timboon reused their total volume of effluent. Overall, a relatively high total of 33% of the volume of effluent was reused within the Otway Coast basin (Table 30-8).

Table 30-8 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Aireys Inlet	111	111	0	111	0	0	0	0
Anglesea	277	86	0	58	0	28	0	191
Apollo Bay	386	15	0	0	0	15	0	371
Lorne	307	15	0	0	0	15	0	292
Cobden	220	128	0	128	0	0	46	46
Port Campbell	63	42	0	42	0	0	8	13
Simpson	23	4	0	4	0	0	27	-8
Timboon (4)	61	72	0	72	0	0	0	-11
Total	**1,447**	**472**	**0**	**415**	**0**	**58**	**81**	**894**

Notes:

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

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

(3) Other refers to a change in on-site effluent storage, ocean discharge, 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.

31 Hopkins Basin

31.1 Location of Water Resources

The Hopkins basin is located within the South East Coast Drainage Division in Western Victoria. The two major rivers within the basin are the Merri River and the Hopkins River. A map of the river basin is shown in Figure 31-1.

Water supply protection areas (WSPAs) within the Hopkins Basin include part of the Nullawarre WSPA, Yangery WSPA and Upper Loddon WSPA. Groundwater management areas within the Hopkins Basin include part of the Glenormiston GMA.

31.2 Responsibilities for Management of Water Resources

Southern Rural Water is the licensing authority responsible for managing groundwater and surface water licensed diversions.

South West Water supplies water to towns located in the south of the basin including Warrnambool. Grampians Wimmera Mallee Water supplies water to towns located in the north west of the basin including Ararat. Central Highlands Water supplies water to towns in the north east of the basin, including Beaufort and Skipton.

The Glenelg Hopkins Catchment Management Authority is responsible for waterway management in the Hopkins basin.

31.3 Seasonal Overview

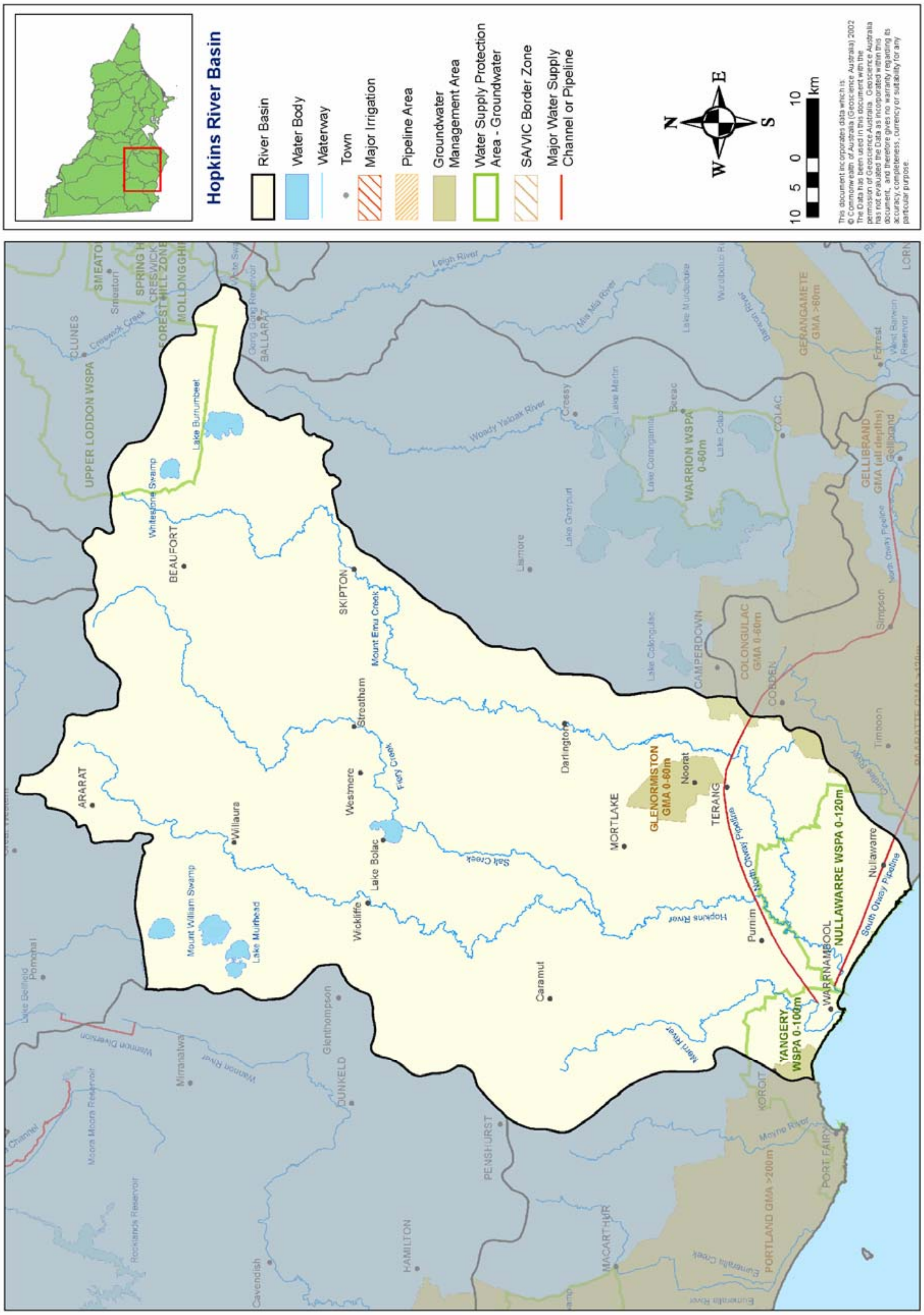
Rainfall in the Hopkins basin was close to the long-term average (80-100%) during 2004/05. Streamflows were well below average in the upper parts of the basin, with both the Hopkins River at Wickliffe (streamflow gauge 236202) and Fiery Creek at Streatham (streamflow gauge 236204) exhibiting flows of between 20% and 25% of long-term average streamflows. Lower parts of the catchment experienced greater run-off relative to rainfall, with streamflows in the Hopkins River at Framlingham (streamflow gauge 236210) being 73% of the long-term average. Streamflows in Brucknell Creek at Cudgee (streamflow gauge 236212), located in a small catchment close to the coast, experienced streamflows 25% higher than long-term average values. Overall, streamflows in 2004/05 are estimated to be 62% of the long-term average, and over 50% higher than those estimated in 2003/04.

Medium level water restrictions prevailed in 2004/05 throughout the basin. Stage 3 restrictions (of five stage policy) continued in Ararat for the whole of 2004/05. The Stage 3 restrictions have been in place since February 2003. Restrictions also applied to irrigation diversions along the Merri River from January 2005 until the end of the season. Restrictions were at Stage 1 levels at all times except March and April 2005, when Stage 3 restrictions applied upstream of Woodford.

An assessment of the environmental health of rivers and streams in the Hopkins basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net).

In February 2005, a blue-green algae bloom was recorded in the Merri River at Warrnambool. Appropriate public safety protocols were implemented by the local council. Continued efforts to manage nutrients through partnership projects and dairy farm initiatives will assist in the long-term. A Streamflow Management Plan for the Merri River has been identified as a priority in the Victorian Government's *Our Water Our Future* action plan.

Figure 31-1 Map of the Hopkins basin



Details of works undertaken to improve the basin's long-term water quality and river health during 2004/05 are available from the Glenelg Hopkins Catchment Management Authority.

31.4 Summary of the 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 31-1. Wannon Water transferred water from the Otway Coast basin into the Hopkins basin to supply urban demands, Central Highlands Water transferred water from the Ballarat supply system in the Barwon basin into the Hopkins basin to supply Skipton, and Grampians Wimmera Mallee Water transferred water from the Wimmera basin to supply the towns of Ararat, Moyston, Willaura, Lake Bolac and Wickliffe.

Table 31-1 Summary of total water resource and water use in the Hopkins basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	395,300	70,300
Groundwater [1]	Not available	Not available
Recycled Water	6,060	1,090

Notes:

(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90% of their surface area within the river basin boundary.

31.5 Water for the Environment

There was no formal environmental water reserve established in the Hopkins basin in 2004/05. The environment's share of total flow at the basin outlet was 295,100 ML, which is about 75% of the total streamflow in the basin (Table 31-2). This 295,100 ML represents all water flowing from the basin which was not taken out of waterways for consumptive uses.

The declaration of a water supply protection area for the Hopkins River has been deferred subject to a review of technical information regarding the method used to determine the required environmental flows and additional information investigating the links between the river, its mouth opening and the estuary.

The draft Merri Streamflow Management Plan (1998) has capped consumptive water use in this catchment and prescribed restriction triggers for licensed diversions.

31.6 Surface Water Resources

31.6.1 Water Balance

A water balance for the Hopkins basin is shown in Table 31-2. As indicated by the water balance, there are no major water storages (> 1,000 ML in size) for consumptive use in the basin.

The inflows to the Hopkins basin are estimated to be 395,100 ML in 2004/05. This is equivalent to 62% of the average catchment inflows, of 635,000 ML a year (National Land and Water Audit, 2001). Approximately 18% of the total inflows were diverted for consumptive use, the majority of which comprised of extractions from small catchment dams.

To calculate the water balance, inflows to the Hopkins basin were estimated to be the sum of diversions and outflows. Although transfers occurred into the basin for the purposes of urban water supply, these did not affect streamflows and so are not accounted for in the water balance for the Hopkins basin.

The volume of treated effluent discharged to rivers has reduced relative to the previous year because of better understanding of the destination of treated effluent.

Table 31-2 Balance of surface water in the Hopkins basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
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)	395,100	251,100
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river (2)	210	5,100
Sub-total	**395,300**	**256,200**
Usage		
Urban diversions	340	220
Licensed private diversions from unregulated streams	5,400	5,300
Small catchment dams	64,600	64,500
Sub-total	**70,300**	**70,100**
Losses		
Net evaporation losses from major storages	0	0
Losses from small catchment dams	29,900	30,000
In-stream infiltration to groundwater, flows to floodplain and evaporation (3)	0	0
Sub-total	**29,900**	**30,000**
Water Passed at Outlet of Basin		
River outflows to the ocean	295,100	156,100
Environment's Share of Total Flow in the Hopkins Basin	**295,100**	**156,100**

Notes:

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

(2) Volume reduced from the previous year due to an improved understanding of the destination of treated effluent.

(3) Assumed to be zero because data is not readily available.

31.6.2 Small Catchment Dams

The capacity of small catchment dams in the Hopkins basin is estimated to be around 89,300 ML (Table 31-3). Usage from the dams is estimated to be approximately equal to the average annual usage of 64,600 ML and, after allowing for losses, the total catchment run-off that is harvested by the dams is estimated to be 94,500 ML.

Table 31-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	30,900	15,500	n/a
Irrigation	58,400	49,100	n/a
Total	**89,300**	**64,600**	**94,500**

Note:

(1) n/a: information not available

31.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water entitlements or diversion licences within the basin in 2004/05.

31.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 31-4. 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 2004/05.

Licences on unregulated streams are not currently metered and hence compliance has not been assessed. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

No water was extracted under the Skipton bulk entitlement as the demand was supplied from the Ballarat system. Water supplies for Willaura, Moyston, Lake Bolac and Wickliffe are sourced from streams located in both the Wimmera Basin and the Hopkins basin.

Table 31-4 Volume of water diverted under surface water entitlements in the Hopkins basin

Entitlement	Period of Bulk Entitlement (years)	Total Bulk Entitlement –30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?
Central Highlands Water						
Beaufort	1	n/a	0	n/a	166	n/a
Skipton	1	n/a	0	n/a	0	n/a
Central Highlands Water						
Willaura, Moyston, Lake Bolac and Wickliffe	1	n/a	0	n/a	176	n/a
Total Annual Volume of Bulk Entitlements		**n/a**	**0**	**n/a**	**342**	
Licensed Diversions from Unregulated Streams		9,956	0	9,956	5,400	

Note:

(1) n/a: bulk entitlement conversion order was not finalised at the beginning of 2004/05.

31.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

There are no bulk entitlements currently in operation in the Hopkins basin.

31.6.6 Compliance with Streamflow Management Plans

There is no streamflow management plan (SFMP) currently in operation in the Hopkins basin.

A SFMP for the Merri River was drafted in 1998. It is yet to be formally endorsed by the Minister for Water and is currently being reviewed under the new legislative requirements for management plans in the *Water Act 1989*.

31.7 Groundwater Resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Hopkins basin, excluding stock and domestic use, is presented in Table 31-5. An estimate of stock and domestic groundwater use is provided in Table 31-6. In the Hopkins basin groundwater is used as an urban water supply for the townships of Mortlake, Warrnambool, Koroit, Allansford, Caramut, Darlington and Glenthompson. The licensed entitlement and metered use for this groundwater supply is provided in Table 31-7.

The Hopkins basin contains all of the Glenormiston GMA as well as parts of the Nullawarre WSPA, Upper Loddon WSPA, Yangery WSPA and Colongulac GMA. The volumes described in Table 31-5 and Table 31-6 are totals for the management areas and include the area that falls outside the Hopkins basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 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 31-5 Compliance with licensed groundwater volumes, Hopkins basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Colongulac GMA (9%)	0-60	14,271	3,600	0	1,260	1,260	Not Available (6)
Glenormistom GMA (100%)	0-60	5,042	2,512	0	879	879	5,042
Nullawarre WSPA (89%)	0-120	22,238	22,238	9,490	0	9,490	Not Available (6)
Upper Loddon WSPA (25%)		13,036	13,036	2,210	4,000	6,210	Not Available (6)
Yangery WSPA (60%)	0-100	14,473	14,473	4,520	0	4,520	Not Available (6)

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 31-6 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Colongulac GMA	208	416
Glenormistom GMA	125	250
Nullawarre WSPA	1,197	2,394
Upper Loddon WSPA	306	612
Yangery WSPA	1,432	2,864

Note:

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

Table 31-7 Urban groundwater usage

Town Supplied	Licensed Allocation ML	Metered Use
Mortlake (part)	295	43
Warrnambool, Allansford and Koroit (part)	750	341
Caramut	50	39
Darlington	10	2
Koroit	524	0
Glenthompson/Nekeeya	140	

31.8 Recycled Water

Three separate water authorities operate sewage treatment plants within the Hopkins basin. All of the effluent from Ararat is reused by Grampians Water. Overall 18% of the total effluent volume in the basin is reused (Table 31-8).

Table 31-8 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Ararat	832	832	101	731	0	0	0	0
Beaufort	101	0	0	0	0	0	101	0
Mortlake	108	59	0	59	0	0	16	34
Terang	287	203	0	203	0	0	82	2
Warrnambool	4,719	0	0	0	0	0	0	4,719
Willaura	14	0	0	0	0	0	14	0
Total	**6,062**	**1,094**	**101**	**993**	**0**	**0**	**213**	**4,755**

Notes:

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

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

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

32 Portland Coast Basin

32.1 Location of Water Resources

The Portland Coast basin is located within the South East Coast Drainage Division in Western Victoria. Major rivers within the basin include the Moyne River, Eumeralla River, Fitzroy River and the Surry River. A map of the river basin is shown in Figure 32-1.

Groundwater water supply protection areas (WSPAs) within the Portland Coast basin include parts of the Condah WSPA and Yangery WSPA. Groundwater management areas (GMAs) within the Portland Coast basin include the entire Heywood GMA and part of the Portland GMA.

32.2 Responsibilities for Management of Water Resources

Southern Rural Water is the licensing authority responsible for managing groundwater and surface water licensed diversions within the basin. Wannon Water (formerly South West Water, Portland Coast Water and Glenelg Water) supplies water sourced from the Otway Coast basin to the township of Koroit and from groundwater to the towns of Port Fairy, Heywood and Portland. The Glenelg Hopkins Catchment Management Authority is responsible for waterway management in the Portland Coast basin.

32.3 Seasonal Overview

Portland Coast basin recorded close to the long-term average (80-100%) rainfall during 2004/05. Streamflows in the catchment were generally above the long-term average, with sustained high flows evident in July and August 2004. Streamflows were 144% of average flows in the Eumeralla River (gauge 237206), 109% in Darlot Creek (gauge 237205) and 266% in the Surry River (gauge 237207). Most of the Surry River flow occurred in July and August 2004. Overall, streamflows are estimated to be 165% of the long-term average in 2004/05, and were almost triple that estimated in the previous season.

No urban restrictions were in place during 2004/05. A number of waterways were subject to irrigation bans and restrictions in 2004/05. These were as follows:

- Condah Drain was subject to Stage 2 restrictions from January 2005 until the end of the 2004/05 period;
- Eumarella River was subject to an irrigation ban from January to February 2005, and then again in May 2005. Other months in 2005 were subject to Stage 1 restrictions;
- Crawford River was subject to an irrigation ban from January to May 2005;
- Surry River was subject to an irrigation ban from January to June 2005;
- Fitzroy River was subject to an irrigation ban from February to April 2005; and
- Moyne River was subject to an irrigation ban from February 2005 until the end of the 2004/05 season.

Stratification and severely depleted oxygen levels were detected in the Surry River estuary during routine monitoring in May 2005. Further water quality testing confirmed that a 4.6 km length of the upper Surry estuary was affected. It is suspected that nutrient enrichment within the estuary leading to algal blooms was the likely cause.

A minor health issue was observed in September 2004 in Black Bream caught in Yambuk Lake. Ulcers and lesions were detected on a small number of individuals. Subsequent testing proved inconclusive as to the cause, however changes in water quality and/or large freshwater inflows can combine to stress fish and increase the susceptibility to disease.

Figure 32-1 Map of the Portland Coast basin

An assessment of the environmental health of rivers and streams in the Portland Coast basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net). Details of works undertaken to improve the basin's long-term water quality and river health during 2004/05 are available from the Glenelg Hopkins Catchment Management Authority.

32.4 Summary of the 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 32-1.

Table 32-1 Summary of total water resource and water use in the Portland Coast basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	607,200	17,000
Groundwater (1)	Not available	Not available
Recycled Water	2,360	260

Notes:

(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90% of their surface area within the river basin boundary.

32.5 Water for the Environment

In 2004/05 there was no formal environmental water reserve established in the Portland Coast basin. The environment's share of total flow at the basin outlet was 585,700 ML, which is about 96% of the total streamflow in the basin (Table 32-2). This volume represents all water flowing from the basin which was not taken out of waterways for consumptive uses.

32.6 Surface Water Resources

32.6.1 Water Balance

A water balance for the Portland Coast basin is shown in Table 32-2. There are no major storages (greater than 1,000 ML in size) in the Portland Coast basin.

The inflows in the Portland Coast basin were 607,200 ML. This is equivalent to 168% of the average catchment inflows, which are 361,000 ML a year (Department of Natural Resources and Environment, 2002). Approximately 3% of the total inflows were diverted for consumptive use, with the largest diversions estimated to be due to consumption and losses from small catchment dams. All towns serviced by Wannon Water in this basin are supplied by groundwater or from other river basins and hence urban diversions in this river basin are zero.

As part of the water balance calculation, inflows to the Portland Coast basin were estimated to be the sum of diversions and outflows. Due to a lack of information it was assumed that there were no in-stream losses to groundwater and evaporation.

Table 32-2 Balance of surface water in the Portland Coast basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
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)	607,200	209,700
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	40	1,990
Sub-total	**607,200**	**211,700**
Usage		
Urban diversions	0	0
Licensed private diversions from unregulated streams	800	800
Small catchment dams	16,200	16,100
Sub-total	**17,000**	**16,900**
Losses		
Net evaporation losses from major storages	0	0
Losses from small catchment dams	4,500	4,500
In-stream infiltration to to groundwater, flows to floodplain and evaporation (2)	0	0
Sub-total	**4,500**	**4,500**
Water Passed at Outlet of Basin		
River outflows to the ocean	585,700	190,300
Environment's Share of Total Flow in the Portland Coast Basin	**585,700**	**190,300**

Notes:

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

(2) Assumed to be zero because data is not readily available.

32.6.2 Small Catchment Dams

The capacity of small catchment dams in the Portland Coast basin is estimated to be around 21,000 ML (Table 32-3). Usage from the dams is estimated to be approximately equal to the average annual usage of 16,200 ML and, after allowing for losses, the total catchment run-off that is harvested by the dams is estimated to be 20,700 ML.

Table 32-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	4,500	2,300	n/a
Irrigation	16,500	13,900	n/a
Total	**21,000**	**16,200**	**20,700**

Note:

(1) n/a: information not available

32.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water entitlements or diversion licences within the basin in 2004/05.

32.6.4 Volume Diverted

The only licences utilised in the Portland Coast basin are licences on unregulated streams (Table 32-4). Licences on unregulated streams are not currently metered and hence compliance has not been assessed. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

Table 32-4 Volume of water diverted under surface water entitlements in the Portland Coast basin

Entitlement	Period of Bulk Entitlement (years)	Total Bulk Entitlement –30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?
Licensed Diversions from Unregulated Streams		1,223	0	1,223	800	

32.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

There are no bulk entitlements currently in operation in the Portland Coast basin.

32.6.6 Compliance with Streamflow Management Plans

There is no streamflow management plan currently in operation in the Portland Coast basin.

32.7 Groundwater Resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Portland Coast basin, excluding stock and domestic use, is presented in Table 32-5. An estimate of stock and domestic groundwater use is provided in Table 32-6. In the Portland Coast Basin groundwater is used as an urban water supply for the townships of Portland, Port Fairy and Heywood. The licensed entitlement and metered use for these groundwater supplies is provided in Table 32-7. In 2004/05 extractions were well within the licence volumes.

The Portland Coast basin contains all of the Heywood GMA as well as part of the Condah WSPA, Yangery WSPA and Portland GMA. The volumes described in Table 32-5 and are totals for the management areas and include the area that falls outside the Portland Coast basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

The Portland GMA comprises the deep, geothermal waters of the Dilwyn Formation aquifer. This aquifer is recharged in its northern parts where it is closer to the ground surface. The increasing area of plantation forests in the recharge zones of the Dilwyn Aquifer of the Portland GMA has the potential to deplete recharge to the aquifer. The impact of these plantations is being considered in the management of the groundwater resource.

Table 32-5 Compliance with licensed groundwater volumes, Portland Coast basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Heywood GMA (100%)	0-70	21,763	6,442	0	2,255	2,255	21,763
Portland GMA (72%)	>200	20,683	1,646	0	576	576	Not Available (6)
Condah WSPA (53%)	70-200	7,568	7,568	3,270	0	3,270	Not Available (6)
Yangery WSPA (40%)	0-100	14,473	14,473	4,520	0	4,520	Not Available (6)

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 32-6 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Heywood GMA	1,735	3,470
Portland GMA	63	126
Condah WSPA	58	116
Yangery WSPA	1,432	2,864

Note:

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

Table 32-7 Urban groundwater usage

Town Supplied	Licensed Allocation ML	Metered Use
Portland	6,222	1,989
Port Fairy	1,026	790
Heywood	333	212

32.8 Recycled Water

Within the Portland Coast basin the sewerage systems are operated by Wannon Water. In 2004/05, 11% of the total effluent produced in the basin was reused (Table 32-8). The recycled effluent from Heywood was used to irrigate pasture.

Table 32-8 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Heywood	299	257	0	257	0	0	42	0
Port Fairy	1,258	0	0	0	0	0	0	1,258
Portland	807	0	0	0	0	0	0	807
Total	2,364	257	0	257	0	0	42	2,065

Notes:

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

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

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

33 Glenelg Basin

33.1 Location of Water Resources

The Glenelg basin is located with the South East Coast Drainage Division in far Western Victoria. A map of the river basin is shown in Figure 33-1.

Water supply protection areas (WSPAs) within the Glenelg basin include part of the Condah WSPA and Glenelg WSPA. Groundwater management areas (GMAs) within the Glenelg basin include part of the Portland GMA. The Glenelg basin also contains border groundwater management zone 1B and parts of zones 2B and 3B. These zones help govern a groundwater sharing agreement between Victoria and South Australia and are distinct from the management framework that governs groundwater resources across the rest of the state.

33.2 Responsibilities for Management of Water Resources

Southern Rural Water is the licensing authority for managing groundwater and surface water licensed diversions for the entire basin except the Glenelg River above the bridge on Casterton-Harrow Road, which is managed by Grampians Wimmera Mallee Water. Grampians Wimmera Mallee Water also manages the Wimmera-Mallee water supply system which includes Rocklands and Moora Moora Reservoirs and several other small diversion weirs in the upper Glenelg and Wannon Rivers.

The former organisations of Wimmera Mallee Water and Grampians Water merged to become Grampians Wimmera Mallee Water in July 2004.

Wannon Water (formerly Glenelg Water) supplies water to the majority towns within the basin, with the exception of Harrow which is supplied by Grampians Wimmera Mallee Water. The Glenelg-Hopkins Catchment Management Authority is responsible for waterway management in the Glenelg basin.

33.3 Seasonal Overview

Conditions in the Glenelg basin are reported over the period 1 November 2004 to 31 October 2005, to concur with the specifications of major bulk entitlements in the basin.

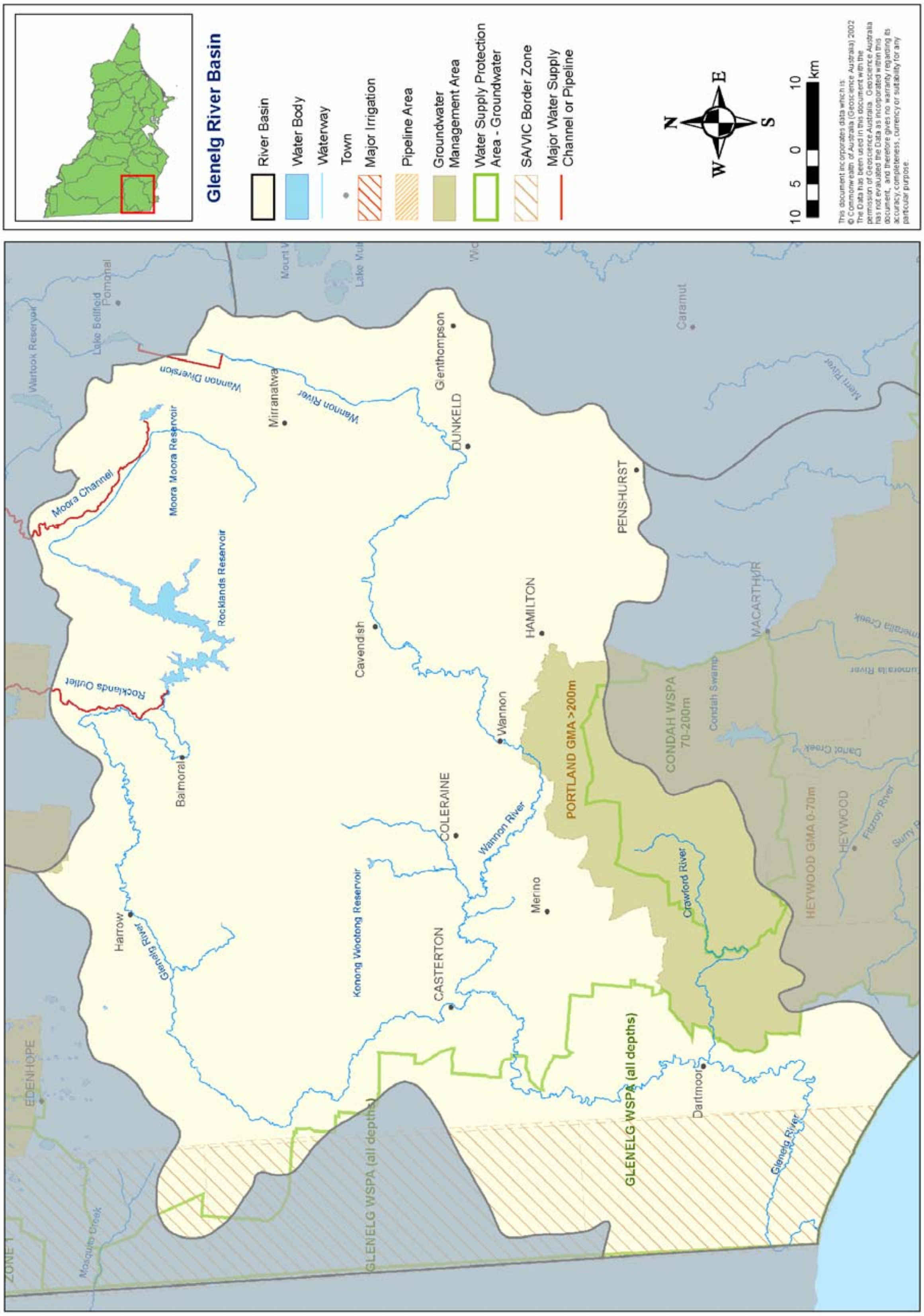
During 2004/05, rainfall in the Glenelg Basin was slightly below the long-term average. Streamflows across the basin were typically lower than average. Over the period November 2004 to October 2005, streamflow recorded in the Crawford River at Lower Crawford (gauge 238235) was only 14% of the long-term average. However, it is noted that in the four months from July to October 2004, this stream discharged more than two and half times its mean annual flow.

In 2004/05, stage 1 (of four stage policy) urban water restrictions remained in place in Balmoral (imposed in January 2003), while Stage 2 (of five stage policy) urban restrictions, imposed in November 2003, continued at Harrow. Between February and July 2005, there were irrigation bans in place for Grange Burn Creek (except for May), and the Wannon and Glenelg Rivers.

The continued effects of the drought on storage levels in the Wimmera-Mallee system has impacted upon all water users, including the environment, through restricted allocations.

An assessment of the environmental health of rivers and streams in the Glenelg basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net).

Figure 33-1 Map of the Glenelg basin



In January 2005, a large fire burnt over 10,000 ha of land in the upper Glenelg catchment. A clean-up operation to limit the potential for sediment and ash to wash into the river following rainfall events was commenced soon after the fire was under control. No decline in water quality was observed as a result of the fire.

Details of works undertaken to improve the basin's long-term water quality and river health during 2004/05 are available from the Glenelg Hopkins Catchment Management Authority

33.4 Summary of the 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 33-1. Grampians Wimmera Mallee Water transferred 32,500 ML from the Glenelg basin into the Wimmera basin.

Table 33-1 Summary of total water resource and water use in the Glenelg basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water	177,200	90,800
Groundwater (1)	Not available	Not available
Recycled Water	1,230	1,230

Note:

(1) The total resource and use is not stated because not all GMAs or WSPAs in this basin have more than 90% of their surface area within the river basin boundary.

33.5 Water for the Environment

2004/05 was the first year of operation of the bulk entitlement orders for the Wimmera Mallee system. A Flora and Fauna Bulk entitlement order for the Glenelg and Wimmera Rivers is one of five orders for the region.

Consistent with the bulk entitlement conversion orders, a total of 11,987 ML was allocated to the Glenelg and Wimmera Rivers during the 2004/05 flow season (1 November 2004 – 30th October 2005). In addition, 3,300 ML was allocated to the Glenelg River as a compensation flow to contribute in achieving environmental objectives. The Inter Catchment Advisory Group (ICAG) met to determine the split of environmental allocation between catchments. As a result of these negotiations, and based on recommendations and priorities identified by the Stressed Rivers report, the Glenelg River received 4,900 ML (including the compensation flow) for implementation of a summer baseflow.

The environment's share of total flow in 2004/05 was 69,400 ML, which is about 39% of the streamflow in the basin. This amount consists of environmental flow releases and all other water flowing in the basin which was not taken out of the streams for consumptive uses. Whilst the river still receives a significant proportion of the natural flow, the construction of Rocklands Reservoir in 1953 has resulted in the reaches of the river directly below the storage being highly flow-stressed.

Environmental flow releases occurred from November 2004 until the end of May 2005, and were made into the upper reaches of the Glenelg River downstream of Rocklands Reservoir from the dam wall outlet and the five-mile outlet of the Rocklands-Toolondo channel. A native fish community of high value exists within the mid to upper reaches of the Glenelg River, and sustaining these populations is the key objective of environmental flows. Summer baseflows have been identified as the highest priority flow component as this has the key role of water quality maintenance and providing links between important habitats.

33.6 Surface Water Resources

33.6.1 Water Balance

A water balance for the Glenelg basin is shown in Table 33-2. The largest consumption of water in the Glenelg basin was via farm dams in 2004/05. Approximately 78% of the basin inflows were diverted or lost during the year.

There are four major storages within the basin. During 2004/05 the volume of water held within the two Grampians Wimmera Mallee Water storages, Rocklands Reservoir and Moora Moora Reservoir, decreased from 14% of capacity in November 2004 to 5% by October 2005. Wannon Water operates two storages: Koonongwootong Reservoir and Hayes Reservoir. In 2004/05, the volume held in these storages decreased from 93% to 72% of total capacity.

Table 33-2 Balance of surface water in the Glenelg basin

Water Account Component	2004/05 (ML)	2003/04 (ML)
Storage Volume		
Volume in storage at start of year (1)	53,400	14,300
Volume in storage at end of year	23,300	14,800
Change in storage	-30,100	500
Inflows		
Catchment inflow (2)	177,200	467,200
Transfers from other basins	0	0
Return flow from irrigation	0	0
Treated effluent discharged back to river	0	430
Sub-total	**177,200**	**467,600**
Usage		
Urban diversions	1,990	2,820
Diversions to the Wimmera Mallee Water System	32,500	34,900
Licensed private diversions from unregulated streams	800	800
Small catchment dams	55,500	55,500
Sub-total	**90,800**	**94,000**
Losses		
Net evaporation losses from major storages	13,000	6,200
Losses from small catchment dams	24,600	24,700
In-stream infiltration to groundwater, flows to floodplain and evaporation (3)	9,500	0
Sub-total	**47,100**	**30,900**
Water Passed at Outlet of Basin		
River outflows to the ocean	69,400	342,200
Environment's Share of Total Flow in the Glenelg Basin	**69,400**	**342,200**

Notes:

(1) For the Glenelg Basin, the 2004/05 period is from 1 November 2004 to 31 of October 2005. The 2003/04 period is from July 2003 to the end of June 2004.

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

(3) Estimated from loss functions in the Glenelg River REALM model. The volume of estimated losses increased from the previous year due to an improvement of the calculation method.

33.6.2 Small Catchment Dams

The capacity of small catchment dams in the Glenelg basin is estimated to be around 77,000 ML (Table 33-3). Usage in 2004/05 is estimated to be approximately equal to the average annual usage of 55,500 ML and, after allowing for losses, the total catchment run-off that is harvested as a result of the small catchment dams is estimated to be 80,100 ML.

Table 33-3 Small catchment dam information

Type of Small Catchment Dam	Capacity (ML)	Usage (ML)	Total Water Harvested (ML)
Stock and domestic	27,100	13,600	n/a
Irrigation	49,900	41,900	n/a
Total	**77,000**	**55,500**	**80,100**

Note:
(1) n/a: information not available

33.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water entitlements within the basin in 2004/05.

33.6.4 Volume Diverted

The volume of water diverted under each water authority's bulk entitlement is shown in Table 33-4. Compliance with individual bulk entitlement volumes is deemed to occur in Table 33-4 if water use is not more than the maximum volume allowed to be diverted in 2004/05.

Licences on unregulated streams are not currently metered and hence compliance has not been assessed. Licensed diversions from unregulated streams are estimated based on irrigation demand modelling and climate information.

The amount diverted for the Glenthompson and Coleraine bulk entitlement is not measured by Glenelg Water. The amount diverted for the Coleraine bulk entitlement was estimated based on the volume of water supplied to the towns. The amount diverted for the Glenthompson bulk entitlement was known to be zero because run-off did not occur in the Glenthompson catchment.

33.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

All passing flow obligations under bulk entitlements in the Glenelg basin were met in 2004/05.

33.6.6 Compliance with Streamflow Management Plans

There is no streamflow management plan currently in operation in the Glenelg basin.

33.7 Groundwater Resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Glenelg basin, excluding stock and domestic use, is presented in Table 33-5. An estimate of stock and domestic groundwater use is provided in Table 33-6. Groundwater is used as an urban water supply for the townships of Penshurst, Macarthur, Merino, Casterton and Dartmoor. The licensed entitlement and metered use for these groundwater supplies is provided in Table 33-7.

The Glenelg basin contains part of the Condah WSPA, Glenelg WSPA and Portland GMA. The volumes described in Table 33-5 and Table 33-6 are totals for the management areas and include the area that falls outside the Glenelg basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 33-4 Volume of water diverted under surface water entitlements in the Glenelg basin

Entitlement	Period of Bulk Entitle-ment (years)	Total Bulk Entitlement – 30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?	Volume Diverted in 2004/05 (ML)
Glenelg Water							
Coleraine, Casterton, Sanford	1	855	0	855	334	Yes	334
Dunkeld	1	170	0	170	0	Yes	0
Glenthompson	1	94	0	94	0	Yes	0
Hamilton	1	3,435	0	3,435	1,573	Yes	1,573
Wimmera and Glenelg Rivers	5	465	0	465	n/a		85
Grampians Wimmera Mallee Water							
Wimmera and Glenelg Rivers - Wimmera Mallee Water	5	802,100	0	802,100	n/a	n/a	67,276
Minister for Environment							
Wimmera and Glenelg Rivers	5	161,200	0	161,200	n/a	n/a	7,554
Total Annual Volume of Bulk Entitlements		**197,307**	**0**	**197,307**			**76,822**
Licensed Diversions from Unregulated Streams		1,166	0	1,166	800		800

Notes:

(1) For multi-year entitlements, the maximum allowable diversion is estimated based on bulk entitlement volume as at 1 July 2004, plus allowances for permanent transfers of entitlement (annual volume multiplied by period of bulk entitlement) and temporary transfers that occurred in the 2004-05 period. The actual maximum allowable diversion will depend on when permanent transfers occurred over the applicable period, and the inclusion of temporary transfers that may have occurred in previous years.

(2) n/a: bulk entitlement conversion order was either not finalised at the beginning of 2004/05, or, in the case of multi-year bulk entitlements, 2004/05 was the first season of operation of bulk entitlements and diversions prior to 2004/05 are not applicable.

Table 33-5 Compliance with licensed groundwater volumes, Glenelg basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Portland GMA (27%)	>200	20,683	1,646	0	576	576	Not Available (6)
Condah WSPA (47%)	70-200	7,568	7,568	3,270	0	3,270	Not Available (6)
Glenelg WSPA (66%)	ALL	32,782	32,782	19,950	0	19,950	Not Available (6)

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.
(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 33-6 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Portland GMA	63	126
Condah WSPA	58	116
Glenelg WSPA	Not Available	Not Available

Note:
(1) There are a number of licensed groundwater allocations that also incorporate stock and domestic use. The estimated use for these bores is included in the licensed allocation in the previous table.

Table 33-7 Urban groundwater usage

Town Supplied	Licensed Allocation ML	Metered Use
Penshurst	250	148
Macarthur	80	11
Merino	100	51
Casterton	1000	403
Dartmoor	170	19

33.8 Recycled Water

Wannon Water operates four sewage treatment plants in the Glenelg basin. All effluent is reused within the basin, mainly for irrigation (Table 33-8).

Table 33-8 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Casterton	170	170	0	170	0	0	0	0
Coleraine	80	80	0	80	0	0	0	0
Dunkeld	40	40	0	40	0	0	0	0
Hamilton	940	940	0	940	0	0	0	0
Total	1,230	1,230	0	1,230	0	0	0	0

Notes:
(1) Volume used to deliver specific environmental flow benefits.
(2) Water that is reused in sewage treatment processes, e.g. backflushing of filters.
(3) Other refers to a change in on-site effluent storage, ocean discharge, or other item affecting the annual water balance for recycled water that is not otherwise accounted for.

34 Millicent Coast Basin

34.1 Location of Water Resources

The Millicent Coast basin is located within the South East Coast Drainage Division. It spans parts of both Victoria and South Australia. The surface water hydrology of the Victorian section of the basin is determined by numerous internally draining inter-dune wetlands, mainly in the south, with several minor waterways which flow intermittently and continue into South Australia. A map of the river basin is shown in Figure 34-1.

The groundwater resources of the basin are comparatively more significant than the surface water resources. Water supply protection areas (WSPAs) cover groundwater resources within the basin, including the whole Apsley WSPA, Neuarpur WSPA and Little Desert GMA, in addition to part of the Telopea Downs WSPA, Kaniva WSPA and Glenelg WSPA. Groundwater management areas within the Millicent Coast basin include the entire Little Desert GMA and part of the Goroke GMA and Kaniva GMA. The Millicent Coast basin also contains border groundwater management zones 4B, 5B, 6B and 7B, in addition to part of zones 2B, 3B and 8B. These zones help govern a groundwater sharing agreement between Victoria and South Australia and are distinct from the management framework that governs groundwater resources across the rest of the state. Groundwater allocations and use within the border zones have not been included in the accounts in 2004/05.

34.2 Responsibilities for Management of Water Resources

Grampians Wimmera Mallee Water is the licensing authority responsible for managing groundwater and surface water licensed diversions within the basin. Groundwater management is undertaken jointly by South Australia and Victoria under the Border agreement. Grampians Wimmera Mallee Water is also responsible for urban water supply in the Millicent Coast basin, including the town of Edenhope. The Wimmera Catchment Management Authority is responsible for waterway management in the basin.

34.3 Seasonal Overview

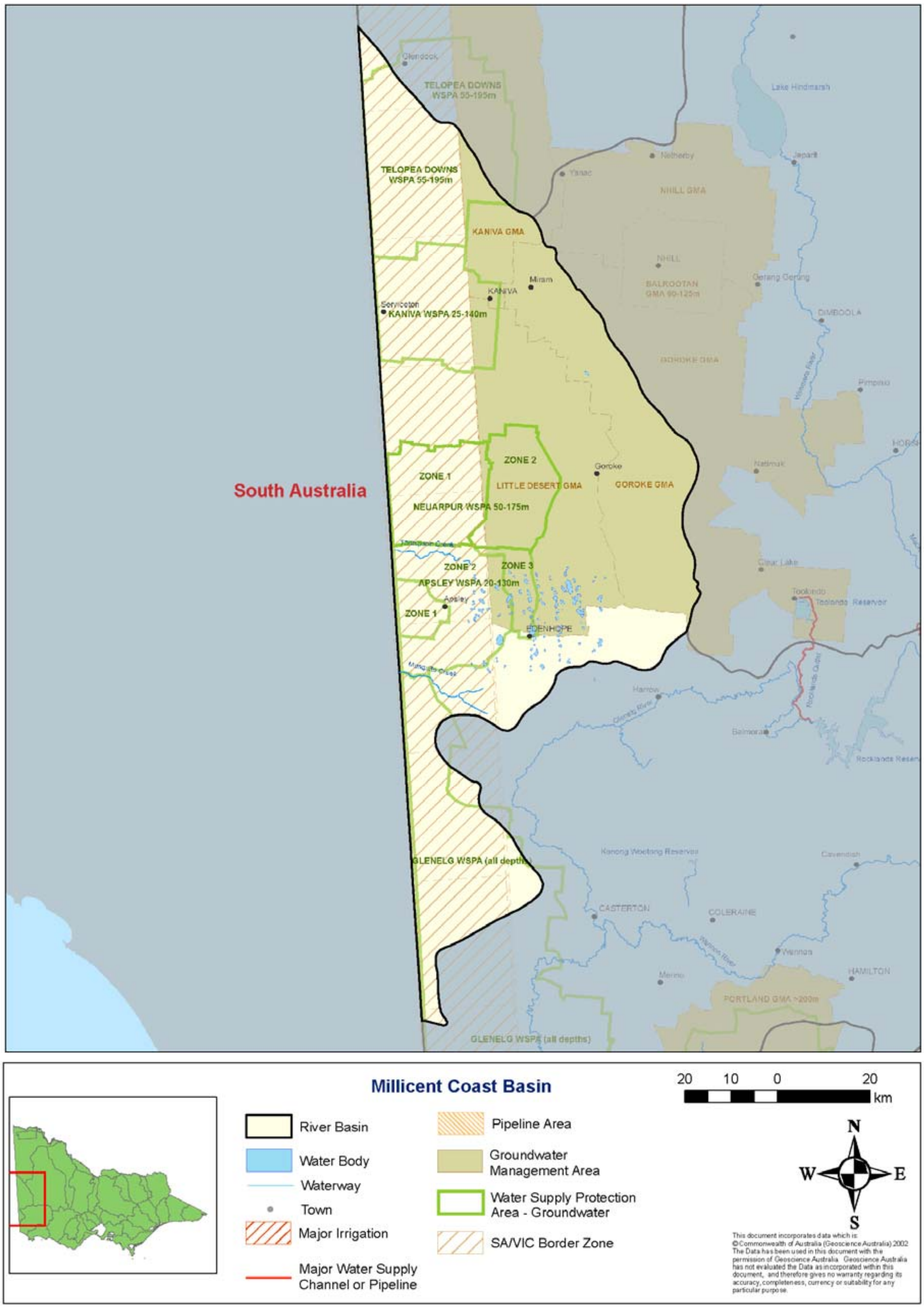
Rainfall within the Millicent Coast basin was close to the long-term average (80-100%) during 2004/05. However, Stage 1 (of five stage policy) urban restrictions remained in place at Edenhope between November 2004 and October 2005.

The Millicent Coast basin contains many ecologically significant wetlands, most of which are situated on private land. As part of the implementation of the Wimmera Regional Catchment Strategy, investigations were carried out in 2004/05 with the aim to develop a strategy to conserve the values associated with these wetlands in conjunction with landholders.

A statewide assessment of stream condition found that 36% of streams in the Millicent Coast basin are in good or excellent condition, and 64% of streams are in moderate condition. No streams were found to be in poor or very poor condition. No streamflows are currently recorded in the basin, because there is only a very low use of the resource.

An assessment of the environmental health of rivers and streams in the Millicent Coast basin is available in the Index of Stream Condition (Department of Sustainability and Environment, 2005). (Go to: www.vicwaterdata.net).

Figure 34-1 Map of the Millicent Coast basin



34.4 Summary of the 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 34-1. The volume of the surface water resource has notionally been set to the water diverted from streams in 2004/05.

Table 34-1 Summary of total water resource and water use in the Millicent Coast basin, 2004/05

Water Source	Total Water Resource (ML)	Total Use (ML)
Surface Water (1)	200	200
Groundwater (2)	Not available	Not available
Recycled Water	190	190

Note:

(1) The volume of the water resource has notionally been set to the water diverted from streams for the year.

34.5 Water for the Environment

In 2004/05 there was no formal environmental water reserve established in the Millicent Coast basin.

As there are no stream gauges within the Millicent Coast basin in Victoria, an estimate of the volume of environment's share of total flow was not made. Any surface water that forms the environment's share of total flow at the State border flows on to become an available resource to South Australia.

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 2004/05 inflows could not reliably be made, and has notionally been set to the volume of diversions which is estimated to be approximately 200 ML. This is considered to be an underestimate of the total surface water resource.

There is currently limited information available regarding farm dam volumes and usage within the Millicent Coast basin, and so no values could be included in the water balance.

During 2004/05, 150 ML was diverted from surface water to supply Edenhope and an estimated 85 ML was diverted by licensed diverters.

Due to the limited information for surface water availability and use in the Millicent Coast basin, a water balance has not been included for the basin.

34.6.2 Small Catchment Dams

No information regarding farm dams is readily available within the Millicent Coast basin.

34.6.3 Water Entitlement Transfers

There was no temporary or permanent transfer of water entitlements or diversion licences within the basin in 2004/05.

34.6.4 Volume Diverted

The bulk entitlement for the water supply to towns in the Millicent Coast basin was not completed by the start of 2004/05 and values are not reported against this bulk entitlement.

Licences on unregulated streams are not currently metered and hence compliance has not been assessed (Table 34-2). Licensed diversions from unregulated streams are estimated based on full use of stock and domestic water entitlements, and the application of a simple evaporation-irrigation demand relationship for the use of irrigation water entitlements.

Table 34-2 Volume of water diverted under surface water entitlements in the Millicent Coast basin

Entitlement	Period of Bulk Entitle-ment (years)	Total Bulk Entitlement – 30 June 2005 (ML)	Net Temporary Transfer in 2004/05 (ML)	Maximum Allowable Diversion over Period (ML)	Total Volume Diverted over Period (ML)	Complied?	Volume Diverted in 2004/05 (ML)
Grampians Wimmera Mallee Water							
Edenhope	n/a	n/a	0	n/a	150	n/a	150
Total Annual Volume of Bulk Entitlements		**n/a**	**0**	**n/a**	**n/a**		**150**
Licensed Diversions from Unregulated Streams		85	0	85	85		85

Note:

(1) n/a: bulk entitlement conversion order was not finalised at the beginning of 2004/05

34.6.5 Compliance with Passing Flow Obligations in Bulk Entitlements

No bulk entitlements were operating in the basin during 2004/05.

34.6.6 Compliance with Streamflow Management Plans

There is no streamflow management plan in operation in the Millicent Coast basin.

34.7 Groundwater Resources

A summary of the licensed entitlements and use for groundwater management units that overlap the Millicent Coast basin, excluding stock and domestic use, is shown in Table 34-3. An estimate of stock and domestic groundwater use is provided in Table 34-4. 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 entitlement and metered use for these groundwater supplies is provided in Table 34-5.

The Millicent Coast basin contains the whole Kaniva WSPA, Neuarpur WSPA, Apsley WSPA and Little Desert GMA, as well as part of the Glenelg WSPA, Telopea Downs WSPA, Kaniva GMA and Goroke GMA. The volumes described in Table 34-3 and Table 34-4 are totals for the management areas and include the area that falls outside the Millicent Coast basin. Groundwater entitlements and use for unincorporated areas have not been included in the 2004/05 water accounts.

Table 34-3 Compliance with licensed groundwater volumes, Millicent Coast basin 2004/05

Water Supply Protection Area/ Groundwater Management Area (1)	GMA/ WSPA Depth Limits (m) (2)	Allocation Limit (ML/year) (3)	Licensed Entitlement Allocated (ML/year) (4)	Metered Use (ML)	Estimated Use in Unmetered Bores (ML) (5)	Total Licensed Groundwater Use (ML)	Total Groundwater Resource (ML)
Goroke GMA (37%)	Tertiary Confined Sand Aquifer	2,200	0	0	0	0	Not Available (6)
Kaniva GMA (17%)	Tertiary Confined Sand Aquifer	1,100	0	0	0	0	Not Available (6)
Little Desert GMA (100%)	Tertiary Confined Sand Aquifer	1,100	0	0	0	0	1,100
Apsley WSPA (100%)	20-130	4,285	4,285	1,360	0	1,360	4,285
Glenelg WSPA (30%)	ALL	32,782	32,782	19,950	0	19,950	Not Available (6)
Kaniva WSPA (100%)	25-140	3,673	3,673	2,250	0	2,250	3,673
Neuarpur WSPA (100%)	50-175	24,696	24,696	19,250	0	19,250	24,696
Telopea Downs WSPA (61%)	55-195	7,482	7,482	3,830	0	3,830	Not Available (6)

Notes:

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

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

(3) The allocation limit represents either the sum of licensed entitlements for WSPAs or the permissible annual volume (PAV) for GMAs, and does not include groundwater resources from unincorporated areas within the basin.

(4) Includes domestic and stock usage in those cases where this forms part of a licensed allocation.

(5) For unmetered bores, usage is estimated using the average percentage of licensed entitlements that was used in metred areas across the State. In 2004/05 this was 36%.

(6) No estimate of the total groundwater resource is provided when >10% of the GMA/WSPA is located outside the river basin.

Table 34-4 Number of stock and domestic bores and estimated use

Water Supply Protection Area/ Groundwater Management Area	No. of Stock and Domestic Bores (1)	Estimated Stock and Domestic Use (Assuming 2ML/bore) (ML)
Goroke GMA	0	0
Kaniva GMA	0	0
Little Desert GMA	0	0
Apsley WSPA	110	220
Glenelg WSPA	Not Available	Not Available
Kaniva WSPA	93	186
Neuarpur WSPA	255	510
Telopea Downs WSPA	73	146

Note:

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

Table 34-5 Urban groundwater usage

Town Supplied	Licensed Allocation ML	Metered Use
Boikerbert (Apsley)	40	37
Kaniva	600	160
Lillimur	32	24
Goroke	86	79
Leeor (Serviceton)	25	11
Mirampiram (Miram)	7	3
Harrow	29	54
Edenhope (emergency bores)	currently being reviewed	150

34.8 Recycled Water

Grampians Wimmera Mallee Water operates sewage treatment plants in three towns within the Millicent Coast basin. All of the effluent from Edenhope was recycled. No effluent was recycled from Kaniva or Serviceton as the volume produced (including about 90 ML at the Kaniva treatment plants) was evaporated on-site. Under current reporting arrangements, this effluent is not reported as “volume produced” (Table 34-6).

Table 34-6 Volume of recycled water

Treatment Plant	Volume Produced (ML)	Volume Reused (ML)	End Use Type for Effluent Reuse (ML)				Volume Discharged to the Environment (ML)	Other (ML) (3)
			Urban & Industrial	Agriculture	Beneficial Allocation (1)	Within Process (2)		
Edenhope	188	188	188	0	0	0	0	0
Kaniva North	0	0	0	0	0	0	0	0
Kaniva South	0	0	0	0	0	0	0	0
Serviceton	0	0	0	0	0	0	0	0
Total	**188**	**188**	**188**	**0**	**0**	**0**	**0**	**0**

Notes:

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

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

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

Part 3
Directions for Victorian Water Resource Management and Reporting

Part 3 provides an overview into the major environmental and policy influences on this and future editions of the State Water Report. Since last year's report, several important initiatives, many resulting from the Victorian Government's *Our Water Our Future* action plan, have progressed or been completed.

The most important is the introduction of the *Water (Resource Management) Act 2005*, which for the first time grants the environment a legal share of the State's water resources. Also impacting water-sharing arrangements are the recent snapshot of the health of Victorian rivers; climate change studies; regional sustainable water strategies; and the continued evolution of the water market aided by the creation of a state-wide Water Register, improved monitoring, reporting and accounting.

Future editions of the State Water Report will reflect these influences, developing and improving the accuracy, accountability and accessibility of Victoria's water resource information.

35 Securing the Environmental Health of Water Resources

35.1 Introduction

The environmental health of waterways in each of Victoria's river basins is a fundamental factor in deciding how much water is protected and held for the environment and how much is allocated for consumptive use.

The Victorian Government's *Our Water Our Future* action plan recognised the need to protect the environment's share of water when it planned the creation of the Environmental Water Reserve. In the past, the environment was not sufficiently considered in water allocation decisions and, as a result, many rivers and some aquifers are stressed and their environmental condition is degrading.

The *Water (Resource Management) Act 2005* brought the Environmental Water Reserve to fruition by granting the environment a legal share of water resources. Accordingly, all water resource planning in Victoria must make the Environmental Water Reserve a central consideration, and future State Water Reports will reflect its status. While it does not feature in the State Water Accounts 2004/05, it will be reported in the future.

This chapter begins with a brief overview of key aspects of the health of Victoria's rivers. Their condition will help determine the share of overall water resources that is set aside when quantifying the Environmental Water Reserve in each river basin. This is followed by an outline of the Environmental Water Reserve, plans to enhance its volumes in the future, and responsibilities for its management.

35.2 River Health

The harnessing of rivers to provide secure water supplies for towns and irrigation has had profound effects on the ecology of rivers, floodplains and estuaries. Large dams and other regulating structures, diversions from streams, groundwater bores and small catchment dams have changed the natural flow regime of our rivers.

River health is a term used to describe the ecological condition of a river and is more than just the flora and fauna that live in it or the quality and quantity of the water. In general terms, when considering the health of a river system, we need to take into account the diversity of the habitats and biota, the effectiveness of linkages and the maintenance of ecological processes. Each is influenced by the river's flow regime.

Generally an ecologically healthy river strikes a balance between human use and the ecology of the river – a balance where the integrity of the system is still preserved, a reasonable level of human needs can be met, and where both can be sustained into the future.

An assessment of the environmental health of Victoria's rivers made in 2004 was published in the Index of Stream Condition (ISC) in 2005. The first ISC assessment was undertaken in 1999. The ISC provides a consistent statewide picture of the environmental condition of rivers and streams, along with a clear way to communicate all the aspects of rivers that need to be managed together to maintain or improve river health. It includes measures of the five major components of rivers that contribute to stream health: hydrology (flow), water quality, aquatic life, physical form and streamside zone. The ISC has been developed to detect changes in the environmental condition of stream reaches in the long term. The output from the hydrology component of the assessment provides a statewide overview of flow stressed river basins, which needs to be supplemented by environmental flow studies to provide more specific assessments and recommendations.

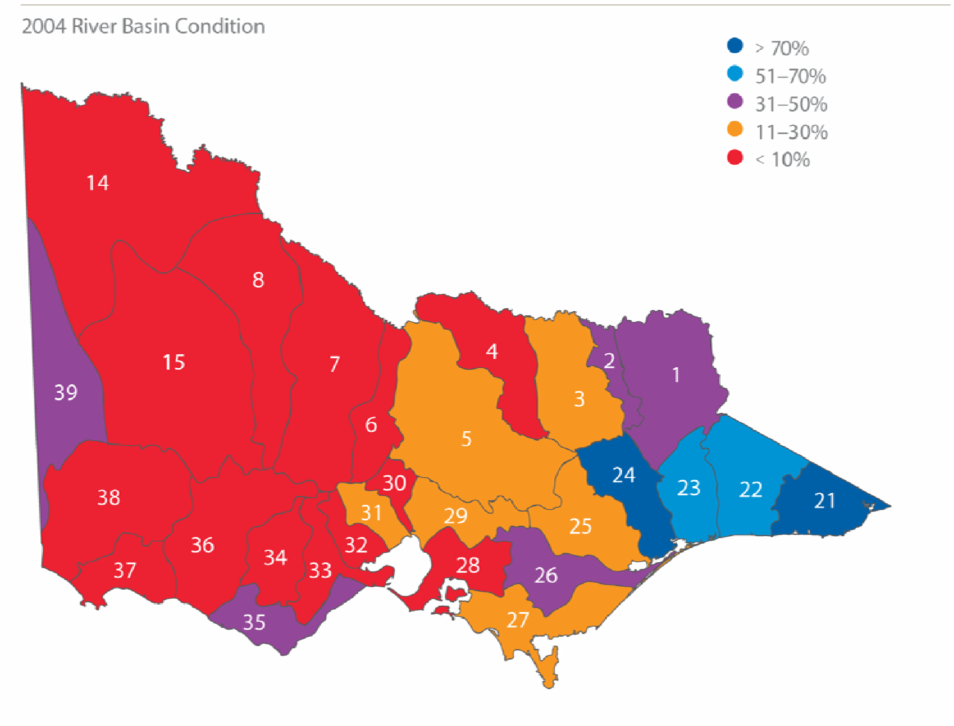
35.2.1 Current River Condition

At a statewide level, basins in the east of the state are generally in better condition than those in the mid and west regions. This is largely attributed to the lower level of development in the east, both water harvesting (dams, diversions and stream pumping) and land clearing, and more reliable rainfalls. Figure 35-1 shows this general pattern.

The next assessment of river health using the Index of Stream Condition is due to be undertaken in 2009.

To gain a complete detailed picture of the condition of Victoria's rivers based on the 2004 ISC assessment, the full report should be viewed. Visit the Victorian Water Resources Data Warehouse at www.vicwaterdata.net (click on the 'Browse Index of Stream Condition' link), or obtain a hard copy from the Department of Sustainability and Environment Customer Service Centre.

Figure 35-1 Percentage length of major rivers and tributaries in each river basin in good or excellent condition



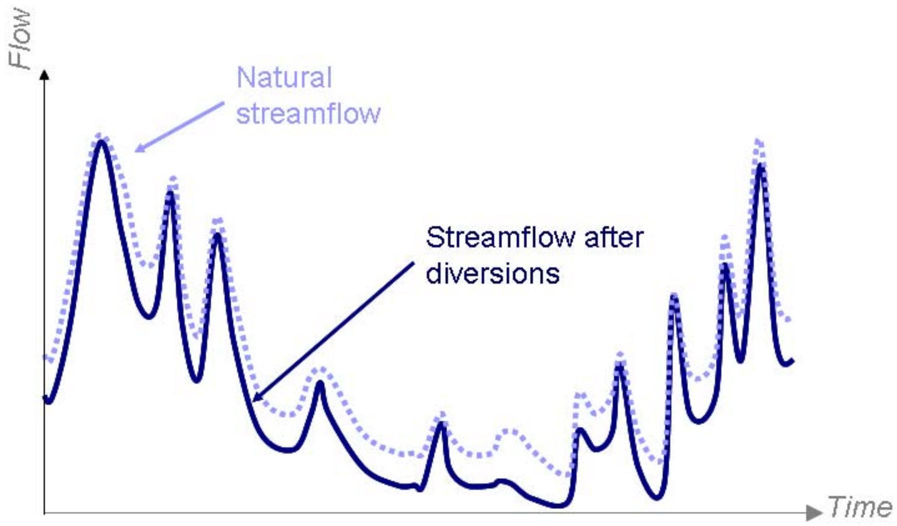
1 Upper Murray
2 Kiewa
3 Ovens
4 Broken
5 Goulburn
6 Campaspe
7 Loddon
8 Avoca
14 Mallee
15 Wimmera
21 East Gippsland
22 Snowy
23 Tambo
24 Mitchell
25 Thomson
26 LaTrobe
27 South Gippsland
28 Bunyip
29 Yarra
30 Maribyrnong
31 Werribee
32 Moorabool
33 Barwon
34 Corangamite
35 Otway
36 Hopkins
37 Portland
38 Glenelg
39 Millicent

35.2.2 Effects of flow on river health

Adequate flows of water are important to sustain our streams, rivers and groundwater, and their dependent ecosystems. Each component of the flow regime plays an important role in river ecology, many of which cease to exist due to the competing consumptive demands, resulting in flow stressed river systems.

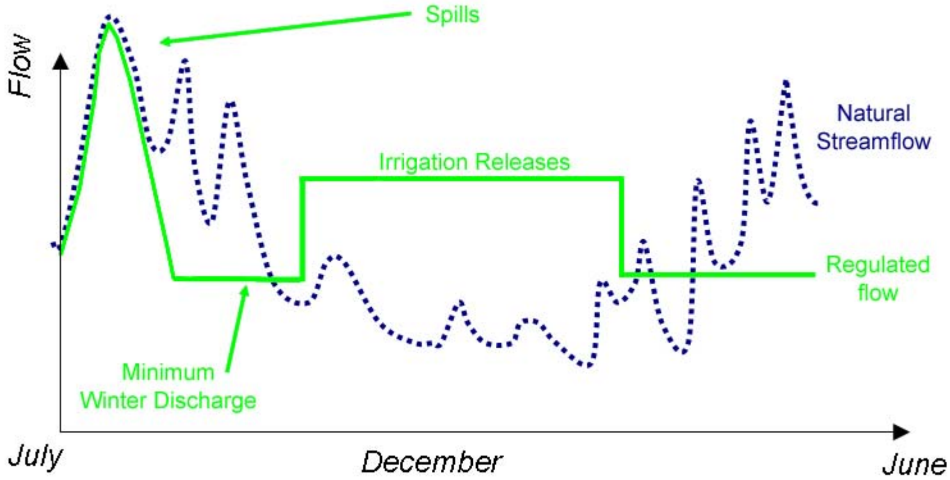
In unregulated river systems, flow is affected by extraction under bulk entitlements and licensed diversions. Typically, there is little change to overall volume on an annual basis but, as Figure 35-2 shows, it is the frequency, timing, duration, and magnitude of the extraction that causes the biggest impact. For example high extraction rates in summer causes the most impact due to the already low levels of water in the system.

Figure 35-2 Effect of diversions on unregulated streams



In regulated river systems, flow is regulated by storage operation rules, with reductions in all parts of the flow regime except flood events, when water will spill past weirs and reservoirs. As Figure 35-3 shows, a minimum rate of flow is provided during winter, as well as an inversion of flow rates, with high levels of water to provide irrigation releases during summer.

Figure 35-3 Effect of regulated systems on streamflow



35.2.3 Improving river health

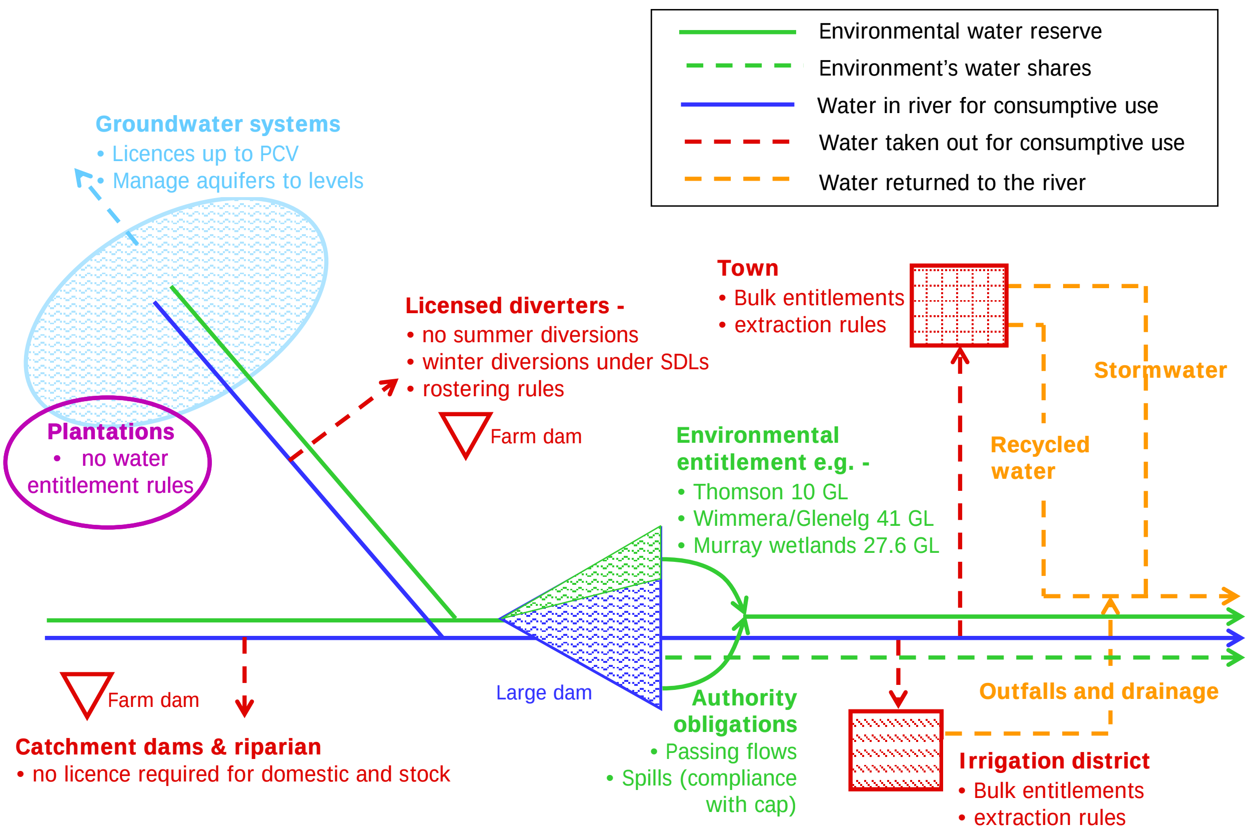
The *Our Water Our Future* action plan restated the Government's commitment to improving the health of Victoria's rivers through implementing the *Victorian River Health Strategy*. The strategy outlines the Government's long-term direction for the management of Victoria's rivers and is a blueprint for integrating all efforts on rivers. Importantly, it provides the framework for regional communities to make decisions on river protection and restoration and to find the balance between using our rivers and maintaining their ecological condition.

35.3 Establishment of the Environmental Water Reserve

The Environmental Water Reserve is defined as 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.

In response to the degraded state of Victoria's rivers and aquifers, the Government has established the Environmental Water Reserve to provide a higher degree of legal protection and recognition for the environment's share of water resources as described in more detail below. Figure 35-4 shows the relationship between the Environmental Water Reserve and other water in a hypothetical river basin.

Figure 35-4 Environmental Water Reserve in a hypothetical river basin



PCV: Permissible consumptive volume.
SDL: Sustainable diversion limit.

The *Water (Resource Management) Act 2005* provided for the creation of the Environmental Water Reserve and formally defines it as water set aside for the environment through:

(a) Environmental entitlements: The legislation provides for volumes of water in regulated river systems to be granted to the environment. Environmental entitlements are held by the Minister for Environment. The existing bulk entitlements held by the Minister for Environment are equivalent to environmental entitlements and it is expected they will be amended so as to afford them the same legal status as environmental entitlements. Because they exist in regulated water supply systems, which provide opportunities for discretionary releases of water, environmental entitlements can be managed with considerable flexibility to meet environmental objectives.

(b) Entitlement holders meeting the obligations attached to their water entitlements: This is flow that an entitlement holder must allow to pass before they can take any water; it is also flow that is in excess of entitlement holders' needs and/or rights. This component of the Environmental Water Reserve does not include water set aside for future consumptive purposes in a river basin, but which is not yet allocated under a formal entitlement (e.g. unallocated water within permissible consumptive volumes for groundwater; or the statewide sustainable diversions rules and unallocated water identified in regulated systems).

(c) Operation of a management plan: e.g. a streamflow management plan.

(d) Operation of other legislation, eg. the *Murray Darling Basin Act 1993* and the *Groundwater (Border Agreement) Act 1985*.

Environmental entitlements already exist in the Wimmera/Glenelg river system (41 GL), Thomson River (10 GL), Loddon River (2 GL), River Murray (27.6 GL), and the Snowy (21.5 GL). The status and annual allocation for the environmental entitlements that existed in 2004/05 are reported in the basin Water Accounts and summarised in Chapter 2.

New or expanded environmental entitlements are proposed for the following systems: River Murray, Loddon, Wimmera/Glenelg, Macalister, Thomson, Yarra, Werribee, Maribyrnong, Barwon, Moorabool and Tarago Rivers.

Other types of water entitlements will become available for environmental use. Water shares fall in this category. This is water that was originally held as a tradeable consumptive entitlement (e.g. irrigation water rights, irrigation sales water) which is legally transferred to the environment for environmental purposes. The rules and conditions for supply of this water are similar (but not necessarily identical) to the consumptive entitlement from which the water share was derived. Water shares will be held by Catchment Management Authorities or the Secretary of the Department of Sustainability and Environment.

Stormwater, recycled water and irrigation drainage flows may also contribute to the environmental well-being of a river or stream, but are not currently included in the Environmental Water Reserve.

There are a number of actions required by Government to fully establish the Environmental Water Reserve:

- Completion of all consumptive bulk entitlements across the state. The largest of these are the bulk entitlements for Melbourne Water to take from the Yarra and Tarago rivers. There are a handful of other small town water supplies which require bulk entitlements to formalise their water supply entitlements, as well as the Newlyn Reservoir/Hepburns lagoon system in the upper part of the Loddon basin.
- In unregulated streams, the statutory recognition of the statewide sustainable diversion limits as permissible consumptive volumes.
- For groundwater management units, the proclamation of permissible consumptive volumes.

35.4 Enhancing the Environmental Water Reserve

The Government's *Our Water Our Future* action plan outlines key projects for enhancing the Environmental Water Reserve including:

- Unbundling water entitlements: This irrigation reform initiative will improve the security of irrigation water entitlements and enhance the water market. The agreed implementation package for irrigation areas in northern Victoria includes the transfer of 20% of the new irrigation sales entitlements to the environment. The project will deliver a total of 145,000 ML a year towards Victoria's share of the water required for the Living Murray project. This water will be transferred into environmental entitlements for use in improving environmental flows in the River Murray as well as the Goulburn, Broken, Campaspe and Loddon rivers. The *Water (Resource Management) Act 2005* was passed in the spring session of Parliament 2005 to enable the unbundling of water entitlements. On the first of July 2007, 120,000 ML of lower reliability entitlement will be transferred to the environment. The supply of this water will depend on the annual allocation for lower reliability entitlements.
- Snowy River: The Victorian Government, together with the Commonwealth and New South Wales Governments, have committed to increase the river's flow below Jindabyne Dam from approximately 1% to 21% of its natural flow. This requires 212,000 ML of water to be recovered by water savings projects in New South Wales and Victoria. An allocation of 10,200 ML for the Snowy River was available in 2004/2005, which was created through water savings projects in Normanville, Woorinen and Goulburn-Murray irrigation districts that were completed during 2003/2004. This volume was carried over for use in 2005/06 (see Chapter 2). Other water savings projects initiated in Victoria include the decommissioning of Lake Mokoan, and the channel reconfiguration project in the Goulburn-Murray Irrigation District.
- River Murray: The Living Murray initiative, from the Murray Darling Basin Ministerial Council, aims to improve the ecological health of the River Murray, initially focussing on six priority sites. Under the First Step Decision by the Council, 500,000 ML will be returned to the River Murray for the environment (this includes 145,000 ML for the environment from the unbundling water entitlements project). Structures such as regulators and channels to deliver and manage the environmental water at the priority sites will be developed under a $150 million works program. Four of the six sites are wholly or partly within Victoria: Barmah/Millewa, Gunbower-Pericoota/Koondrook, Hattah Lakes and Chowilla-Lindsay/Wallpolla.
- Thomson/Macalister: An additional 10,000 ML of water for environmental flows in the Thomson River was transferred to the environment from Melbourne Water's Thomson River entitlement in June 2005. This is the first instalment of the *Our Water Our Future* action plan's proposed total transfer of 18,000 ML of additional water for environmental flows in the Thomson River. Planning has commenced on improving the efficiency of water delivery in part of the Macalister Irrigation District. This project is expected to save an estimated 5,000 ML for the environment initially, with more savings expected to follow as efficiency improvements are extended to other parts of the district.
- Wimmera-Glenelg: The Wimmera-Mallee pipelining project will completely change the balance between consumptive and environmental use in the basin with the environment's average share of total annual flows increasing from the current 20% to an estimated 60%. In September 2005, 9,000 ML of entitlement from pipeline savings was added to the environment's existing entitlements to bring the total annual entitlement up to 40,563 ML.

Further information regarding these projects can be found in the Government's *Our Water Our Future* action plan, or by visiting the Department of Sustainability and Environment's website at www.dse.vic.gov.au.

35.5 Managing the Environmental Water Reserve

Catchment Management Authorities will have responsibility for the operational management of the Environmental Water Reserve. In Port Phillip and Westernport region, Melbourne Water will manage the Environmental Water Reserve.

The *Water (Resource Management) Act 2005* requires the Environmental Water Reserve to be managed in accordance with the environmental water reserve objective specified in the Act.

Management of the Environmental Water Reserve will:

- Aim to achieve ecological objectives for the protection and/or restoration of priority river, wetland and aquifer assets,
- Be undertaken as one key component of an integrated program of river, wetland, and aquifer restoration aimed at achieving ecological objectives,
- Aim to achieve the most effective use of environmental water, achieving the greatest level of environmental benefits possible and minimising as far as possible any adverse impacts on water users, and
- Engage communities, particularly where these are likely to be affected by the water management regime.

Environmental operating strategies will be prepared by the Environmental Water Reserve managers for the operational management of environmental entitlement held in storage. The catchment management authorities are required to report to the Minister for Environment on the allocation and use of the environment’s water currently held under bulk entitlements.

Reporting on the allocation and use of the various components of the environment’s water will be further developed as management systems for the Environmental Water Reserve are established. These reports could be included in the annual State Water Account for each river basin and aquifer.

The Department of Sustainability and Environment has commissioned the eWater Co-operative Research Centre (CRC) to initiate an ecological monitoring program to assess the outcomes of the use of environmental water. Reporting on the ecological response of rivers, wetlands and aquifers to environmental flows is not in the scope of the State Water Report, and will be reported on separately once the ecological monitoring program is implemented.

36 Climate Change and Victoria's Water Resources

36.1 Introduction

The total amount of water available in the future for use by humans and by the environment in each river basin is expected to differ from today due to the impacts of climate change. This chapter outlines a high-level CSIRO study and how the potential impacts of climate change are being taken into account in water resource planning and management. The actual effects of climate change in comparison with predicted outcomes will become apparent in trends outlined in future State Water Reports.

36.2 Predicted Change

Across Victoria, climate change is expected to increase temperatures, reduce rainfall and increase potential evaporation. Extreme events, such as flooding and drought, are also likely to increase in frequency and severity. The CSIRO (2004) has estimated the magnitude of expected changes on rainfall using global simulation models (Table 36-1). The impact is expected to be greater in the north of the State, and marked seasonal changes are expected. However, there is still a high degree of uncertainty about the likely magnitude of these changes.

Table 36-1 Range of predicted change in average annual rainfall relative to 1990 conditions

Year	Northern Victoria	Southern Victoria
2030	-15% to +3%	-9% to +3%
2070	-40% to +10%	-25% to +9%

Source: CSIRO, 2004

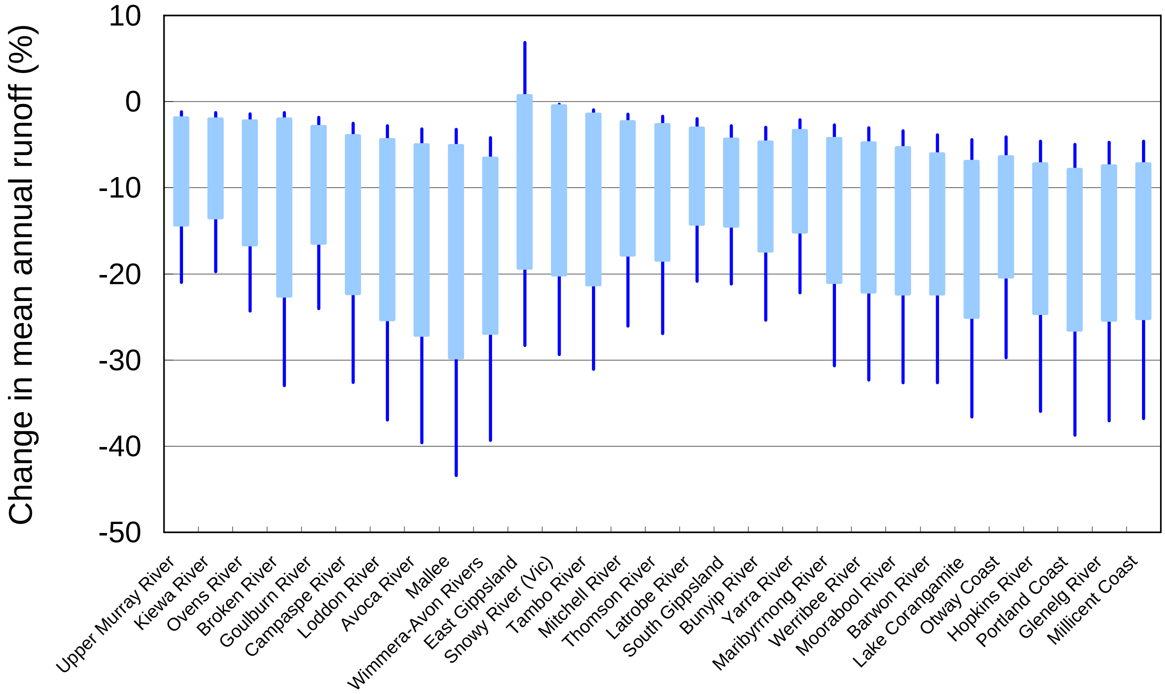
Climate change is also expected to decrease average annual streamflows. Run-off is only generated within a catchment once enough rain has fallen to sufficiently wet it and the soil has reached a threshold moisture content. Therefore a decrease in rainfall due to climate change leads to a proportionally greater reduction in run-off.

In addition to the rainfall study, the CSIRO (2005b) has estimated the impacts of climate change on Victoria's run-off. This study looks at streamflows across Victoria into the future while applying low, median and high climate change scenarios.

The extent that average streamflows may decrease in Victoria is also likely to vary between different regions, with streams in the western parts of Victoria likely to experience a larger reduction in average flow compared to streams in the east. The impact of climate change on water supply is thus likely to be much more pronounced in western parts of the state.

The range of possible changes in run-off up to 2030 in different regions of Victoria can be seen in Figure 36-1. The thin vertical lines measure the total range of change from ten climate models with a range of global warming of 0.54–1.24˚C. The central boxes project the range of change at a 0.85˚C (median) global warming.

Figure 36-1 Predicted range of possible change in run-off by 2030 across Victoria's river basins



Source: CSIRO (2005)

36.3 Determining the Impacts

A high level of uncertainty exists regarding these projected changes, however a three-year research project, led by the Department of Sustainability and Environment and in collaboration with other government agencies, is being undertaken as part of the Victorian Government's *Our Water Our Future* action plan This research aims to further enhance our understanding of the potential impacts of climate change on the south-eastern part of Australia and to reduce the level of uncertainty around projected future impacts across Victoria. The research will also enhance our ability to predict the impacts of climate change on rainfall and streamflow at the scale of tens of kilometres compared to the current scale of over a hundred kilometres.

Until this study is completed, the Government is using the CSIRO (2005) data to ensure that estimates of the impact of climate change are included in its water resource planning. For example, each water authority is required to prepare a Supply-Demand Strategy every five years, with a 50 year outlook that must include the impacts of climate change in projections of water availability. Similarly, the draft Central Region Sustainable Water Strategy (Department of Sustainability and Environment, 2006) discussed in Chapter 37 has included climate change impacts in its future projections of water availability to 2055.

37 Sustainable Water Strategies

37.1 Introduction

Regional sustainable water strategies are a key action from the Victorian Government's *Our Water Our Future* action plan. As such, they form a key plank in Victoria's new planning framework for determining large-scale, long-term changes in water use. Once the strategies are implemented, the annual water accounts included in the State Water Reports will track the allocation and use of water resources over time and provide useful information that can be fed back into future reviews of sustainable water strategies. The State Water Reports will also provide information on any emerging discrepancies between forecasts and what actually happens. Five sustainable water strategies are being developed across Victoria – Central Region, Wimmera and Glenelg Region, Northern Victoria, Gippsland Region and South-West Region.

A draft strategy for the Central Region of Victoria was released for public comment on 20 April 2006, with the final strategy due to be released later in 2006. The other four strategies will be progressively completed in the future.

37.2 Aim of each sustainable water strategy

The sustainable water strategies consider the total picture of water resource management in each of the regions over the next 50 years. This includes protecting and improving river health, meeting consumptive demand including the needs of households, industry and primary industries, considering alternative water sources and the investment of water authorities and the community. A range of water resource management issues and opportunities are identified and options proposed to maintain and improve the condition of our rivers and to provide safe, reliable water supplies for all users.

The key elements in developing a sustainable water strategy are:

1. Estimating how water needs and supplies will look over the next 50 years based on the best available data.
2. Identifying options to address the resource outlook.
3. Establishing an implementation plan.
4. Monitoring the resource outlook and adapting the implementation plan to reflect discrepancies between forecasts and what actually happens.
5. Ensuring adequate preparation.
6. Reviewing the strategy at least every seven to 10 years as our knowledge improves.

Sustainable water strategies will adopt an adaptive management approach, where regular reviews will be used to manage uncertainties and allow new knowledge of our water resources to be incorporated as it emerges.

37.3 Draft Central Region Sustainable Water Strategy

The Draft Central Region Sustainable Water Strategy encompasses Melbourne and the urban centres of Geelong, Ballarat, Sunbury, Melton, Bacchus Marsh, Warragul, Moe, Morwell and Traralgon. Released for public comment in April 2006, the draft strategy contains the following key points:

The main pressures on the Central Region's water resources in the next 50 years will be:

- Population growth – estimated to increase from the current 4.2 million to 5.7 million by 2055.
- Economic development – from water-reliant industries.
- Land-use changes and events – likely to include changed vegetation management, revegetation, and small catchment dams, as well as unpredictable events such as bushfires.
- Climate change – estimated to reduce water in our aquifers, rivers and reservoirs by anything from 7% to 64%.

The region relies heavily on water from rivers to meet drinking and other consumptive needs, however the community also expects our rivers to be in good condition. In order to balance future water needs, the strategy will:

- Protect and where necessary improve the health of rivers and aquifers.
- Conserve and use our existing water supplies more efficiently.
- Interconnect water supply systems.
- Make use of alternative sources such as recycled water and stormwater.
- Augment current urban supply systems.

Furthermore, the strategy proposes that a ‘buffer’, which is a supply of water in excess of current demands, will be maintained for urban systems to ensure the region has sufficient time to implement the next set of options needed to maintain a balance between supply and demand

An outline of how the strategy could be implemented to meet the needs of the environment and urban and agricultural users over the next 50 years is contained in the draft document.

37.4 Conclusion

The development of sustainable water strategies for each region is another step in systematically planning for Victoria’s water future. An adaptive management approach, which relies on regular reviews, will be used in each regional strategy to manage uncertainties and allow new knowledge to be incorporated as it emerges.

More information on the Draft Central Region Sustainable Water Strategy is available at www.dse.vic.gov.au.

38 Water Accounting and Reporting

38.1 Improving Systems and Accuracy

As the demand for water increases, the integrity of water entitlements and environmental flows must be protected by upgrading the way we manage our scarce water resources. The future direction of water management, in Victoria and nationally, lies in enabling water trade and providing a secure basis for investment decisions. If this is to be achieved, water accounting systems need to be improved, monitoring and reporting enhanced, and the public given greater access to water information.

Key actions in the Victorian Government's *Our Water Our Future* action plan that contribute to improving the accuracy, accountability and accessibility of water resource information are:

- the State Water Report: release of an annual overview of water allocation and use. It relies on the development of water accounting rules to allow the reporting on water availability and use and includes the basin water accounts.
- the Water Register: development of a public register of water rights, licences, and includes information on bulk entitlements in Victoria, outlined in Section 38.3 below; and
- the metering program: all new licences for commercial and irrigation use are required to be metered and funding incentives are provided to install meters on existing significant un-metered water extractions. Section 38.4 reports on the progress of the program.

While the Water Register is a significant step towards upgrading Victoria's water accounting systems, it needs to be extended to provide a complete record of water flows and water transactions across our water systems. Section 38.2 outlines some ideas and developments in water accounting in Victoria.

38.2 Water Accounting

38.2.1 Adoption of Financial Accounting Concepts for Water Accounting

Water needs to be managed with a high degree of accountability for both its use and management. A key component of this improved management is improved systems and procedures for accounting for water.

The term 'accounting' is commonly used to refer to the recording of financial information and transactions in accordance with generally accepted accounting principles and procedures. Accounting also includes methods for determining revenue and expenditure, and rules for bringing these to account.

The term 'water accounting' is used to describe the record keeping and reporting of all water flows and water entitlement transactions associated with the management, allocation and use of water resources.

Accounting for water parallels financial accounting in that it has equivalent water season and year-end statements and reports:

- A water position statement (i.e. balance sheet) that describes water in store less water committed to users.
- A water performance statement (i.e. profit and loss statement) that describes inflow and outflow plus any changes in forward commitment to users (only applies to some entitlement holders).

- A water movement statement (i.e. cash flow statement) that refers only to the physical inflow and outflow of water to date for the water season.

Rather than recording information in dollars, water is recorded in water measurement units (typically megalitres and gigalitres).

Water accounting also provides for periodic statements of the 'water position' for each water system, including allocations and allocations taken up, trade of water between water systems, and inflows and outflows to date.

38.2.2 Levels in Water Accounting

Water accounting can be applied at any part of the water cycle but, at a practical level, water managers are particularly interested in the terrestrial phase ie. from the time water falls on the landscape as rain to the time it is used in a household or on a farm or it flows out to sea.

Three levels of water accounting have been suggested: resource, wholesale and retail. Water accounting can be undertaken at each of these levels to meet the practical needs of water users and water managers. It is worth noting that the term retail is used in this report in a broad sense to include all consumptive and environmental entitlement holders supplied by water authorities in regulated systems.

38.2.3 Water Accounting in the State Water Report 2004/05

Currently, water accounting is based on water authorities' customer accounting and water supply operating systems that focus on measuring consumption and billing customers. It also includes annual assessments of water resources to determine seasonal allocations for irrigators in the large regulated water supply systems. Generally speaking, water accounts are kept for individual entities and can be aggregated to larger groupings to allow analysis on a wider scale.

The State Water Accounts 2004/05 included in Part 2 of this report are an example of simple annual water accounting at the river basin and aquifer scale. These are at an early stage of development and it is expected that the scope of water accounts in future State Water Reports will be broadened to include a more complete record of transactions associated with holding and transferring bulk water and environmental flows.

The State Water Accounts 2004/05 show a water balance for each river basin. These balances are essentially water movement statements and partial water position statements combined. They refer to physical water and are equivalent to cash statements rather than accrual statements.

Some accrual type elements (such as water trading summaries) are included in the basin Water Accounts but are not incorporated into any formal water accounts. The State Water Accounts also have an 'accrual' aspect in that they record forward commitments to water. This is consistent with the 'conservatism principle' as it ensures that the State Water Accounts do not overstate the availability of water.

It is expected that both State and national initiatives to improve water resource accounting will lead to improved rigour and levels of confidence in water resource management, particularly through the development of:

- professional and legally recognised standards, principles, and concepts; and
- double entry accounting, which provides for an independently auditable transaction trail.

38.2.4 Accounting for Groundwater

While including groundwater as part of a wholesale water account appears at first glance to be an obvious way to produce combined surface water/groundwater accounts, groundwater poses a number of challenges for water accounting:

- If an aquifer underlies more than one surface water basin, an accounting system that tries to deal with groundwater within the boundaries of river basins will present great difficulties.
- Groundwater and surface water are connected, often flowing into each other. If double counting of some water is to be avoided, the connections must be identified and understood.
- Groundwater management areas and water supply protection areas in Victoria are currently managed using extraction rates and groundwater levels, not volumes in aquifers.

At this stage it is preferable to regard water in an aquifer as a retail delivery system account at the same level as a surface water distribution system and quantify such items as inflows from recharge, water feeding into rivers and other groundwater systems, and water extracted by retail customers. However, of these items, only the extractions are readily available and these are reported in the basin Water Accounts.

Estimating the other items is a technical exercise involving modelling and high levels of uncertainty. Given that groundwater management units are essentially managed using extraction rates and groundwater levels (which can be measured), at this stage there is little point in pursuing full groundwater accounts of this type except as a knowledge gathering exercise to better understand surface water/groundwater interconnections.

38.2.5 Accounting for Environmental Water

The *Water (Resources Management) Act 2005* has conferred on the environment a legal share of the water in rivers and aquifers by establishing environmental water reserves.

It is helpful to consider the environment's rights to water in rivers as falling into two classes: extractive rights and in-stream rights. Each class needs to be treated separately in order to develop a consistent water accounting system.

(a) Extractive Rights

These are entitlements to discrete volumes of water in regulated water systems that can be used at the discretion of the environmental manager for, say, watering a wetland. Examples of extractive rights for the environment are the 27,600 ML Flora and Fauna entitlement on the River Murray, the 10,000 ML entitlement on the Thomson River, the 40,000 ML entitlement in the Wimmera and Glenelg rivers and the 20% sales entitlement water that will come into existence in July 2007.

Extractive rights are measured at the point of extraction on a waterway or delivery to a defined location. They will generally be tradable and have many characteristics similar to the extractive rights of consumptive water users. However there may be differences in some cases, such as the ability to accumulate unused water from one water year to the next. The environment's extractive rights will appear in the Water Register and as Victoria's water accounting framework is further developed, will appear in the various retail water accounts .

Victoria's approach to environmental water accounting needs to assist managers trying to optimise the environmental benefits of environmental entitlements. Examples of typical transactions are:

- temporarily using an extractive right for an in-stream purpose; and
- permanently using an extractive right for an in-stream purpose.

(b) In-stream Rights

This component of the environment's share of flow in a river includes flows maintained by a water authority as an obligation, and above-cap water. The timing of flows in this class is determined by rules in water authorities' bulk entitlements and flows in river systems, for example in response to rain when a reservoir spills. Other examples of in-stream rights are passing flows below reservoirs and special agreements such as the Barmah-Millewa forest water account. The environment's in-stream rights are measured as flows at a point in a waterway.

In-stream entitlements need to be recorded in a systematic way, and it is envisaged they will appear as part of the wholesale water accounts for a river basin.

It is worth noting, however, that temporal factors will need to be reported on through non-accounting mechanisms. This is due to the need to recognise characteristics of flow, other than volumes in water reporting.

38.2.6 National Water Initiative

The Federal Government's National Water Initiative envisages a water accounting framework that covers the whole of the terrestrial phase of the water cycle in a way that can be aggregated to a national level. As work progresses in developing national water accounting standards, these developments will find their way into the State Water Accounts, However, given the many complexities in water resource management, there will continue to be many challenges in producing meaningful national accounts.

38.3 Water Register

The Water Register will be a web-based database of irrigation water entitlements and bulk entitlements for water in Victoria. It will facilitate the unbundling of water entitlements into water shares, allocations, delivery shares, water-use licences and works licences, and also enable the leasing and mortgaging of water shares.

The Water Register is presently under development, and is due to be launched in the second half of 2007. Initially, water shares and bulk entitlements in regulated systems in northern river basins will be included in the register. Other systems with transferable entitlements will then be progressively incorporated into the register.

The water register will include an accounting module that will enable water shares, allocation, water use and transfers of water shares and allocation to be recorded, analysed and reported. This will include information regarding owner, delivery system, trading zone, reliability, tenure, source and water authority.

The accounting module of the water register will deal with water accounting at the 'retail' level which will account for water entitlements that have been defined and issued and will include annual allocations, use, water trading and losses incurred. The module will use double entry accounting and provide a transaction-based audit trail that can be independently audited.

The water accounting component of the register will:

- improve information on the compliance of water authorities with their bulk entitlement volumes,
- enable reporting to individuals on the balance of their water share and annual allocation accounts, and
- enable annual reconciliation and reporting of water accounts at the retail system level.

A detailed design of the water register (including rules for retail water accounting) has recently been finalised. The next phase of the project is to complete the detailed build of the register and prepare for data upload in July 2007.

Once complete, the water register will ease the collection of data, simplify the compilation and improve the accuracy of the State Water Accounts.

38.4 Metering Program

Preparing accurate water accounts relies on having accurate and complete data on the volumes of water extracted from rivers and aquifers. The *Our Water Our Future* action plan recognised that the metering of water extractions needed to be improved for resource monitoring and compliance purposes. The Government committed to meter all new surface water and groundwater licenses for commercial and irrigation use, and to provide funds towards the installation of meters on existing un-metered water extractions of significant size.

The Government subsequently introduced the following metering thresholds, which apply unless a lesser volume is specified in a water management plan:

- 10 megalitres and greater to take and use surface water from unregulated systems.
- 20 megalitres and greater to take and use groundwater.

Installation of meters will not be compulsory for licences below these thresholds.

The Government is contributing $5 million towards the metering program for existing un-metered water extractions, which will offset costs to farmers by up to $400 per meter. (The Department of Sustainability and Environment is administering these funds to the licensing authorities). The program for installing meters is underway, with 263 meters installed as at April 2006. The target date for the installation of meters for existing un-metered water extractions is 31 August 2007.

As this project progresses, the accuracy of the figures reported in future State Water Reports on volumes of water extracted from groundwater aquifers and from unregulated streams should be significantly improved. It will add a greater level of confidence in the water resource information presented in future reports and will also assist water managers and water users to comply with their entitlement and licensed volumes.

39 Future State Water Reports

The scope and direction of the annual State Water Report is grounded in the policy directions detailed in the Victorian Government's *Our Water Our Future* action plan. As various elements of the action plan are implemented, the content of future State Water Reports will evolve.

The reports will continue to provide publicly accessible accounts of the state's water resources that support the government's commitment to open, transparent and sustainable management.

Access to the Water Accounts will continue to improve as the web-based mechanisms that facilitate the public's ability to access and utilise data are enhanced.

Importantly, future State Water Reports will use improved water accounting methods that provide more comprehensive reporting that better reflects the complexity of water resource management.

Two commitments from *Our Water Our Future*, the creation of the water register and the metering program discussed in Chapter 38, will provide significant improvements to the quality of data used in the Water Accounts. As a result, future State Water Reports will reflect increased accuracy and consistency in data collation and calculation. They will also show more comprehensive and accurate reporting on various parties' compliance with water entitlements and caps.

Accounting for and reporting on the environmental water reserve in each river basin will become a feature of future State Water Reports now that the environmental water reserve has been defined in the *Water (Resources Management) Act 2005* has been passed. The impacts of this important milestone on the State Water Reports are discussed in Chapter 38.

Investments in water resource related infrastructure positively affect the security, reliability and environmental health of Victoria's water resources. Accordingly, future State Water Reports will include information about significant infrastructure investments that impact on the management of Victorian water resources.

Appendix A

Groundwater Entitlement and Use

Groundwater Management Unit	PAV - as of 30/06/05 (ML)	Licensed Volumes (as of 30/06/2005)							Stock/ Domestic		Total Use (Licensed + S&D)
		Licensed Entitlements (ML)	No. of Licenses	No. of Metered Bores	Estimated: Metering Program Complete %	Metered Volume (ML)	Estimated Non-Metered Use (ML)	Method Used to Estimate Non-Metered Use	No. of Bores	Estimated Use (ML)	
GRAMPIANS WIMMERA MALLEE WATER											
WSPA (Approved plan)											
Murrayville WSPA	10883	9633	33	32	100%	4700	0		250	500	5200
Neuarpur WSPA	(B)	24696	50	111	100%	19250	0		255	510	19760
WSPA (Draft plan)											
Apsley WSPA	(C)	4285	19	9	75%	1360	0		110	220	1580
Kaniva WSPA	(C)	3673	14	17	100%	2250	0		93	186	2436
Telopea Downs WSPA	(C)	7482	9	12	100%	3830	0		73	146	3976
GMA											
Balrootan GMA	980	1522	11	5	40%	370	0	Previous history	38	76	446
Goroke GMA	2200	0	0	0	N/A	0	0		0	0	0
Kaniva GMA	1100	0	0	0	N/A	0	0		0	0	0
Little Desert GMA	1100	0	0	0	N/A	0	0		0	0	0
Nhill GMA	1200	0	0	0	N/A	0	0		0	0	0
Unincorporated areas											
Grampians Wimmera Mallee Water		5909	32	(I)			2068	35% of entitlement	314	628	2696
SOUTHERN RURAL WATER											
WSPA (Approved plan)											
Nullawarre WSPA	(B)	22238	105	161	100%	9490	0		1197	2394	11884
Yangery WSPA	(B)	14473	113	154	100%	4520	0		1432	2864	7384
WSPA (Draft plan)											
Bungaree WSPA	(C)	5356	88	119	100%	2610	0		252	504	3114
Condah WSPA	(C)	7568	36	43	100%	3270	0		58	116	3386
Denison WSPA	(C)	13733	66	97	100%	6500	0		297	594	7094
Deutgam WSPA	(C)	5234	158	152	100%	960	0		257	514	1474

Groundwater Management Unit	PAV - as of 30/06/05 (ML)	Licensed Volumes (as of 30/06/2005)							Stock/ Domestic		Total Use (Licensed + S&D)
		Licensed Entitlements (ML)	No. of Licenses	No. of Metered Bores	Estimated: Metering Program Complete %	Metered Volume (ML)	Estimated Non-Metered Use (ML)	Method Used to Estimate Non-Metered Use	No. of Bores	Estimated Use (ML)	
SOUTHERN RURAL WATER cont'd											
Glenelg WSPA	(C)	32782	66	11	100%	19950	0		(I)		19950
Koo-Wee-Rup WSPA	(C)	13769	254	253	100%	3070	0		600	1200	4270
Merriumu WSPA	(C)	451	11	9	100%	90	0		13	26	116
Sale WSPA	(C)	21574	92	100	100%	7680	0		919	1838	9518
Wandin Yallock WSPA	(C)	3043	185	188	100%	300	0		163	326	626
Warrion WSPA	(C)	14214	103	118	100%	4280	0		461	922	5202
Wy Yung WSPA	(C)	7525	63	65	100%	790	0		116	232	1022
Yarram WSPA	(C)	25657	61	73	100%	8100	0		970	1940	10040
GMA											
Colongulac GMA	14271	3600	41	2	0%	0	1260	35% of entitlement	208	416	1676
Corinella GMA	2550	164	13	0	0%	0	57	35% of entitlement	157	314	371
Cut Paw Paw GMA	3650	531	5	0	0%	0	186	35% of entitlement	2	4	190
Frankston GMA	3200	1098	27	0	0%	0	384	35% of entitlement	199	398	782
Gellibrand GMA	0	0	0	0	100%	0	0		0	0	0
Gerangamete GMA	(D)	4000	1	1	100%	0	0		5	10	10
Giffard GMA	3000	5705	14	16	100%	2520	0		171	342	2862
Glenormiston GMA	5042	2512	35	0	0%	0	879	35% of entitlement	125	250	1129
Heywood GMA	21763	6442	97	1	0%	0	2255	35% of entitlement	1735	3470	5725
Jan Juc GMA	6804	4000	1	0	0%	0	1400	35% of entitlement	0	0	1400
Lancefield GMA	1485	1373	16	16	100%	110	0		76	152	262
Leongatha GMA	6500	1471	31	0	0%	0	515	35% of entitlement	114	228	743
Moe GMA	8193	3096	79	0	0%	0	1084	35% of entitlement	197	394	1478
Moorabbin GMA	4305	2071	31	1	0%	0	725	35% of entitlement	238	476	1201
Nepean GMA	5000	6049	65	8	0%	0	2117	35% of entitlement	1162	349	2466
Newlingrook GMA	74970	1968	5	1	0%	0	689	35% of entitlement	0	0	689

Groundwater Management Unit	PAV - as of 30/06/05 (ML)	Licensed Volumes (as of 30/06/2005)							Stock/ Domestic		Total Use (Licensed + S&D)
		Licensed Entitlements (ML)	No. of Licenses	No. of Metered Bores	Estimated: Metering Program Complete %	Metered Volume (ML)	Estimated Non-Metered Use (ML)	Method Used to Estimate Non-Metered Use	No. of Bores	Estimated Use (ML)	
SOUTHERN RURAL WATER cont'd											
Orbost GMA	1200	1200	3	4	100%	270	0		0	0	270
Paaratte GMA	4606	3192	5	0	0%	0	1117	35% of entitlement	4	8	1125
Portland GMA	20683	1646	7	0	0%	0	576	35% of entitlement	63	126	702
Rosedale GMA	9000	21241	51	35	100%	9920	0		1	2	9922
Stratford GMA	(E)	31553	9	7	100%	17230	0		410	820	18050
Tarwin GMA	1300	41	3	0	0%	0	14	35% of entitlement	806	242	256
Wa De Lock GMA	11500	26865	242	2	0%	0	9403	35% of entitlement	482	964	10367
Unincorporated areas											
Southern Rural Water		61671	635	(I)		0	21585	35% of entitlement	(I)	(I)	21585
GOULBURN-MURRAY WATER											
WSPA (Approved plan)											
Campaspe Deep Lead WSPA	(B)	46039	109	102	100%	25270	443	Operational Knowledge of System	188	376	26089
Shepparton WSPA	(B)	203619	1254	702	100%	64820	15000	Operational Knowledge of System	415	830	80650
Spring Hill WSPA	(B)	4909	56	47	92%	1300	70	Operational Knowledge of System	136	272	1642
Katunga WSPA	(B)	44080	184	112	86%	26200	20	Operational Knowledge of System	593	1186	27406
WSPA (Draft plan)											
Mid Loddon WSPA	(C)	34046	149	108	86%	15580	2000	Operational Knowledge of System	235	470	18050
Upper Loddon WSPA	(C)	13036	166	31	17%	2210	4000	Operational Knowledge of System	306	612	6822

Groundwater Management Unit	PAV - as of 30/06/05 (ML)	Licensed Volumes (as of 30/06/2005)							Stock/ Domestic		Total Use (Licensed + S&D)
		Licensed Entitlements (ML)	No. of Licenses	No. of Metered Bores	Estimated: Metering Program Complete %	Metered Volume (ML)	Estimated Non-Metered Use (ML)	Method Used to Estimate Non-Metered Use	No. of Bores	Estimated Use (ML)	
GOULBURN-MURRAY WATER cont'd											
GMA											
Alexandra GMA	900	1714	20	0	0%	0	600	35% of entitlement	52	104	704
Barnawartha GMA	2100	485	10	0	0%	0	170	35% of entitlement	28	56	226
Ellesmere GMA	1900	2280	10	0	0%	0	798	35% of entitlement	16	32	830
Goorambat GMA	4888	1543	13	0	0%	0	540	35% of entitlement	17	34	574
Kialla (1) GMA	2800	1549	8	0	0%	0	542	35% of entitlement	13	26	568
Kialla (2) GMA	1970	783	5	0	0%	0	274	35% of entitlement	10	20	294
Kinglake GMA	3830	1840	87	0	0%	0	644	35% of entitlement	342	684	1328
Mullindolingong GMA (zone 1&2)	6980	1285	58	0	0%	0	450	35% of entitlement	78	156	606
Murmungee GMA	16710	11792	191	0	0%	0	4127	35% of entitlement	1285	2570	6697
Nagambie GMA	5650	6648	38	20	51%	3410	1000	Operational Knowledge of System	70	140	4550
Unincorporated areas											
Goulburn Murray Water		40891	756	(I)			14312	35% of entitlement	2805	5610	19922
Totals		**852845**				**272210**	**91304**			**37878**	**401392**

Notes:

(A) Areas with zones have been totalled.

(B) No further allocations according to management plan.

(C) Embargo on new allocations applied through Water Act until management plan approved .

(D) There is no PAV for Gerangamete GMA as entitlement is managed under a groundwater licence.

(E) A PAV for Stratford is being determined.

(F) In non metered areas estimates of use are made based on a State average of metered use (35%) of the entitlement.

(G) The numbers of stock and domestic bores are the best estimates as made in 2004/05 based on the state database records.

(H) Domestic and stock use is estimated as 2/ML/yr/bore except in the Tarwin and Nepean GMA (0.3 ML/yr/bore) as advised by Southern Rural Water.

(I) Numbers being determined.

N/A Not applicable

Glossary of Terms

Allocation: The assignment of a water entitlement to a person or authority by Government. See also "seasonal irrigation water allocation".

Aquifer: A geological formation saturated with water.

Baseflows: The component of streamflow supplied by groundwater discharge.

Basin (river basin): In the State Water Report river basins are as defined by the Australian Water Resource Council (AWRC). The exception is the Murray River Basin which, for the purposes of this report, includes the Upper Murray Basin as defined by AWRC and areas in Victoria supplied from the River Murray downstream of Lake Hume. 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 that an authority is entitled to from a river or storage, 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.

Catchment: An area of land where run-off from rainfall goes into one river system.

Catchment Management Authorities (CMAs): The caretakers of river health, responsible for regional and catchment planning and coordination, and waterway, floodplain, salinity and water quality management.

Drainage division: An aggregation of river basins in an area, as in "Murray-Darling Drainage Division", "South-East Coast Drainage Division", etc. Australia has been divided up into 12 drainage divisions.

EC: Electrical conductivity, a measure of water salinity.

Effluent: Wastewater that flows from sewage treatment works.

Entitlement: See "water entitlement".

Environment: Surroundings in which an organisation operates including air, water, land, natural resources, flora, fauna, humans and their interdependence.

Environmental entitlement: A water entitlement held by the environment Minister 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: 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: The relatively smooth valley floors adjacent to and formed by rivers that are subject to overflow during flood events.

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.

Groundwater: Water occurring in an aquifer.

Groundwater allocation limit: is the amount of water which can be allocated in an aquifer under licences and is defined by the permissible consumptive volume.

Groundwater management unit: Either a groundwater management area (GMA) or a water supply protection area (WSPA).

Groundwater management area (GMA): The geographical area from which water is drawn from an aquifer and defined for the purposes of its ongoing management.

Irrigation district: An area declared under the Water Act supplied with water by channels and pipelines used mainly for irrigation purposes.

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, ACT and Australian Governments.

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, a measure of the turbidity of water.

Nutrient: Plant food, 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.

Permissible Annual Volume (PAV): The total amount of water that can be taken in a groundwater management area under a Ministerial declaration. The *Water (Resource Management) Act 2005* has replaced this term with a new term – Permissible Consumptive Volume.

Permissible Consumptive Volume (PCV): See Permissible Annual Volume

Potable: Suitable for drinking.

Precautionary principle: Erring on the side of caution in favour of a given entity. For example, where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

Ramsar Convention: An international treaty that aims to conserve certain wetlands 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 that is treated to a standard that is appropriate for its intended use.

Regulated river: A river which contains structures such as dams or major diversion weirs that 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 irrigators' 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 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.

Spills: An uncontrolled flow of water past a reservoir or a weir.

Stormwater: Untreated rainfall run-off from urban areas.

Stream: 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 that can be diverted from a catchment while protecting the environmental values of the catchment's waterways. The **Statewide Sustainable Diversion Limits** are precautionary estimates of the sustainable diversion limit for 1,600 small Victorian catchments using a statewide methodology.

Unincorporated area: An area of Victoria that 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 that 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.

Water authorities: Authorities established under the Water Act 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 and the extraction of groundwater.

Water balance: A statement of the water flows in a given area and time period, in which the sum of the outflows from the area equals the sum of the inflows less the water accumulated in the area.

Water entitlement: The volume of water authorised to be taken and used by an irrigator or water authority. Water entitlements include bulk entitlements, environmental entitlements, water rights, sales water, surface water and groundwater licences.

Water right: A water entitlement held by an irrigator in an irrigation district.

Water shares: A water entitlement held by a water authority or person. The Government has passed legislation enabling all water rights and licences to be converted into water shares. The first conversions will be in place in July 2007. For more information, refer to the *Our Water Our Future* action plan.

Water supply protection area: An area declared under Section 27 of the *Water Act 1989* to protect the area's groundwater or surface water resources through the development of a management plan which aims for equitable management and long-term sustainability.

Waterway: The *Water Act 1989* defines a waterway as a river, creek, stream, watercourse and a natural channel where water regularly flows, whether or not the flow is continuous.

Wetlands: Inland, standing, shallow bodies of water that may be permanent or temporary, fresh or saline

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